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IZMIR TURKEY

"Integrating Design, Logistics and Branding for Sustainable Value Creation"

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PREFACE

On behalf of İzmir University of Economics and as the chair of ICOVACS 2008 (International Conference on Value Chain Sustainability, I would like to state that we are bonored to host all the participants in İzmir, one of the most important logistics and design centers and port city of Turkey, during ICOVACS 2008, which was held on November 12-14, 2008.

ICOVACS 2008 was organized by Izmir University of Economics, Turkey, and was supported by The University of Tennessee from USA, Tilburg University from The Netherlands, University of Texas at Dallas from USA, the Department of Industrial Product Design of Istanbul Technical University, and the Department of Industrial Design of Middle East Technical University, both from Turkey. The conference was titled as "Integrating Design, Logistics and Branding for Sustainable Value Creation", which has been unanimously decided upon during the first meetings of the organizers. We believe that the founding stone for today's value chains is the integration of three key areas namely; design, logistics and branding. These activities not only constitute the most solid grounds for differentiation, but in an integrated framework they also lead to a better management of other processes. From this standpoint, the theme was timely and the the aim of our conference, which was to bring scholars, professionals, decisionmakers and practitioners working in these three areas was successfully accomplished.

The congress brings together more than 100 academicians, researchers and practitioners from different countries. A total of 49 papers were accepted and presented during the Conference, and published in the Proceedings. These papers cover a wide range of topics including Design and Brand Interaction, Innovative Value Chain Management, Design for Manufacturing and Assembly, Reverse Logistics and Sustainable Design, Innovative Solutions through the Supply Chain, Role of Product Design in Branding, Role and Effect of Consumer in Value Chains; Supplier Development, Early Supplier Involvement and Supplier Selection, Process Design in Value Chains, Design in Value Chains, Design for Logistics, Role of Creativity and Design in Value Chains. We are grateful to our authors and reviewers for all their efforts during this remarkable scientific event.

We would like to thank our partners in organization who have supported us in realizing this event. We also would like to acknowledge the support of the sponsors of the conference for their contributions.

I would like to thank the members of the organizing committee, Erhan Ada, Melike Demirbag Kaplan, Oznur Yurt, Deniz Atik, Deniz Tursel Eliiyi, Can Ozcan, Tugba Orten, Aslihan Gizem Korkmaz, and Elif Kocabiyik who have put great enthusiasm, effort and time into realization of the conference. Finally, we would like to thank everyone who has contributed for making this congress a memorable and successful event.

Sincerely,
Prof. Dr. Tunçdan Baltacıoğlu
Izmir University of Economics
Conference Chair

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CONTENTS

DESIGN AND BRAND INTERACTION

BRAND EXPERIENCE THROUGH DESIGN: THE EXPERIENCE OF (A FACE THROUGH) IMAGES, THE EXPERIENCE OF VISUAL CULTURE 8

NILÜFER TALU 8

DESIGN EDUCATION IN COLLABORATION WITH SMES: IN THE SCOPE OF INNOVATION SUSTAINABILITY

SEÇIL ŞATIR, DENIZ LEBLEBICI BAŞAR 17

THE BRAND NAME MATTERS: THE STRATEGIC USE OF DESIGN IN THE DEVELOPMENT OF A GLOBALLY KNOWN BRAND, MAVI -BLUE- JEANS

GOZDE GONCU, OZLEM ER 25

A DESIGN FOR THE BRANDING OF HIGHER EDUCATION: A SOUTH AFRICAN PERSPECTIVE

GARTH A. VAN GENSEN 33

INNOVATIVE VALUE CHAIN MANAGEMENT

VALUE CHAIN MANAGEMENT FOR SMES

MERVE HANDE ERGIN AND HANDE ERYILMAZ 40

EXPLORING THE IMPACT OF BRANDING AND DESIGN ON SUPPLY CHAIN MANAGEMENT

OZNUR YURT 50

CREATING SUSTAINABLE GLOBAL PRODUCT CHAINS: A THREE LEVELS GAME

W.J.V. VERMEULEN 56

DESIGN FOR MANUFACTURING AND ASSEMBLY

COMPARISON AND REVISION OF TWO INTEGRATED INVENTORY SYSTEM POLICIES

J. RAZMI, A. DARMANI 71

INVESTIGATION OF SOURCES OF CREATIVITY IN CATCHPENNY ARTICLES WITH PARTICULAR FOCUS ON TOYS

DILEK AKBULUT 79

REVERSE LOGISTICS AND SUSTAINABLE DESIGN

THE KEY ISSUES FOR REMANUFACTURING: REVERSE LOGISTICS AND SUSTAINABLE DESIGN

IBRAHIM GURLER 89

IKEA AND THE FLAT-PACK CONCEPT ON SCANDINAVIAN DESIGN TRACES

AYŞE ELIF COŞKUN ORLANDI AND AYŞEM G. ÇAKIROĞLU BAŞAR 99

PLM IN RELATION TO SCM AND CRM, FOR INTEGRATING MANUFACTURING WITH SUSTAINABLE INDUSTRIAL DESIGN

VASILE MERTICARU JR., GAVRIL MUSCA, AND EUGEN AXINTE 109

APPRECIATION OF ECODESIGN WITHIN TURKISH PRODUCTION INDUSTRIES

ECE GÜRAKAR, BAHAR SENER, JAN CAREL DIEHL AND DUYGU KESKIN 119

INNOVATIVE SOLUTIONS THROUGH THE SUPPLY CHAIN

COLLABORATIVE INNOVATION IN FORMATION OF INNOVATIVE SUPPLY CHAINS

ALBERTO DE LA CALLE, ESTHER ALVAREZ, AND JALAL ASHAYERI 130

A VALUE CHAIN FOR PRODUCT DEVELOPMENT IN THE CONTEXT OF CUSTOMER-RETAILER-SUPPLIER CHAIN: AN APPLICATION IN AN ELECTRONIC RETAILER FIRM

GÜLŞEN AKMAN, YEŞIM YAYLA AND AYTAÇ YILDIZ 138

INVESTIGATING THE IMPACT OF VALUE CHAIN PRACTICES ON RETAILER'S PERFORMANCE: A CASUAL APPROACH

ERKAN BAYRAKTAR, EKREM TATOGLU, KAZIM SARI 144

INNOVATIVE ANALYSIS OF A CRM DATABASE USING ONLINE ANALYTICAL PROCESSING (OLAP) TECHNIQUE IN VALUE CHAIN MANAGEMENT APPROACH

ADRIANA OLARU, OLGA UNGUREANU AND ALEXANDRU CAPATINA 154

ROLE OF PRODUCT DESIGN IN BRANDING

DESIGN IN VALUE CHAINS DEVELOPMENT: ADDING VALUE TO LOCAL PRODUCTS

LIA KRUCKEN 160

THE ROLE OF DESIGN IN CREATING AND SUSTAINING BRAND EXPERIENCE

ASLI ÇETIN YILDIRIM 167

ROLE AND EFFECT OF CONSUMERS IN VALUE CHAINS

SATISFYING THE EXPECTATIONS OF CUSTOMERS THROUGHOUT THE VALUE CHAIN: VALUE CHAIN IMPLICATIONS ON SUPERMARKETS VERSUS GROCERIES

EMIR ÖZEREN, ASLIHAN GIZEM KORKMAZ , AND ELIF YÜCEALP 174

PACKAGING VALUE OF COSMETICS PRODUCTS: AN INSIGHT FROM THE VIEW POINT OF CONSUMERS

MERT TOPOYAN, ZEKI ATIL BULUT 183

FACTORS OF VALUE CREATION IN LEAGILE SUPPLY CHAINS: A CUSTOMER PERSPECTIVE

DANUTA KISPERSKA-MORON, ARTUR SWIERCZEK 191

A STUDY ON USER ACCEPTANCE OF PORT COMMUNITY SYSTEMS

YAVUZ KECELI, HYUNG RIM CHOI, YOON SOOK CHA AND Y. VOLKAN AYDOGDU 200

SUPPLIER DEVELOPMENT, EARLY SUPLLIER INVOLVEMENT AND SUPPLIER SELECTION

SUPPLIER DEVELOPMENT IN THE TURKISH AUTOMOTIVE INDUSTRY

ARIF ÖZVER ERGIN 210

SUPPLIER SELECTION PROBLEM IN PRESENCE OF VARIOUS PRICE DISCOUNT OFFERS REGARDING THE BRANDS

R. MOHAMMAD EBRAHIM, J. RAZMI 220

SUPPLIER SELECTION AND DEVELOPMENT BASED ON FUZZY QFD APPROACH

SAMAN HASSANZADEH AMIN, JAFAR RAZMI, AND SINA MOSTAFAEI 230

SUPPLIER SEGMENTATION IN IRANIAN AUTOMOTIVE INDUSTRY

MEHDI RAHIMI, NARGESS IMANIPOOR, NASRIN AKHONDI, SHOHREH GHADAMI 238

PROCESS DESIGN IN VALUE CHAINS

QUALITY FUNCTION DEPLOYMENT APPLICATION IN SUPPLIER SELECTION

ÖZLEM AKÇAY KASAPOĞLU' ANO FATMA LORCU 245

SUPPLY CHAIN PROCESSES MAPPING AND INTEGRATION INTO LOGISTICS INFORMATION SYSTEMS

TÜRKAY YILDIZ 251

TRANSPORT NETWORK DESIGNS AND THEIR IMPLICATIONS ON INTERMODAL RAIL FREIGHT TRANSPORT SYSTEM

HÜLYA ZEYBEK 257

DESIGN AND BRAND INTERACTION II

VALUE CREATION THROUGH THE INTEGRATION OF PRODUCT DESIGN AND BRANDING

EBRU UZUNOĞLU AND SEMA MISÇI 263

GENERAL SYSTEMS THEORY AND THE INTEGRATION OF DISCIPLINES: DESIGN AND MARKETING

BAHAR KURKCU AND JEAN-PIERRE MATHIEU 272

A PACKAGING SUPPLIER'S CONTRIBUTION TO BRANDING AND SUSTAINABILITY

RENEE WEVER, MICHIEL BOUVY, ANDRIES W. HETTEMA, ANO AB STEVELS 278

SOME INSIGHTS ON SERVICE DESIGN AND BRAND INTEGRATION

MELIKE DEMIRBAG KAPLAN 285

DESIGN FOR LOGISTICS

DESIGNING FOR IMPROYED LOGISTICS: A NEW GENERATION AUTOMATED WAREHOUSING CAPABILITY

QIAN WANG, ROBERT JARDINE, RICHARD MCINTOSH AND WEIJUN LI 291

MODELING AN INTERMODAL TRANSPORT SYSTEM IN MARMARA REGION

ÖMER FARUK GÖRÇÜN AND ÖZHAN GÖRÇÜN 301

DESIGN TO SUPPLY CHAIN: CENTRAL VERSUS DECENTRAL DECISION TAKING

PATRICIA HURSCHLER AND ROMAN BOUTELLIER 309

ROLE OF CREATIVITY AND DESIGN IN VALUE CHAINS

DIFFICULTIES OF DESIGN TRANSFER IN CULTURAL CONTEXT AS A CASE OF MANAGEMENT OF GLOBAL VALUE CHAIN THROUGH INTEGRATION

ARIF ÖZVER ERGIN 319

CONSTRAINED CREATIVITY: INFLUENTAL DYNAMICS BEHIND FASHION DESIGN

DENIZ ATIK AND DENIZ TÜRSEL ELIIYI 325

BUILDING A GREEN BRAND: YOUR SUPPLY CHAIN TELLS HOW GREEN YOU ARE

BENGÜ SEVIL ANO TUĞBA ÖRTEN 331

BRAND EXPERIENCE THROUGH DESIGN: THE EXPERIENCE OF (A FACE THROUGH) IMAGES, THE EXPERIENCE OF VISUAL CULTURE

Nilüfer Talu[1]

Abstract

The practice of 'branding' implies creation of an identity or a face for a company. It includes a large variety of practices from the designing of name, logo and slogan to developing website design, marketing materials and every aspect of communication. In our visual culture, however, 'branding' includes far more than the set of practices enumerated above. It equally involves a set of statements that produce and exchange meanings through visual imagery. In other words, 'branding' is concerned with the visual integration of images that construct a visual grammar to communicate something along with those practices, technologies and knowledges. In these terms, the experience of a brand closely and critically relates with the experience of visual images that concur at many sites such as the site of production, the site of the image itself, and the site of audience. There are also different aspects called 'modalities', contributing to a critical understanding of images: technological (from printings to television and internet), compositional (content, color, spatial organization, etc.) and social (economic, social and political relations, institutions and practices). The aim of this study is on the one hand to explore how these sites and modalities intersect in the case of The Coca-Cola Company, on the other hand to show how 'brand experience through design' implies not only the experience of a group of images but also the experience of visual culture.

Keywords: Branding, Visual Culture, Visual Imagery, Visual Methodology, Sites and Modalities, The Coca-Cola Company

1. Introduction: Visual Images, Visual Culture, and the Cultural Display of Meaning

This study conceives of the practice of branding as visually constructed knowledge or meaning and argues that the interpretation of visual images in this context ought to address both cultural meaning and social life. To many social scientists, social life has changed drastically over the last three or four decades. As argued by Gillian Rose, who emphasizes the shift in social life in relation to culture, "social life is constructed through the ideas that people have about it, and the practices that flow from those ideas" (Rose, 2001: 6). In similar manner, Hall accentuates that,

> Culture, it is argued, is not so much a set of things – novels and paintings or TV programmes or comics – as a process, a set of practices. Primarily, culture is concerned with the production and exchange of meanings – the giving and taking of meaning' – between the members of a society or group [...] Thus culture depends on its participants interpreting meaningfully what is around them, and 'making sense' of the world, in broadly similar ways (Hall, 1997: 2).

Rose maintains that these sets of practices, whatever form they take, produce meanings and structure at work in the way people behave in everyday life. Different sorts of technologies and images make sense of the world. They represent the social world in visual vocabulary and display social life in very particular ways. Often, they are not transparent and innocent. Rose particularly emphasizes that these sets of practices, "may be felt as truth or as fantasy, science or common sense; and they may be conveyed through advertising, everyday speech, elaborate rhetoric, high art, TV soap operas, dreams, movies or muzak; and different groups in a society will make sense of the world in different ways" (Rose, 2001: 6).

Today, many writers such as Martin Jay, who deploy the term *ocularcentrism*, claim that the eye in Western Societies occupies a culturally and psychologically central position (Jay, 1993). For John Berger, seeing comes before the word (Berger, 1972: 7). Rose describes the apparent centrality of the visual as bounding the onset of modernity as it had already done in premodern societies where fewer visual images were in circulation. But in the modern period, as again Rose claims, "modern forms of knowledge depend on a scopic regime that equates seeing with knowledge" (Rose, 2001: 7). In a similar manner, Charles Jenks has argued that, "We daily experience and perpetuate the conflation of the 'seen' with the 'known' in conversation through the commonplace linguistic

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appendage of 'do you see?' or 'see what I mean?' to utterances that seem to require confirmation, or, when seeking opinion, by inquiring after people's 'views'" (Jenks, 1995: 3).

The effects of the visual or 'the hegemony of the visible' in the contemporary period celebrate a field that has come to be called 'visual culture' (Mitchell, 1998; 2002). As is known, the term 'visual culture' was first used by Svetlana Alpers in her *The Art of Describing: Dutch Art in the Seventeenth Century* (Alpers, 1983: xxv). Ian Heywood and Barry Sandywell, in turn, have defined visual culture as a "socio-historical realm of interpretative practices" (Heywood & Sandywell, 1999: xi). Visual culture renders images not to be interpreted as mere objects of perception but as production of meaning depending on the view point of the beholder in terms of current social phenomena and difference. Social differences such as race, gender, femininity, the identities of body, but also social phenomena such as the sustainability of nature and social facts such as consumption comprise aspects of advanced industrial capitalism and consumer culture and find their illustration in the visual arts especially at cross-cultural boundaries and multidisciplinary theory.

The field we have come to term 'visual culture' focuses on not only the social effects of images but also the interpretation of images in a knowledgeable way. Its main concern is how images or cultural objects come to visualize the invisible. It is very important to emphasize that, as the writers of visual culture often say, the meaning of the image does not simply reside in the image itself. The image is always beheld by a particular spectator deploying a particular gaze. So, the 'kind of seeing' that is at stake invites 'the visual thing' to visualize a social difference or a social phenomenon concerning femininity, gender, race, ethnicity, socio-economics, political conditions, communities, natural and humanly-made environments, virtual environments, consumption culture, social structures and other aspects of the vast and complex social life. Visual images very often work in conjunction with other kinds of representations. In these terms, we always look at things in relation to ourselves and to other things as John Berger has famously argued in *Ways of Seeing* (Berger, 1972: 9). Following Berger, Rose observes that,

> visual modes of conveying meaning are not the same as written modes [...] [V]isual objects are always embedded into a range of other texts, some of which will be visual and some of which will be written and all which intersect with each other, I find debates about the precise difference between words and images rather sterile. What is much more important, I think, is simply to acknowledge that visual images can be powerful and seductive in their own right (Rose, 2001: 10).

Visual art and design including advertising, the fine arts, movies, television, computer graphics, simulations, urban design, housing design, and contemporary art—all constitute visual forms of production and communication ranging from a pen to a chair, a hut to a tower, and a simple dress to a critical veil as they comprise the domain of visual culture. Thus the interpretation of a visual object generated in the field between art and design refers to the examination of the meanings, purposes, relationships, influences and context in which these objects are embedded. In other words, this investigation is tantamount to the analysis of the social and persistently didactic character of imagery and objects.

Visual art and design are increasingly taking part in daily life. From fast food kiosks to web site designs, interactive information systems to coffee machines rampant in our daily life, visual arts and design are everywhere, not only constructing but also exercising our visual culture. As, again, Rose has pointed out, "Visual images are made, and may be moved, displayed, sold, censored, venerated, discarded, stared at, hidden, recycled, glanced at, damaged, destroyed, touched, reworked" (Rose, 2001: 14). Images are made and used in all sorts of ways by different people for different reasons, and these makings and uses are crucial to the meaning an image carries. In this paper, I'm concerned with the visual images of the Coca Cola Company, especially the soft drinks *Coca Cola* and *Coke* with their advertisements deployed in our visual culture. The logo design and bottle design of Coca Cola, which make up widely and readily recognized images, are cultural icons representing the Americanization of, or the imputing of the face and visions of American culture to, the world along with the other well–known images of American culture (Figure 1). By this, I imply the fact that the experience generated by branding is to be equated with not only the experience of images but also the experience of visual culture; in other words, the experience of culture based on visuality and visions.

Figure 1. Well-known Logo Design of the Coca Cola Company and the Classic Bottle of Coca Cola (The Coca Cola Company, Atlanta, GA)

2. Interpretation of Visual Images of *the Coca Cola Company* at Sites and Modalities

Although numerous social critics and writers today tend to accept images simply as the reflection of their respective social context, there are as many who are critical of this approach. It is widely accepted today in visual studies that visual representations are not reducible only to their context, because, it is maintained, they also wield their own purely visual effects. Thus Rose, for example, deploys a critical approach to interpreting visual images: firstly, he takes images seriously; secondly, he reflects on the social conditions and effects of visual objects; thirdly, he proposes to consider one's own way of looking at images, and adds: "If ways of seeing are historically, geographically, culturally and socially specific, then how you or I look is not natural and innocent" (Rose, 2001: 15-16). Thus interpretations of visual images widely concur at three sites: 1. the site(s) of the production of an image; 2. the site of the image itself; and 3. the site(s) where the image is seen by various audiences. Each of these sites includes different aspects that may be termed 'modalities' that fall in three classes: 1. technological, 2. compositional, and 3. social. Rose defines the technological modality of production as any form of apparatus designed either to be looked at or to enhance natural vision, from oil paintings to television and the Internet. The compositional aspect includes formal strategies: content, color and spatial organization. As for the social, this kind of modality refers to the range of economic, social and political relations, institutions and practices that surround an image and through which the image is seen and put to use (Rose, 2001: 16-17).

Rose describes the site of production through the *auteur* or *author* theory which takes into consideration the intention of the maker of an image as well as the intentionality of the image itself. As is known, for the longest time in the history of western philosophy and semantic theory, deciphering the meaning of the image was held to be tantamount to deciphering the meaning intended by the maker of the image. Rather recently, within the concise span of the second half of the twentieth century, this stance has come under wide critique and *intentionality* has been replaced by *contextuality* particularly with the rampant influence of Ferdinand de Saussure toward the end of the twentieth century. This juxtaposition has equally shifted the emphasis from the author/maker of the image as the holder of the intention and thereby the generator of the meaning, to the beholder and the context in which he/she beholds the image. A number of important theorists including Rose, Roland Barthes and Michel Foucault have elaborated on this shift to contextuality: "[s]ince the image is always made and seen in relation to other images, this wider visual context is more significant for what the image means than what the artist thought they [sic]were doing" (Rose, 2001: 23). In the same manner, Barthes famously announced "the death of the author," which, in the context described above, spelled the death of any recognition of authorial intention (Barthes, 1977: 145-46). Before Barthes, in his seminal "What Is an Author?" of 1968, Michel Foucault had declared the 'author' to be a *thing*—simply one more element among others that made up the forces of discourse: "the function of an author is to characterize the existence, circulation, and operation of certain discourses within a society" (Foucault, 1969: 142).[1] Before all of these prominent contemporary theorists, however, in 1946, William Wimsatt and Monroe C. Beardsley had noted that the poem was, "detached from the author at birth and [went] about the world beyond his power to intend it or control it. The poem belonged to the public" (Wimsatt & Beardsley, 1946). Thus Wimsatt, Beardsley and others proclaimed that the poem—and any discourse, for that matter—did not in fact belong to its author. Through the lens of these speculations of the past half century, we see that the meaning of an image is produced by its production and its audiences, rather than its author. Rose draws attention to the term *genre,* used here in the sense of a classifying of visual images into specific groups. According to Rose, an image particularly fits into a genre of images sharing a specific set of meaningful objects and locations and a limited set of narrative problematics (Rose, 2001: 19).

When we come to focus on Coca Cola, the well-known brand mark, and interpret the images it wields in relation to these three sites, we derive the following: 1. the site(s) of the production of an image; 2. the site of the image itself; and 3. the site(s) where the image is seen by various audiences. Here, we witness the shift and the emphasis on the contextuality and generation of meaning in relation to other images in the wider visual context of

[1] "What Is an Author?" originally appeared in the *Bulletin de la Société française de Philosophie* in 1969 and is based on the inaugural lecture Foucault delivered at the College de France in 1968.

the culture. Accordingly we, again, witness that the images of Coca Cola especially emphasize the social modality of the image site referring to the range of economic, social and political relations. At the same time, we may define the technological and compositional sites of the images of Coca Cola. The technological modality of the production of Coca Cola varies from paintings to animations, modeling, and simulations, including all tools and interactive advertising and media of mass culture. For example, in 2003, Coca Cola first used interactive advertising: iTV and a campaign supporting a wider cross-media promotion was based heavily on SMS (New Media Age, 2003: 2). The World of Coca Cola truly comprised a striking example for understanding how the technological modality of production could be carried from a simple print to the construction of an entire museum as the medium to display a drink. In 2007, tbe New World of Coca Cola launched a 92,000-square-foot, $96 million-museum in Atlanta, expecting a million visitors per year. It included a movie theatre, a 29.5 foot contour coke bottle and more than 1,000 items of memorabilia. The space opened not only for promoting products through interactive technology but also for offering an experience of the brand as a manifestation of its mission, vision and values (Wedekind, 2007: 47). Its compositional modality coalesced with that of Pop Art: striking bright colors, especially red, the color of energy, to encourage consumption and to create the sense of mass society patterns like orders, motion effects, diagonal lines supporting the daily interactions, needs and desires and cultural 'moments' that made up the everyday lives of the mainstream including any number of practices included in cooking, clothing, celebration and entertainment in the mass circulation of items from areas such as fashion, music, sports and film. When we analyze the color and spatial organization of graphic design in the photos below, we readily see the use of both the Coca Cola Logo as dynamic design element and the classical bottle and the tin of drink as dominant elements of composition. These qualities are observable especially in the diagonal directions of text and bottle as well as in the use of contrast. We here see the union of the slogan of 'Coke adds life' (1976-78-79) with the images of Christmas and sports (Figure 2). Yet another example is limited edition series of Diet Coke designed by Patricia Field: Field's 'City Collection' bottles were inspired by the TV series and film *Sex and The City* (Figure 3). Accordingly, the 'City Collection' bottles are colorful and glamorous, referring to the modern, confident, gorgeous, and sexy woman of the film (Daily Mail, 2008: 48). Another example is the union of Coca Cola with 'American Idol,' the entertainment show and competition aired by Fox TV (Brandweek, 2004: 3).

Figure 2. The Images of the Advertising Slogan: 'Coke Adds Life,' 1976 (left); 1978 (middle); 1979 (right) (The Library of Congress, Motion Picture, Broadcasting and Recorded Sound Division, Washington, DC)

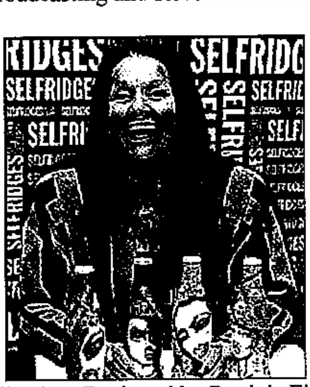

Figure 3. Diet Coke and the City Collection, Designed by Patricia Field, 2008 (*Daily Mail*, 26 May 2008)

Coca Cola is one of those fundamental American cultural icons like Marilyn Monroe and Andy Warhol. It is equated with America and the American people's visions of how they imagine themselves. 'Where There's Coke There's Hospitality' ran the well-known slogan of 1948. This motto not only supported the consumption of Coca Cola but also buffered the idea that America was the place of hospitality—the message which American people imagined best to represent tbem and which they wanted to convey to the world in the years following World War II (Figure 4 (left)). Claiming in 1969 that 'It's the Real Thing', Coco Cola, again, highlighted the desire of America to be 'real', instead of being Disneyland, the country of simulations and simulacra (middle segment of Figure 4). After the Watergate Scandal (1968-74), in 1974 Coca Cola appeared with the slogan, 'Look Up America' (rigbt-hand segment of Figure 4). Constance Hays in his *Real Thing: Truth and Power at the Coca-Cola Company*, aptly pointed out that Coca Cola, "was as American as baseball, as accessible as jazz. [...] Before long, it was everywhere" (Hays, 2004: ix). Hays also emphasized that, "[...] Coke came to stand for the glamorous, prosperous, flag-waving side of America, the part that always looked forward, not back. The soldiers fighting the good fight drank Coca-Cola, and so did presidents and rock stars and other heroes Americans might imagine themselves to be" (Hays, 2004: x).

Figure 4. The Images of the Advertising Slogans: 'Where There's Coke There's Hospitality,' 1948 (left); 'It's the Real Thing,' 1969 (middle); and 'Look Up America,' 1974-75 (right) (The Library of Congress, Motion Picture, Broadcasting and Recorded Sound Division, Washington, DC)

While producing meaning according to social and political situations and strategies of America, Coca Cola itself has been considered productive ground offering material for undertaking the critique of popular and mass culture and consumption society as observable in work by very numerous artists. For Example, Andy Warhol (1928-1987), American painter, printmaker, sculptor, draughtsman, illustrator, film maker, writer and collector, depicted Coca Cola bottles as the product of consumer society (Figure 5 (left)). Cildo Meireles (1948-), Brazilian printmaker and conceptual artist, produced the Coca-Cola Project (1970). Ai Weiwei (1957-), Chinese conceptual artist, curator and architect, painted a Coca-Cola logo across the side of a 2000-year-old Han dynasty pot (Han Dynasty Urn with Coca-Cola Logo (1994)). In 1994, Fiona Hall (1954-), Australian photographer and installation artist, depicted a Buddhist statue cut from Coca-Cola cans (Figure 5 (right)). Arahmaiani (1961-), Indonesian installation, video and performance artist and writer, focused on the Coca Cola bottle in her installation Sex, Religion and Coca-Cola (1994), in which a Coca-Cola bottle was displayed in a glass case placed next to Islamic and Buddhist religious symbols. Wolf Vostell (1932-1998), German painter, sculptor, décollagist, video artist and performance artist; Robert Rauschenberg (1925–) American painter, printmaker, designer, and experimental artist have also worked with Coca Cola bottles.

Figure 5. Andy Warhol, *Three Coca Cola Bottles* (left), Synthetic Polymer Paint and Silkscreen on Canvas, 50.8x40.6 cm, 1962 (Pittsburgh Founding Collection Contribution, The Andy Warhol Foundation for the Visual Arts, Pittsburgh); and Fiona Hall, *The Real Thing* (right), Polaroid photographs, 680×530 mm each, 1994 (Roslyn Oxley9 Gallery, Sydney, Australia)

In the site of audience, the social appears as the most important modality for understanding the audience of the images. Different practices are always conducted in different kinds of spaces that invite different ways of seeing. Rose mentions two aspects of the social modality of audience: 'the social practices of spectating' and 'the social identities of the spectators' (Rose, 2001: 27). Social identity in turn includes four elements: 1. Categorization; 2. Identification as associating with certain groups; 3. Comparison between groups; 4. Psychological distinctiveness of a group. The nature of social practices varies from one group to another like identities. A social practice emerges as a group of techniques, skills, and stylized choices that are embedded in the everyday activities of individuals through social mechanisms of transmission. Strolling from painting to painting in art galleries, for example, and appreciating the particular qualities of each painting, is a social practice of the middle class In the case of Coca Cola, the audiences are the passive spectators of mass culture. In other words, they are the consumer in front of the TV set. They are depicted as passive but projected as surprised by the slogans, themes, advertisements and any kind of visual imagery offered by Coca Cola. We witness the typical depiction of the audience in the television advertisement, *It's Mine!* (Figure 6). In *It's mine*, New York City, another symbol of America, has been used as the scene of Coca Cola with its familiar high-rise buildings which are as American as Coca Cola. While two equally familiar cartoon-characters in balloon form are trying to catch Coke baloons in the sky, The American People are depicted as the quiet audience of this ambitious competition between cartoon cbaracters. At the same time, this advertisement invites higlighting the paradox of the existent desire to be real and the sense of being a culture of simulations.

Figure 6. *It's Mine!,* TV Advertisement, Advertising Agency: Wieden + Kennedy, Portland, Production Company: MJZ, Director: Nicolai Fuglsig, 2008 (The Coca Cola Company, Atlanta, GA)

As for the social identities of the spectators, these are the materials for creating stories as well as social effects through advertisement. We experience the intersection of the site of audience as social identities and the social modality of the image site. *Hilltop* (1971) displayed the power of Coca Cola to connect the people of the world regardless of their national and ethnic origins and made tbem smile to tbe tune of *I'd Like to Buy the World a Coke* (Figure 7). *Mean Joe Greene* (1979) featured the defensive lineman 'Mean' Joe Greene of the Pittsburgh Steelers professional football team and a twelve-year-old boy, Tommy Okon (Figure 8). In this case the plurality of social identities was emphasized in opposition to social difference as race. The story of *Charity* (1998) was featured for the Muslim fasting month of Ramadan and wielded its effect through the spiritual aspects of Ramadan, especially charity and forgiveness (Figure 9). It was aired in twenty Islamic countries including Malaysia, Indonesia, Pakistan, Bangladesh, the United Arab Emirates, Turkey, Egypt, Lebanon, and Morocco. The story of the commercial took place in an orphanage where a boy and his mother visit to offer gifts and a bottle of Coca Cola. The commercial finds its closure in the motto: 'Always in good spirit. Always Coca-Cola.' *First Experience* (1999), on the other hand, featured a boy in a small village with no electricity, no television, and no Coca-Cola. The village was located outside Ouarzazat in a remote part of Morocco. The boy took a taste of Coca Cola as if he were kissing it. In *Jinx* (2008), Democratic strategist and commentator James Carville and former Senate Majority Leader Bill Frist, despite their political disagreements were seen to have fun together with icy bottles of Coca-Cola in their hand (Figure 10).

Figure 7. *Hilltop,*TV Advertisement, Produced in Rome, Italy, 1971(The Library of Congress, Motion Picture, Broadcasting and Recorded Sound Division, Washington, DC)

Figure 8. *Mean Joe Greene,* TV Advertisement, 35 mm film, Producer/Advertising Agency: Jean-Claude Kaufman/McCann-Erickson, Writer: Penny Hawkey, Art Director: Roger Mosconi, 1979 (The Coca Cola Company, Atlanta, GA)

Figure 9. *Charity*, TV Advertisement, 35 mm film, Producer/Advertising Agency: McCann-Erickson, 1998 (The Library of Congress, Motion Picture, Broadcasting and Recorded Sound Division, Washington, DC)

Figure 10. *Jinx*, TV Advertisement, Advertising Agency: Pio Schunker/David Campbell Agency, Production: Wieden + Kennedy, 2008 (The Coca Cola Company, Atlanta, GA)

3. Epilogue: Branding As Cultural Display of Discourse, Brand Experience As Visual Integration of Images and A Set of Statements

These specific images of the Coca Cola Company, producer of a world-wide brand of mass culture, derive from a genre originating in popular culture and pop art. They are displayed in gallery spaces and places of daily life, and wield a specific discourse that has been conveyed through the specific images of Coca Cola. In other words, together they constitute a discourse that is conveyed through the work of branding. This discourse is based on the themes of advertisements that can be defined as *statements*. The images in these statements are based on the visual grammar of pop culture, originating in the famous drawings and icons of Pop Art. Referring to the specific arguments of Michel Foucault and his method of discourse analysis, we are able to demonstrate that we have here a discourse conveyed by images and slogans of *The Coca Cola Company*. Though this method did not originate with Foucault, Foucault has developed it further by the inclusion of Freudian and Lacanian psychoanalysis in so far as visual images were the object of analysis. He has also stressed that the extant state of the method had not paid enough attention to the social construction of difference. In his writings on the development of modern clinical and psychiatric medicine, on the birth of the prison, and on attitudes towards sexuality, Foucault described the means by which the individual has come to be categorized as sub-human, abnormal, normal, deviant, etc. in very particular ways within various practices and institutions. Through this method, Foucault has shown that the human subject was not original and simply born, but constructed and produced through various practices, social processes and discursive formations, which were at the same time constructs circulating in the social field (Foucault, 1972). Gillian Rose has elucidated Foucault's stance as follows: "Discourse has specific meanings. It refers to groups of statements which structure the way a thing is thought, and the way we act on this basis. In other words, discourse is a particular knowledge about the world which shapes how the world is understood and how things are done in it" (Rose, 2001: 136).

While discourse is a particular knowledge about the world that is produced by practices, actions, verbal and visual images as well as subjects, at the same time subjects are produced by discourse. To the extent language enables it, discourse is articulated through various materials such as images, texts, practices, events, etc. In these terms, intertextuality appears as a siginificant approach for understanding discourse. Rose defines intertextuality in this context as referring, "to the way that the meanings of any one discursive image or text depend not only on that one text or image, but also on the meanings carried by other images and texts" (Rose, 2001: 136). We may thus surmise that there is a strong connection between visuality and discourse. In fact, visuality can itself be held as a sort of discourse. Thus specific visuality and scopic regimes will render certain things visible in particular ways while they will render other things invisible. At this point, another term, *discursive formation*, emerges as designating systems of dispersion that indicate the way meanings are connected together in a particular discourse. A 'discursive formation' refers to the regularity of statements that include an order, transformations, correlations, functionings, and positions (Foucault, 1972: 38).

When this notion of discourse is brought to bear the case of *The Coca Cola Company*, the latter emerges as an entire discursive/visual formation with its own grammar and discursive structure which are based on the advertising themes of Coca Cola and the visual images conveying the meanings embedded in any number images, texts and issues of America. I should like to assert that the images, and especially the slogans, in fact comprise 'statements' within the discourse of Americanization and the latter's influence on the culture of other countries. Coca Cola's ad-statements construct what America and the American people wish to say to the world. It is possible to formulate this discursive formation simply at the junction of its slogans and advertising themes: 'It had to be good to get where it is' (1926); 'Around the Corner from Everywhere' (1927); 'The Only Thing Like Coca-Cola is Coca-Cola Itself' (1942); 'Where There's Coke There's Hospitality' (1948); 'Things Go Better with Coke' (1963); 'You Can't Beat the Real Thing' (1990); 'Always Coca-Cola' (1993 – 1999) (Figure 11).

The relation of texts to each other, their respective positions and their power to create other texts and to determine the position of the subject, structure the formation of a discourse which communicates that 'America is everywhere;' 'Where is America there is hospitality;' 'Things will be better with America;' 'America is the reality of the world;' and 'Always America.' In other words, the motto of 1886, the first slogan of *The Coca Cola Company*, 'Drink Coca Cola' means today 'Be American' (Figure 12).

Figure 11. The Images of the Advertising Slogans: Things Go Better with Coke, 1963 (left); You Can't Beat the Real Thing, 1990 (middle); Always Coca-Cola, 1999 (right) (The Library of Congress, Motion Picture, Broadcasting and Recorded Sound Division, Washington, DC)

Figure 12. The Image of the Advertising Slogan: Drink Coca Cola, 1886 (The Library of Congress, Motion Picture, Broadcasting and Recorded Sound Division, Washington, DC)

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DESIGN EDUCATION IN COLLABORATION WITH SMES: IN THE SCOPE OF INNOVATION SUSTAINABILITY

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Abstract

Small and Medium-sized Enterprises (SMEs) form the backbone of industry in Turkey. In this context, it can be said that designing or teaching design in Turkey means designing for SMEs, in the first place. The needs, requirements and necessities of SMEs put certain points in the foreground during design work. The companies of this scale were researched and they were given preliminary briefings about design before collaborative design projects for SMEs were made in product design classes. Each one company was matched with one student insofar as it is possible. Final designs largely met the expectations of SMEs. It was concluded that such design studies should be given priority in Turkey, where 93.3% of the enterprises are SMEs. This resolution suggests the sustainability of innovation in design. Experimental design work in this matter is carried on at the Department of Industrial Product Design, Istanbul Technical University (I.T.U.) and there is an ongoing effort to develop consciousness towards design with SMEs. In this context, due to the difference between companies and their specific requirements, their design developments differ[3].

Keywords: Instruction, Design education, collaborative work with SMEs, sustainability of innovation.

Introduction

The aim of this study is to contribute to the development of Small and Medium-sized Enterprises (SMEs) in Turkey in the field of Industrial Product Design (IPD). Such contribution is proportional to the definition of university-industry collaboration, which is among I.T.U.'s missions and vision. Compared to widespread consciousness about industrial design in developed countries, Turkey lacks prevalent learnedness in industrial product design as well as conception and new product development. Retrospectively, almost no information was provided in the scope of SME supports. Therefore it is the aim of this study to have a closer look at SMEs and make them conscious about design. By having a closer look at SMEs, it will be possible to orient the developments in country-specific industrial product designs and their content.

Collaborative work with SMEs who hold a serious percentage in production in Turkey and make cheap production for other brands both familiarizes these companies with product design and leads them to produce their own products which provided added value in competitive medium. Meanwhile this collaborative work also allows students have the chance to study Turkish industry closer.

Definition of SME

An increasing attention is being attached to SMEs nowadays. Though different figures are given by various sources, enterprises that employ up to 250 people are defined as SMEs according to Small and Medium-sized Enterprises Development and Support Organization (SMEDSO), subordinated to Turkish Ministry of Industry and Trade.

Tbe definition acquired a decisive quality with the "Regulation about the Definition, Features and Classification of Small and Medium-sized Enterprises" resolution number 2005/9627, and dated 18.11.2005 and issued on the Official Gazette numbered 25997. Accordingly, it is written that "organizations that support small and medium-sized enterprises (SME) are governed by these regulations." Organizations may determine their sectors and size unless they exceed the limitations shown in this Regulation.

According to Regulation, SMEs are defined as "economic units that employ less than 250 employees and whose yearly proceeds or fiscal balance do not exceed TRY 25,000,000, and are classified as micro-sized, small-sized or medium-sized enterprises and are shortly referred to as "SMEs". As per Article 5 of the Regulation and Notification dated 2001/1 on the Implementation of Resolution about State Investments on Small and Medium-sized Enterprises:

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1. Medium-sized enterprises employing between 50-250 workers,
2. Small-sized enterprises employing between 10- 49 workers,
3. Micro-sized enterprises employing between 1-9 workers are defined as SMEs." (http://www.kobinet.org.tr/hizmetler/bilgibankasi/mevzuat/015.html).

According to SMEDSO data on October 2003, SMEs make 93.3% of the total number of enterprises; they generate 76.5% of total employment, 26.5% of total investments, 38% of total added value, and 10% of export (Eenerci, 2003).

In EU definitions enterprises that employ up to 250 workers fall to the group of SMEs, this definition has more comprehensive information.

SMEs in Turkey are aware of and make use of a central institution (SMEDSO) that supports them in matters such as "design development, protection of industrial design, creating brands". Within the *supports* headings of SMEDSO's, the following exists as a subheading *Technology Research and Development Supports*: "technological research and development support is provided to such enterprises to develop or produce new products" (http://www.kosgeb.gov.tr/Destekler/destek.aspx?dID=17). This is a benefiting statement for industrial design.

Taking into consideration the position of SMEs in economy, 94.6% of the enterprises constitutes of sectors as trade, brokerage, renovation, transportation, storage, communication, manufacture industry, hotels and restaurants, other social and individual fields of service. The total number of enterprises is 1,881,433, and among these fields the number of enterprises that do business in manufacture industry is 267,184 according to 2002 databases (http://www.isbank.com.tr/dosya/ekon-tr_kobiler2004.pdf). The same data also presents that textile, ready-made clothing, leather industry heads up with 63,412 enterprises. This is followed by metal goods industry (Excl. Machinery and Equipment) and furniture industry with 35,258 enterprises and 34,427 enterprises, respectively. The figures project that product design will develop more intensely in these sectors.

SMEs and Innovation in the Context of Sustainability

Açıkgöz's explanations in the speech titled Protection Strategies for SMEs in the Discussion Process with EU were as follows: "SMEs weaknesses in Turkey include use of technology, R&D and access to information, financial deprivation, obstacles before the sustainability of competitive powers, exportation difficulties, and inability to reach new markets." (Açıkgoz, 2006). It is obvious that financial difficulties as well as deficiency in innovation (and of new products), which is required by exportation and new markets, form the main cause of the obstacles before the sustainability of competitive powers and difficulties encountered in exportation and new markets.

In meetings titled "Risk Management and Effects of Basel II on SMEs" held in 19 cities by Turkish Association of Chambers and Stock Exchanges (TACSE), Hisarcıklıoğlu stated that the most important problem faced by state economies was sustainable economic growth and he stressed the significance of sustainable development through SMEs in competitive medium. Accordingly, he explained the importance of SME's flexibility and adaptation advantage in terms of sustainability as follows: "enterprises which make use of their flexibility and adaptation capabilities arising from their smaller size to their advantage in competition will sustain through development." (Hisarcıklıoğlu, 2005).

According to SMEs in Membership Process to EU report by Economy Policy Research Institute (EPRI), it was determined that SMEs provided sustainable development. In terms of the vision of SMEs in Turkey, it was seen that they could produce and implement projects in European standards, and had sustainable competitive power in foreign and domestic markets. When thriving principles are revealed it is suggested that in order for companies to have sustainable competitive power, they should be open to innovation and go for the manufacture of products with high added values (http://www.tepav.org.tr). Eor sustainable competition it is necessary to develop SME's technology and innovative capacities, and encourage them to set up R&D departments or to have researches done in R&D departments. However, for the short term the novelties in their product design would lead them to successful competition, because one of the most important conditions of innovativeness is innovation in product design.

Value Chain Management-VCM within SMEs

Value Change Management concerns management of the total chain system comprising all independent organizations, including all establishments, functional activities, etc which take part in the production of products and their delivery. VCM is a system which will play a role in causing SMEs to produce novelties so that the novelty can provide an added value.

Compared to supply chain, VCM also comprises such concepts as demand, supplier, the supplier's supplier, logistics, distributor, production plant, distribution center, customer, consumer, etc. However, "while being big is important for supply chain, being fast and creative is important for value chain" (www.referansgazetesi.com). Taking this into account, SMEs are not big enterprises, but they can catch value chain advantage if they are fast and creative. Technology is on the foreground in supply chain, whereas in VCM, information is important. SMEs must be warned to pay attention to information.

It is not possible to think of a product design without considering it on the basis of these concepts. As for SMEs, we have to be more sensitive. Competitive environments of SMEs should be designed in such a way that they will follow a chain process including their competitive environments, their market shares and customers. To assure the production of high-quality products on time and to guarantee their sale can only be realized by the implementation of VCM. Customer demand wbich is reckoned to be customer expectation in design field, determines not only wbat design to create for the product, but also sales volume within the dynamics of value chain management and production planning. It is impossible to reach an effective output without this information which was tried to be provided by marketing experts in the past. Value Chain Management appeared in 1996. VCM has been defined as "the integration of all key business processes starting with the supplier's supplier". It integrates all these processes under close control and it attempts to optimize customer satisfaction and to gain new customers without sacrificing quality.

To reach perfectness, value change management include following key metrics:

- Syncronization of all business plans and their observation
- Making decisions which are sensitive to the changing needs of customers throughout the chain and rapidity in decision making
- Minimization of stocks throughout the chain
- Short-process cycle time
- An Effective cause and effect analysis
- Performance scheduling carried out continuously and performance development.

In order to realize the above mentioned characters, SMEs look for a solution with operational, tactical and strategic decisions. (www.kalder.org).

Research and Application Process

The research which is considered in the framework of sustainable development and forms the subject of this paper was initiated for SMEs theoretically in June 2002 and practically in Spring Semester of the academic year 2002-2003.

KOSGEB Technology Development Center (TDC) at İstanbul Technical University (I.T.U.), linked to KOSGEB Ankara Head Office KOSGEB was contacted and a research was planned to study the information levels and application capacities of SMEs in terms of Industrial Product Design (IPD) in İstanbul and in south eastern Anatolia Region. The research titled "A Sustainable Development of SMEs which Supports Competitiveness with Innovation in Regional Development" continued with moral support from the Chairman of I.T.U.-KOSGEB-TDC and some experts from Consultancy Support List. Accordingly, experimental design projects started in November 2002. I.T.U-KOSGEB-TDC joined Consultancy Support List with its designer identity for the first time.[1] By joining the list with designer identity, it was aimed to inform the enterprises about the preparations for the competitive medium at product level.

The first of experimental design projects started at the elective class, Fashion Accessories Design (FAD) in the Spring Semester of 2002-2003 Academic year and two different projects were conducted with SMEs. The first of these started with a preliminary trial with a seminar by three SMEs that manufactured shoes and an official from the Board of Directors of Shoemakers' Association and each of the 13 students designed a pair of shoes in collaboration with SMEs. The second project in FAD class included design of home accessories in collaboration with Iznik Tile and Ceramics Enterprise, an SME which manufactured and sold traditional ceramic crafted objects. After all students have applied their modelling work in the ceramic atelier of the faculty, 8 final projects were chosen to be manufactured with the support of the collaborative firm. The conceptual models were made by the students in the sophisticated manufacturing plant of the company, outside İstanbul.

More comprehensive experimental design projects were realized in the Spring Semester of 2002-2003 Academic year with 30 students of the group, Project VI, with the collaboration of an equal number of SMEs[2]. Here SMEs were from various sectors, representing different fields of manufacture. These projects were later classified into sectors and collaborations were made with associations of related sectors.

I.T.U. - Industrial Product Design Department is a pioneer institution which has made collaboration with SMEs; with this collaboration it continues an education which considers SMEs as a very important industrial partner. I.T.U-IPDD has been carrying out this collaboration with special application methods since 2002. One of these methods is

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[1] Joining to Consultancy Support List with a designer identity and making a direct link with industrial companies gave fruitful results. Industrial Product Design was promoted in collabative projects in spring semesters of the academic years 2003-2004 and 2004-2005, and communication increased thanks to Leather Industrialists Association (SSD), Turkish Shoemakers' Association (TASD), Turkish Shoe By-Industries Association (AYSAD), Turkish Shoe Industry Research Develapment and Training Foundation (TASEV), Office Furniture Industry and Businessmen Association (OMSIAD), and Lighting Fixtures Manufacturers' Association (AGID). Many collaborations were realized with these establishments and countless others. These collaborations continue.

[2] In this first project with SMEs, group instructors Assoc Prof. Dr. S. Şatır, Prof. Dr. N. Bayazıt, Ins. O. Akman, Guest Ins. Ü. Celbiş directed their groups. Researchers G. Özdemir Turan, A. Z. Turan, D. Leblebici Başar, C. Vatan, and A. Enşici also took part.

sectoral SME projects, directed by Assoc. Prof. Dr. S. Şatır, working with undergraduate students in collaboration with industry associations and sometimes with SMEs chosen ftom among non-members to associations. The main objective in these projects is to promote product design and directly and more consciously encourage SMEs to purchase design services regardless of whether enterprises are familiar with design or whether they would like to buy design service.

Another method is held in diploma projects. A systematic approach for collaborating with SMEs has been constituted. This collaboration is formed with Istanbul Chamber of Commerce (ITO) and by Prof. Dr. Alpay Er; it is the applied part of the SME project conducted as a project of Quality and Technology Specialization Committee (KATEK) formed in ITO. It is strictly defined that SMEs collaborating in diploma projects shouldn't have had a previous work experience with a designer. Students who complete their diploma projects with SMEs are provided with job opportunities after graduation.

Each of the two groups completed around 140-150 projects respectively. These projects perform the "mission" to form an active strategy to introduce industrial design to the related sections of the society for its efficient use in the development and welfare of the country (www.tasarim.itu.edu.tr).

The collaboration projects included various areas in industrial production such as; children's playgrounds-large toys manufacturer on leather sector and synthetic materials in 2003-2004 Spring Semester, footwear manufacturers with their educational and sectoral associations in 2004-2005 Spring and Fall Semesters, wood, metal and plastic furniture manufacturers in 2006-2007 Fall Semester in collaboration with ICC , ceramic objects producer in Kutahya, in 2007-2008 Fall Semester with AGID member lighting sector SMEs. The findings gained from the interviews with SME officials and results of the final projects reveal a significant data.

Experimental SME Projects at the Department of Industrial Product Design I.T.U

While the collaboration projects familiarized students with a large part of Turkish industry, it can be said that the collaborating SMEs experienced industrial product design in a certain extent. A small briefing and discussion was held about design, its context and new product development with the collaborating firms which consist of approximately 140 SMEs. The aim was to collect some data about SMEs' design expectations during application process and find out whether these expectations can create a difference in small and medium-sized enterprises. Observation method used all through the design practise process. Thus, with such systematically defined projects, it was aimed to make SMEs more conscious about industrial product design, as KOSGEB defined "bringing design to light", where a common language has not yet been formed.

Taking into account the general conditions of different SMEs, the general attitude of the officials from exporting enterprises was helping an educational institution by contributing to students' projects while testing the benefits of university collaboration to their company. On the other hand, officials from enterprises who were not familiar with design followed the developments with keen interest and tried to experience the importance and benefit of design. Some examples from the collaboration projects with the abovementioned objectives are as follows:

- Home lighting products,
- Glass tableware set, for a subcontractor company that paints glasses,
- Various lighting products such as glass wall sconces, glass floor lamp and some other decorative glass products for a glass producer company,
- Footwear,
- A door handle and a new developed locking mechanism,
- Copper products for global markets,
- Corian Sanitaryware set,
- Bathroom accessories,
- Cast iron coal stove, for a company that produced stovepipes,
- A waste oil stove used in local ateliers,
- A modular GRP cabin or stand for outdoor use,
- Baby stroller.

Figure 1. Glass tableware set by Gökhan Karasu, Wall sconce by Gökhan Yeşilgöz, Shoe design by Bahar Yıldırım, New door handle and locking system design by Şiar Yavaş.

In Figure 1 above is shown a glass tableware set. Kısmet Glass Company has 22 employees and the enterprise depends 85-90% on manual labour. The company would like to shift its production from cologne bottles to glassware. Though they are not familiar with design, they did not fail to reply our questionnaire by choosing 'the healthiest, the safest, and the most beautiful' concepts. They feel that more support should be given to SMEs. Işın Cam was an interior lighting products manufacturer and would like to make good use of the material in their storehouse and required us to make new designs with these materials. Gökhan Yeşilgöz chose the glass tubes as his material and put them into most practical use. The footwear shown above, was produced by Fortis Shoe Company, is a successful example of university-industry collaboration. All the final designs and the prototypes were exhibited in a professional footwear fair, AYMOD 200, and this pair was bought by the company officials for mass production.

The drawings which are also shown in figure 1 are the final project presentations of a door handle. Product briefing was given by Meloni Company for a low-cost door handle which is easy to manufacture. No prototype was developed during the project. The project in collaboration with SME showed that SMEs generally required low-cost and economical products.

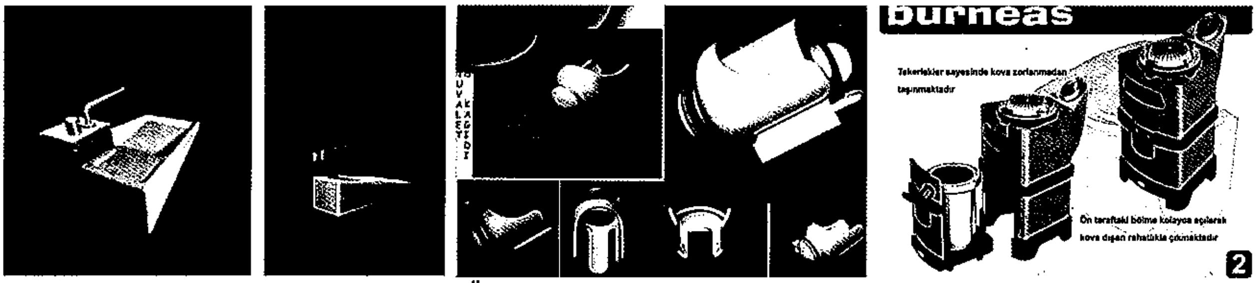

Figure 2. Washbasin and set by Denizhan Öncel, WC paper holder by Berker Dorkip, Coal stove by Çağrı Altınbay.

Another project shown in Figure 2 is a washbasin. It was a material oriented project. The company's expectation was creating an innovative design as the material Corian. However, it had to be easily purchasable. Both the inner and the outer surfaces were adversely curved. The drain was opened in the shape of a thin and long crevice instead of a circular hole. With different codes a multi-purpose use was designed. Despite its ordinary look, an innovative design was obtained.

Duravit Firm is a giant joint venture and is referred to with the same name. It is a medium sized SME with 150 employees. They attach importance to health, safety and pleasure in design. Since they value the sustainability of institutional identity, all their design need is met by the central institution in Germany. The student's previous familiarity with international examples helped him design a toilet paper holder with an original use, which does not fall contrary to institution's identity, and his design was much liked by the firm. It was a good example that origniality of design is sustainable even with SMEs (Figure 2).

Last drawing shown in figure 2 is a coal stove produced by Kassan. The company manufactures and sells stovepipes, determined a theme with the idea that they could also manufacture stoves. They collaborated in order to obtain information. It is a small-sized SME with 14 employees, and their customers are established. However, the company may enlarge its business with stove production and provide sustainability to its business in the same sector. The project brought solution to the difficulties of lighting up a coal stove. Another dimension of sustainability was providing ease of use in winter.

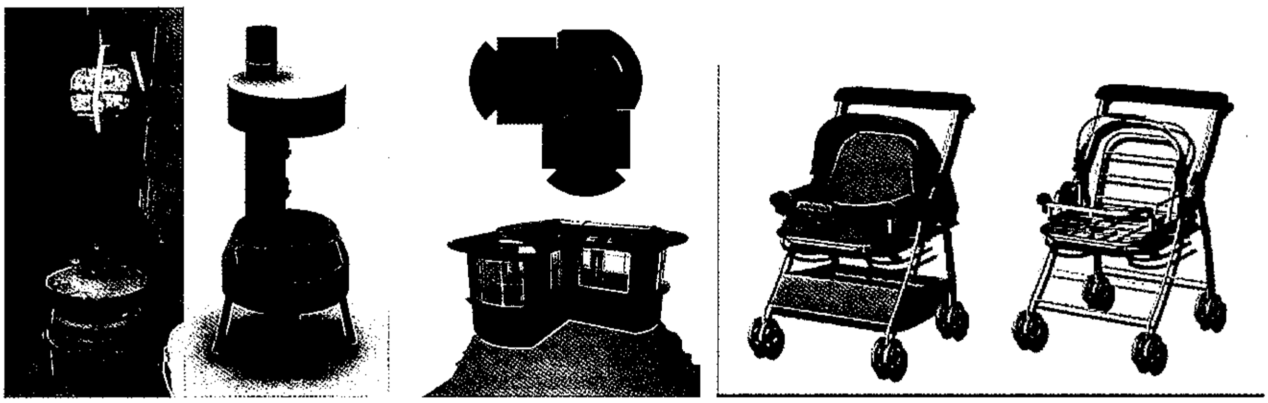

Figure 3. Waste oil stove; existing in an atelier in Sanayi Mahallesi İstanbul, Waste oil stove by Umut Sağlam (ITU-ISO project), Urban unit: CTP Modular Cabin System by Göksel Elmas, baby stroller by İrem Bektaş.

The diesel fuelled stove shown in the first photograph of figure I is designed and currently being used by the workmen in Sanayi Mahallesi, İstanbul. The stove was made by the workers themselves with waste material. Bersey

Firm was an SME with 50 employees and manufactured burning chambers for factories. The company official did not hesitate to say "We do not employ designers; we develop things with our workers and sometimes we copy original designs of other firms. The company liked the idea to design a product which would use waste oil from their own company and from their customers. The result was a useful dimension of sustainability in terms of the protection of environment and productivity.

The drawing shown in figure 3 is a multi-purpose modular cabin. The company's briefing was designing a cabin which is different from those universal cabins that have existed in the market for a long time and that entered the catalogues of almost all modular cabin manufacturers. Modularity was taken as a key point in design.

Uzay baby Strollers Company is a small-sized SME with 48 employees. The company is not familiar with design, however they deem the designer is responsible from the conception of a product to its end-user. The member of the board of directors of the company finds the idea of a new product on his own. He emphasizes that they look for the missing things in products that exist in the market; and added that the product they develop should not be similar to those in the market and it should sell well. In this project shown in 3D graphic images, in figure 3, existing and subcontracted plastic linking parts had to be used. The limitations of the project were high. Nevertheless the student persevered and developed a design that is really different from existing ones. The company was very pleased with the result.

An evaluation of Design Works with SME regarding the concept of Value Chain Management (VCM)

When value change management is needed in SMEs, it can be interpreted that inside activities of the firm are not adequate, outsourcing should be carried out, i.e. some byproducts and services should be bought or as competition is growing, measures to be taken should also involve and require product design, for this reason:

- The quantity or series of products can be increasable
- When needed product life cycle can be diminished without sacrificing quality
- Products should be individualized, thus they should gain modularity
- Far markets should be looked for in a world of globalization, e-trade should be supported so that SMEs can take part in e-trade.

In addition, SMEs should definitely know their own capabilities and they should know their customers well. They should also make a right decision about what sort of products they should produce for certain types of customers, whether they should produce standard, custom manufactured, innovatory, prestige...etc. type of products. Further analysis offer following conclusions:

As they get into a complicated situation after shifting from a single product they have constantly manufactured to a more complex product, SMEs will need VCM more than before because demand, suppliers and suppliers' suppliers will increase. Chain system of the company will enlarge. Dealer demands will increase as well. Customers will see the company under a different identity in an unexpected moment. In this case, the company should take necessary cautions in order not to shake their customers' confidence. They should look for new customers; they should increase the standardization in supplying matters. If the company has a VCM professional, its work in the new integration will be facilitated. If not it will have to provide all the solutions on its own. The company should observe its business at every level, from demand and from the supplier's supplier to the end-user and it should always keep on taking control at every level and never give it up. Having the opportunity to see all these points within an organizational schema and in computerized environments, and taking the precautions at the right time by processing all the failures in this schema, the company has acquired information about these contemporary fields, which means that the company's work will be easier. It is essential to be conducted by process automation. However a great number of SMEs are not able to do that. In this case, they have to work three or five times harder in order to accomplish semi-machine and semi-hand work on time and they have to keep strict controls.

In general, companies want to manufacture new products that have low cost and simple manufacturing processes. SMEs even desire and demand to have a new design with mass production and within their existing production methods without changing their already supplied equipment. They also would like to have their new design similar to the ones existing in the market but it should still be new. It is clear to see the challenges a designer faces for generating an idea. However on the basis of VCM approach, supplying without diverging from standardization will synchronize supply chain. Control by the producing company will be easier. As products which will suit customers' habits will be released to the market, customers will not be surprised. Meanwhile, if the product has a little novelties but it is in high-quality, customers' interest will increase. When demands are increasing, production will turn to be carried out in big series. The number of dealers might also increase. An increase in delivery will certainly be noticed. At this point, it is the main duty of VCM to increase the quality while decreasing the cost by coordinating operational processes in the management and by keeping more strict controls on their integration. As most of the small SMEs have their roots in engineering, they are able to carry out this kind of management by acquiring the necessary information on VCM. For many other SMEs, contact meetings organized by KOSGEB, chambers of commerce, some banks, supporting foundations etc. will be beneficial.

Another crucial point is semi-finishing products accumulating in warehouses, which were bought without considering supply and demand balance or which are produced by contract manufacturers. Recycling of waste products may also be regarded as a similar kind of problem. Designers have sought a solution from their angle, and this causes an important problem for SME works.

When we regard this accumulation problem in terms of VCM, we may deduce following points:

- In terms of supplying; it is a must to recycle hundreds of sub-production pieces accumulated in warehouses, it is suggested that it can be realized as;
  -The designer can do new designs with these pieces.
  -These pieces can be sold to others as supplies
  -They can be sold as scrap.
- From the company's angle, a designer who is a skillful expert in her/his own field, can realize a new design out of an old, standart product, s/he can also produce that item with waste semi-finishing material. The designer will produce a brand-new packing design so that a novelty could be brought into the market. This kind of novelty bas been already included within VCM.
- In terms of delivery process, it is important to consider facilities to be provided in transport and loading, as well as a few vacuum calculations. On condition that it is for all products, not only for the ones left in warebouses , it is also necessary to construct a modular delivery system wbicb will save time and wbicb will prevent vacuum
- Customers have their own babits. If a product, which is very useful and of high quality can be designed, custom manufactured material or semi-finishing products left in a warehouse will gain value. That means VCM has completely performed its duty. While carrying out this, VCM has to provide all individuals who are operating in the organization with complete adaptation to the activities. VCM bas to keep more sensible balances too. It should absolutely be in complete cooperation with designers.
- If SMEs do not bave VCM professional, they can cooperate with designers on these issues which are very similar to design management. Thus, they can control every coil of chain together so that they can make a decision together.

Conclusion

The findings of the previously held researches, that were made 7-8 months before the collaborative projects started, had shown that there were differences between the SMEs in Turkey and those in developed countries. The variety of the lifestyles of people in developed countries, and the variety of innovation and originality in their market showed that design was learned in natural media and through experience. On tbe other hand, the efforts of some conscious SMEs to attend international exhibitions increased their knowledge and experience, and provided them information about the concept of design. Another important difference is that small-sized SMEs generally make production in ateliers, largely depending on manual labour. Even though labour-intensive manufacture is a positive feature for Turkey in terms of employment of workers, it leads to a less cost-effective production compared to China. Accordingly, the expectations of SMEs from design depend on labor-intensiveness and the machines in their production tracks. But only a small number of conscious SMEs could sell products in global markets despite their boutique-style production. This issue, which should be seriously taken into consideration, shows the necessity to inform SMEs about industrial product design. Obtaining new products with design meets all expectations of SMEs. Gaining competitive power in national and international markets means that a solution is found for the sustainability of their existence.

It is very important that SMEs, seen today as the most significant tools of sustainable economic development, have an innovative thought system and primarily distinguish between sbort and long term novelties with their entrepreneurship. While they need to make research and development projects to form a basis for patents in the long term, they need to obtain novelty in order to register their imitation-free and original products in the short term. Thus they will continue to exist in national and international competitive markets. SMEs that accepted innovation as their mission may develop alternatives and novelties in their products while continuing their R&D studies. University-industry collaboration is a positive tool to continue innovation.

Considering the supply and value chain operations, VCM comprises sucb basic processes as demand, planning, supplying, production, delivery and recycling which are similar to the basic processes of product design. From this point of view, SMEs should be informed primarily by supporting foundations about both VCM and product design. Information and support can be provided by the following foundations: KOSGEB, TOBB, TTGV. International sources can be provided by TUBİTAK, TİM, ETMK, etc. There are also developing centers which may be called as "Turkish Innovation System" whicb cooperate with important foundations. Through these centers, providing support to SMEs can also be realized due to the cooperation within the fields of product design and VCM.

In addition, as in Italy and as is suggested by Özcan and Adanalı, a state policy is required which will help SMEs to "cluster together as a sector". In addition, SME clusters oriented to sectors should be built up in every city and every industrial zone (http://www.izto.org.tr). These clusters should also be called as SME Industrial Centers. In these centers, as can be seen in the banks, there should be individual SME representatives, which will provide SMEs with mass information. Above all, in these centers, having completed all the intermediate coils in the chain, SMEs should be easy to be reached beginning with the supplier's supplier to the end-user's representative.

Apart from the supply chain of VCM, SMEs should get to be aware of such characteristics as being flexible, fast, innovatory, creative and dependable. It is these peculiarities of VCM that mean much more to SMEs. They should also benefit from all contemporary data concerning production, service, and quality with the help of VCM.

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THE BRAND NAME MATTERS: THE STRATEGIC USE OF DESIGN IN THE DEVELOPMENT OF A GLOBALLY KNOWN BRAND, MAVI - BLUE- JEANS

Gozde Goncu[1], Ozlem Er[2]

Abstract

Mavi Jeans is an internationally known Turkish blue jeans brand sold at more than 4.600 stores in 50 different countries including the US, Australia, Canada, Germany, England, Denmark, Italy, France and the Netherlands. The brand is created in 1991 by Erak Clothing Company which had experience in blue jeans production as a subcontractor for well known brands. The word "Mavi" used in the brand name which is the direct translation of "Blue" was a sign of the future ambition of the company to make an original contribution to the "blue jeans" culture; a culture associated with the American life style.

As the brand of a parent company capable of producing the materials that they use in their products and undertaking innovations in them, Mavi Jeans has been a self confident player in the textiles sector. Backed with their experience in production and marketing in the sector, Mavi Jeans has used design as a tool to create original collections with an international appeal as well as a tool to create a differentiated position for itself and to communicate it.

This paper will examine the strategic use of design in the development of Mavi Jeans as a brand with a local and global appeal.

Keywords: blue jeans, denim, design, brand

1. Introduction

Mavi Jeans is an internationally known Turkish blue jeans brand sold at more than 4.600 stores in 50 different countries including the US, Australia, Canada, Germany, England, Denmark, Italy, France and the Netherlands. The brand was created in 1991 by Erak Clothing Company which had experience in blue jeans production as a subcontractor for well known brands.

In this paper the authors analyze the transition process of Erak Clothing from contract manufacturing to brand name manufacturing and the strategic use of design in this transition period together with the role of design in Erak Clothing's brand Mavi Jeans. The main purpose of the study is to understand the role of design in upgrading from contract manufacturing to brand name manufacturing and in tbe success of brand today. The study is based on data gathered from primary and secondary sources. Interviews conducted with Public Relations Manager and Design Coordinator of Mavi Jeans are the primary sources employed by the research. Statistical reports, annual company reports, industry magazines, reports by industrial associations, news clippings and articles were employed as secondary data sources.

The study first provides an overview of the Turkish blue jeans and denim industry. This is followed by an in-depth analysis of Mavi Jeans in terms of the development pattern of the company, its current size, production capability and current markets, the strategic use of design by the company; design activities and the use of design in marketing and communication of the brand. The paper provides an analysis of Mavi Jeans at two levels; the industrial level as well as the firm level. The paper ends with key findings and discusses the strategic use of design in the development of Mavi Jeans as a brand with a local and global appeal.

1.1. Development of the Turkish Ready to Wear Industry

Turkish clothing industry saw an accelerated growth period in the 1980s by the new governmental trade policy which supported export oriented growth. However, the developments that triggered the rise of Turkish ready to wear sector date back to 1991; the dissolution of the Soviet Union and to 1996; the Customs Union with the EU countries.

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These two important events offered special advantages in terms of vast informal and quota free trade opportunities. Additionally, Turkey was one of the twelve Mediterranean countries that benefited from the removal of quotas on textile and apparel imports by the EU (Begg, Pickles & Smith, 2003).

Today, Turkish clothing industry is one of the most developed sectors of Turkish economy in terms of production capacity, exports and employment rates. Clothing production has been heavily located in Marmara Region. Istanbul, Bursa, Tekirdag, Corlu and Gaziantep are the cities that handle the largest amount of clothing production in Turkey. Turkish clothing industry entered into the global market as a full-package supplier in the late 1980s. As stated by Tokatli (2007), Turkey is a full package supplier of knitted and woven garments and categories such as tailored suit and leather garments. Knit-wear is the largest sub-sector of the clothing industry with accounts for 51% of Turkey's total clothing exports. Major items of exports in the clothing industry are knitted T-shirts, sweaters and socks (cited in "Textiles and clothing industry"2006).

Turkish clothing industry holds several advantages. The primary advantages are being one of the most important cotton producers of the world, geographical position of the country which is close to main markets and particularly the EU, therefore short delivery times. Skilled labor and the customs union with the EU and free trade agreements with many other countries are also other strengths of the Turkish clothing industry. Today, Turkey is the second largest clothing supplier of EU after China. Recently some of Turkish clothing suppliers began to make the transition to branded manufacturing. As Gereffi (1997, 1999) stated when full-package producers are capable of providing all the organization necessary to convert buyer's designs into finished products that meet the required volumes and quality on time, they develop the potential of turning to brand name manufacturing. Some of the best examples of this transition happened in the Turkish blue jeans and denim industry recently. Turkish blue jeans manufacturers experienced upgrading to higher value added activities such as design and brand name manufacturing due to the experience gained as full package suppliers of international brands (Tokatli & Kizilgun, 2004).

1.2. The Turkish Blue Jeans Industry

The cotton yarn is traditionally the most important ingredient of the textile industry that is produced domestically in Turkey. By 2000, Turkey emerged as a major denim and jeans exporter since she holds the advantages of being the world's one of the largest cotton manufacturer with a strong textiles and apparel sector. Turkey was one of the top ten denim exporting countries in 2005 together with China, Hong Kong, the U.S., Italy, Japan, India, Brazil, Spain and Pakistan. Together, these countries accounted for as much as 83% of world denim fabric exports (cited in "Denim fabric: Global trade and leading players"2007).

Starting from 1990's Turkish denim manufacturers like Orta Anadolu, ISKO, Bossa Denim, Gap Guneydogu, Birlik, Tayteks and Kipas thrived as they tried to meet the increasing fabric demands of manufacturers in the growing domestic export markets (cited in "Kot'un Yukselisi" 2004). Denim producers are particularly successful in foreign markets, namely the U.S. and the EU. In 2004, Turkey exported U.S. $ 2.2 billion worth of denim fabric, jeans and other denim products and this turned country into an important jeans manufacturing site with a %6.5 share of world's market. ISKO is the largest denim producer in Turkey as well as in Europe which also produces for Mavi jeans and global brands like Zara and Levi's. The production capacity of ISKO per year is over 120 million meters of denim. ISKO's consistent growth led, in 2002, to a joint venture with the NC-based Cone Mills, the long-standing supplier of Levi's. The 51/49 joint venture, "IsKone," made ISKO the largest manufacturer of denim in Europe. According to the agreement between the two companies, IsKone would be the sole supplier of fabrics in Europe for Levis 501 jeans [1]. Headquartered in the southern cotton-growing city of Adana, Bossa is another large integrated textiles firm in Turkey. The company started denim manufacturing in 1991 at its fourth factory in Adana. According to 2007 data, Bossa manufactured 29.7 million meters of denim fabric [2]. Ordenim, Kipas and Birlik Mensucat are the other important denim producers in Turkey. Except denim and blue jeans manufacturing all accessories necessary for blue jeans like, labels, zippers, buttons are also produced in Turkey.

In addition to the large domestic denim manufacturers, Turkish blue jeans manufacturers learned a lot by being subcontractors of global brands and made significant improvements in quality, flexibility, punctuality and productivity. They produce, on a full-package basis for well-known brand names such as the Italian Rifle, Diesel, Armani and Miss Sixty; the German Mustang and Hugo Boss; the British Next; the Dutch Canoe; the Spanish Zara; the Swedish H&M; the American Levi's, Lee, Wrangler, HIS, Polo, Tommy, Guess, Gap, Mexx, and DKNY (Tokatli, 2007)

By 1990's the quality of the denim manufactured in Turkey increased simultaneously. As Turkey became one of the largest denim suppliers of the World, many local blue jeans brands started to appear in the domestic market by upgrading into higher value added activities like design, marketing and retailing. Mavi Jeans, Little Big (LTB), Collin's, Lofl, Lotus, Pyramid, Collins, Blue System and Rodi are a few of the Turkish blue jeans brands. From these, Mavi Jeans was the first one entering the U.S. market with its own brand name, and LTB was the follower company which now operates with its own stores in New York. Mavi Jeans is the leader blue jeans company in the local market since 1996 with its %60 share in the market. Company has over 7.000.000 pairs sales amount and

[1] cited from www.isko.com.tr
[2] cited from www.bossa.com.tr

3.000.000 pairs export amount annually. While annual turnover of Mavi Jeans was 12 million U.S. $, it reached 80 million U.S. $ in 2000 and 138 million U.S. $ in 2005 (cited from company reports). Mavi Jeans has 527 sales points in Turkey and out of these 99 belongs directly to company (cited from company reports). Mavi Jeans has showrooms in 11 different countries including Turkey and has flagship stores in 3 countries. By the year 2006, company has 173 Mavi Shops around the world including cities like Vancouver, Milan, Paris, London and New York.

2. The Case of Mavi Jeans

2.1. The Transformation of Erak Clothing

The infrastructure of Mavi Jeans started to form by 1954 when the owner of the company, Sait Akarlilar started to work in ready to wear sector. He founded his own company Guven Tekstil in 1971 and manufactured blue jeans in a small workshop experimenting on different dying and finishing techniques. His attitude towards trying new techniques was the first signals of his vision about differentiating blue jeans. He founded Erak Clothing in 1984 and manufactured blue jeans for international brands like Mustang, Lee, Wrangler, His, Otto, Chevignon, Old Navy, Tommy Hilfiger, Canoe, Joop, Edie Bauer and Espirit. The company has been functioning as a subcontractor of global brands for many years while improving its production capabilities and manufacturing technology.

Today, Erak is Turkey's largest blue jeans factory; a factory which can have 3 million meters of denim fabric in its stocks, with its 50.000 square meters of open and 25.000 square meters of closed field. Sait Akarlilar explained the evaluation period of Erak together with Mavi Jeans which once followed Rifle as an example; "When we first started, we followed Rifle as our example. As it was a brand from a country similar to Turkey like Italy, we were fascinated by its high quality and manufacturing conception. 30 years passed and now we are producing blue jeans for the Rifle Group" (Calislar, 2002: 3).

2.1.1. From Subcontracting to Brand Name Manufacturing

In 1991, Erak decided to upgrade to higher value added activities by creating its own brand name and running its own marketing and retailing activities. Mavi Clothing Inc. was established in 1991 as a marketing and sales company of the new brand. Erak's attempt to create its own blue jeans brand was very timely; since it was just the time when the structure of the blue jeans market changed and many brands entered the global market. Until 1990's Levi Strauss & Co. was the leader in blue jeans market. However after the 1990s with the emergence of designer brands in blue jeans industry such as Calvin Klein, Ralph Lauren, Versace and Moschino, Levi Strauss&Co. lived a sharp decrease in sales. Brands like the Gap and Tommy Hilfiger occupied the middle segment between designer brands and bridge level brands. Therefore, creating difference by design was rather important due to the change in the structure in the global blue jeans market.

The first step of brand building was finding a brand name and designing its corporate identity. Since Erak had been the manufacturer of many different brand names, it was decided that the brand name should not be "Erak", instead it should be something unique. The brand took its name directly from "blue" jeans, which is "Mavi" Jeans in Turkish. This small word trick used in the name of the brand explained the strategic aim and future positioning of Mavi Jeans; becoming a globally known brand with its roots in a specific locality. With the decision about the brand name and therefore the strategy, Erak also differentiated itself from local competitors which used English brand names.

2.1.2. Developing Brand Identity and Upgrading to Design

Since Erak has been a full package supplier company, Erak was used to manufacturing designs from abroad and did not have its own design team. Therefore, Erak started to look for designers to design the first Mavi collections. However, in those years there were not any blue jeans designers in Turkey and Erak decided to work with a foreign design consultant who was an expert on blue jeans and denim design. First, they worked with Italian Fiorucci design team who used Hawaiian concepts as inspiration. Although, the concepts of Fiorucci did not fit to the Turkish customers' expectations, it was an important experience for Erak and Mavi to understand how a design team should be and should work.

Mavi started to work with another professional; Adriano Goldschmied who is a well known denim and blue jeans designer and is known for building brands like Diesel and Replay. Mavi, received design consultancy from Adriano Goldschmied for four years about product development and trends. During this period Mavi also worked with another internationally known name; pattern designer Venuccia de Russi who designs patterns for Calvin Klein, Replay, Armani, Versace, Diesel and Miss Sixty [1]

Effects created by washing, finishing and stone washing, seam types and patterns of the blue jeans are the most important differentiation factors in blue jeans and denim design. The two main characteristics of Mavi Jeans' blue

[1] cited from http://hurarsiv.hurriyet.com.tr/goster/haber.aspx?id=3658348&tarih=2005-12-19

jeans; the style of the denim and the pattern of the products differentiated Mavi from other blue jeans brands. Ordenim, the major denim supplier of Mavi Jeans produces high quality and vintage looking denim which is the major characteristic of Mavi's blue jeans. The denim used by Mavi is lighter and stretchy than usual and the touch of the denim is smoother. The fleecy and worn look denim produced for Mavi by Ordenim was originally obtained by a lucky mistake owing to a defective machine at the Ordenim factory in 1990 (Tokatli, 1990)

Mavi adopted the "perfect fit" slogan as its design strategy and developed unique blue jeans patterns. Company designs different patterns for the local market as well as foreign markets. In the first years of the brand this strategy became successful in the local market. The model 174 with its low waist and close fitting blue jeans fitted Turkish people very well and caught remarkable success in the sales. By using different dying, finishing and stitching techniques on this model Mavi created different versions and named the new models such as "Qırmızı", "GREVV", "GRESS", "ZAPP" and "ZIEFT" with different advertising strategies and kept selling the model until 2000s (Calislar, 2001).

2.1.3. Learning Retailing and Communicating Brand Identity

In 1991, the same year that Mavi Jeans brand was created; Erak also entered retailing by opening its first store in Yeni Bosna which is a textiles manufacturing area in Istanbul. Starting from 1993, Mavi opened new stores in the local market. While doing so, Mavi reevaluated all assets in the company and in the stores such as personnel motivation, decoration, display design, sales campaigns and communication. Mavi also received professional consultancy to educate its personnel about stock control and financial communication.

The design oriented approach of Mavi showed itself also in retailing. The first innovation Mavi brought to retailing was the arrangement of products in the store where customers can touch and experience the product themselves. Mavi invested in designing new store concepts for new collections. Today, Mavi has an in-house design team that only works for visual merchandising and display designs of Mavi stores.

Mavi heavily uses advertising and communication activities to sustain the emotional connection with its customers. Mavi consecutively had many successful advertising campaigns starting with "we are being too much". In this advertisement global blue jeans companies were portrayed as being angry at the Turkish firm's success and complaining that "these Turks were being too much". With this campaign, Mavi started to use the moon and the star in the Turkish flag in a stylized version with denim texture as a logo. Mavi also highlighted its Mediterranean identity and its global success with "we are doing very well" campaign (Calislar, 2001).

2.1.4. Entering into the Global Market: Mavi Amerika

In 1997, Mavi entered to new markets in South Africa, Middle East and East Europe and opened show rooms in Vancouver and Los Angeles the same year. In 1998, Mavi reached 1 million unit exports rate and lived a sharp, increase in the sales in the U.S., Canada and Germany markets (cited from company reports).

The Eoreign Operations CEO of Mavi Jeans, Mr. Ersin Akarlilar explained how Mavi Jeans brand was launched to the U.S. market: "It was not planned, I was studying in New York, I graduated but I did not want to return Turkey. The best choice for me was to bring Mavi to New York. Therefore, I started looking for ways to market Mavi Jeans in New York." Ersin Akarlilar (2004) stated that he first brought first examples of Mavi Jeans to the U.S. in his luggage. The first order came from Nordstrom which was only 18 pairs of blue jeans. Mavi Jeans entrance to Bloomingdale's was a lucky coincidence in 1998. While Mavi Jeans was looking for ways to enter Bloomingdale's, they made an offer to Mavi Jeans when the daughter of Bloomingdale's sales manager asked her father: "Why don't you sell Mavi. All my friends are wearing Mavi Jeans" (cited in "They call Mavi Meyvi", 2004).

By 1999, Mavi opened new stores in New Jersey and Soho. American celebrities like Cher, Darly Hannah and Cherly Clinton were spotted wearing Mavi Jeans, which fueled further interest to brand. The same year in the local market Mavi was listed as 161st in the ranking of 500 Turkish companies. By the year 2000, Mavi climbed to the 128th row and to 77 in 2002. Also in 2002, Mavi opened its fist flagship store in Canada and the following year another store in Union Square, NY. In 2003, Mavi was in Time magazine and was the first Turkish brand exhibiting in Bread and Butter Exhibition in Germany

"Perfect Fit" philosophy of Mavi Jeans also worked well in the U.S. market. Mavi defined its target market as metropolitan cool, lively, trend follower than a trendsetter; aged around 18's and formed the characters of "Mavi Girl" and "Mavi Boy". Einally Mavi developed the Molly model, which is defined as skinny, sexy but still comfortable. Mavi tested itself in the U.S. market with this model and did not run any advertisement campaigns until 2001. Not having any advertisement brought an unexpected advantage to Mavi. The success of Mavi widened through word of mouth; the brand was "out of no where" and people were wondering "What is this Mavi?" (Calislar, 2001). By using this advantage Mavi invested in "Made in Maviland" advertisement campaign in the U.S. In this campaign the brand was still a mystery and subject of the campaign was about two young people looking for a fictional denim land and finally finding what they are looking for in Maviland. As the second part of this campaign, the book named "Exploring Maviland on a Jeanstring" was published to explain what Maviland is. Mavi Jeans also started a new higher price point brand named "Nomad" for the U.S. market. Mavi jeans' CEO Ersin Akarlilar defines this brand; "This is our new brand, We want to upgrade to higher price point blue jeans $120-180 with this brand"(cited in "Mavi is not enough for Mavi"2004).

The key factors affecting Mavi Jeans's success in the U.S. market were first the strict analysis of the target market, focusing directly on the target market by using model names like Molly, Maggie, Kate, Max, Matt and choosing the sales points in strategic locations where the targeted youth mostly live. Other important factors were Mavi's ability to respond the demand from the U.S. on time and sustaining the collaboration with professionals in an effective way. Mavi Jeans' U.S. operations director David Frankel, who was once the manager of Urban Outfitter's Free People states that by tbe advantage gained from fast transportation, Mavi can be in newest trends and new models can be in stores on time.

2.2. Mavi Jeans Today

2.2.1 Organizational Structure

Sait Akarlılar, the founder of Erak Clothing and Mavi Jeans is the board chairman; Ersin Akarlılar, Foreign Operations CEO and Elif Akarlılar, Global Brand Director are the other board members. Global Brand Director Elif Akarlılar is responsible for brand and design management activities at the board level. Sustaining brand identity, collection and store concept designs and the activities such as advertising and human relations are all under Global Brand Director's responsibility. Mercbandising manager who is responsible for product development and trend analysis, design manager, visual merchandising manager and advertising manager are directly related to Elif Akarlılar. All the departments under the management of Elif Akarlılar function together. Coordination among these departments is set up by department managers and Elif Akarlılar. Additionally, Mavi design departments in other countries and consultant designers work with Elif Akarlılar. Elif Akarlılar is a member of board as a manager of all design and brand activities and this attitude reflects Mavi Jeans' emphasis on design. Mavi manages and discusses design activities at the highest level in the company.

2.2.2. Brand Strategies

Mavi Jeans manage brand and design strategies together. The goal of Mavi Jeans is "being a global brand with its roots in local appeal" and its brand and design strategies are formed according to this goal. To reach this goal, company first invested in gaining quality standards and kept investing in technological upgrade. Today, these infrastructural investments lead to high quality products and development of local and worldwide supply chain. In Mavi Jeans, the concept of "perfect fit", constant communication activities and improving design capabilities shape the general strategy and support attainment of goals towards being a global brand.

2.2.2.1. Perfect Fit

Mavi Jeans' brand and design strategy is built upon the concept of "perfect fit". According to Mavi, "perfect fit" means fit to body, culture and budget. This concept is accepted by the employees at all levels. The company focuses on the culture and body type of people in the country before launching the brand to a new market. They study the life style and culture of the target market deeply. By their production experience and the consultancy from experienced designers and pattern makers, the brand creates its perfect fit for every body type. In the local market, Mavi Jeans developed patterns suitable to the Turkish people's body type and different from other brands added the sizes of 29, 31 and 33 for women' blue jeans (Calislar, 2001). Additionally Mavi Jeans orders items in the store according to the slogan of 'perfect fit'. The products are ordered according to tbe size other than the style.

2.2.2.2. Constant Communication

Mavi Jeans' one of tbe most important strategies is "constant communication". Constant communication of brand takes place at two levels; communication of the brand within the company and communication with the consumer of the brand. In terms of inner communication of the company, the brand tries to minimize the time and distance between employees working in different countries and foreign selling points. The magazine Mavi Communication helps to sustain the communication within the company.

Mavi organizes activities wbere the brand can meet the target consumers. Maviology; another magazine published both in Turkish and Englisb and many books printed by Mavi Production are the channels where Mavi meets with consumers. Mavi continues this strategy also in foreign countries. While the general sense of brand stays the same, Mavi runs different communication activities for each country. The Gallery in Mavi Store in Union Square, NY provides opportunity for young artists and designers to display their work. Besides exhibitions, short film nights called Cinemavi helps to improve communication with consumers.

2.2.3. Design in Mavi Jeans

Design is one of the most important elements in Mavi Jeans' brand strategy. Sait Akarlilar's personal approacb to design was one of the biggest factors that affected company's position today. Blue jeans entered Turkey in 1960s and Akarlilar tried to differentiate his products while every company was copying the style that was available. Today, Akarlilar's approach to design became a philosophy adopted by the company at every level. Additionally

Elif Akarlilar's position as a member of board reflects that design is a function that is represented and managed at the highest level of the firm.

2.2.3.1. Design Philosophy

Mavi Jeans' brand strategy of "perfect fit" is also its main design philosophy. Company aims to design garments that fit every body type and every culture. Thus, the company received consultancy from the experienced designers and created its own design team accordingly. Mavi Jeans Turkey's design director Guney Oktar explains the concept "We are designing for every body type and for every taste. This is the first rule. An Australian woman can wear Mavi as also an American or Danish woman does. The body types of women in the countries I just counted are very different. We're doing detailed calculations to create jeans that will fit all these body types. We are designing as if we are solving an equation" [1].

Another important factor that effects the design perception in Mavi is that "Mavi is a Mediterranean brand". Everybody in the design team is very sensitive to Mediterranean identity and they explain with these words; "We are telling a story of being a world citizen through the eyes of a Mediterranean"[2]. Design team defines the Mediterranean identity as cheerful, sexy, warm, comfortable and exotic.

Global design director Elif Akarlilar who is also responsible for all the design functions in the company, expresses that they employ fashion design in further scales than its classical meaning. She defines it as research and problem solving process rather than creating artistic illustrations "Millions of blue jeans are manufactured all over the world and it has been modified in many terms for many years, to make a consumer buy your product among this much alternative, you have to differentiate it and make it appropriate for that person. By developing new stitches, new patterns, new finishing techniques you can create unique blue jeans" (Calislar, 2002: 88). Key design elements for Mavi Jeans are the differentiation created by different finishing and stone washing techniques as well as pattern development and stitch types and embroidery at the back pocket of blue jeans.

Istanbul based Mavi Jeans became a world brand by the techniques that the design team employs while developing new products. Not only visiting international fairs but traveling all around the world, living with the target consumers, reading the same magazines, listening to the same music and renewing themselves accordingly helped the company to catch success in design (Calislar, 2002)

2.2.3.2. The Design Team

The design team of Mavi Jeans is also multicultural like the brand. Mavi Jeans employs 9 designers in Istanbul, 3 designers in New York, 1 in Vancouver and 1 in Sidney (cited in "Mavi" 2008). The company plans to widen the design team in Vancouver very soon. Product development team of 14 people which deals with technical details of the products supports the design team and design activities. All the teams related to design activities are under the Global Brand Director and work with the director. The coordination between teams is secured by the meetings every six months in Istanbul or in New York and they are also in continuous contact by internet and phone.

In addition to the in-house design team, Mavi Jeans continues to collaborate with professional designers outside the company for product design, merchandising or marketing activities. Company sustains its multicultural design approach while working with outside design professionals. The latest collaborative collection design of Mavi Jeans was with England based Turkish fashion designer Rifat Ozbek and France based Turkish designer Yazbukey. Rifat Ozbek who is the creative director of Pollini designed Mavi Jeans' limited edition collection for Spring 2007. Rifat Ozbek for Mavi; a 30 pieces collection is Ozbek's first collaboration with a Turkish apparel company. The Global design director Elif Akarlilar explains this collaboration with these words; "We are very similar. He has been a global player and has Mediterranean origin that we like". Mavi Jeans collaborated with Yazbukey for an accessories collection; a holiday set which also represents Mediterranean identity of Mavi.

Mavi received design consultancy for store and display designs from Dean Holdiman who designs for high end global brands like Gucci and Fendi and for ready to wear brands like Urban Outfitters and Anthropology. He designed the store concepts that represent the Mediterranean brand identity. Lately; Mavi Jeans worked with Oliviero Toscani for the advertising campaign "Kafana Gore Takil" . Oliviero Toscani who designs remarkable and debated advertising campaigns, is inspired by the Mediterranean culture.

2.2.3.3. The Design Process

Mavi Jeans' brand identity "being Mediterranean" does not change from season to season and is used in collections as well as store and display designs. Collections are designed according to the brand identity but at the same time according to the changing trends. Trend analysis is carried by designers. Designers use, street styles, travels, fairs, magazines, internet sources, up to date art events and second hand stores as a source for trend research. Mavi design team creates two big collections per year. These two main collections are made up of 3 smaller collections. Thus, 6 small collections are designed per year and collections are designed two seasons beforehand.

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[1] cited from http://hurarsiv.hurriyet.com.tr/goster/haber.aspx?id=3658348&tarih=2005-12-19

[2] cited from http://hurarsiv.hurriyet.com.tr/goster/haber.aspx?id=3658348&tarih=2005-12-19

The Turkish collection contains most of the outfits of foreign collections. However, depending on the demand from different cultures the collections may differ from eacb other for different markets.

Besides blue jeans, Mavi Jeans also designs t-shirts, shirts, sweaters, outerwear, socks, bags, hats and other accessories. In 2006 Mavi Jeans added organic blue jeans and t-shirts to its collections whicb are 100% organic Aegean cotton. Mavi also lunched % 100 cashmere, silk and linen products same year.

3. Conclusion

Erak was the forerunner company out of thousands of jeans manufacturers in Turkey that managed to create a globally known brand. This case study was an attempt to understand how Erak overcame the cballenge of upgrading in high value added activities by creating the Mavi Jeans brand. Our findings show that managing all design embedded activities of the company in compliance with the identified brand identity of Mavi Jeans and the financial and technological support provided by its parent Erak have been instrumental in the establishment of Mavi Jeans as a global brand. Due to its high production capacity Erak still continues to act as a subcontractor of foreign brands while Mavi Jeans functions as an independent company responsible for marketing and retailing of the brand Mavi Jeans. Erak functions as the sole supplier of denim products for Mavi and sources denim fabric from experienced local fabric manufacturers like Guneydogu and Ordenim. The main factors bebind the success of Mavi Jeans are the manufacturing experience of Erak Clotbing, its technological potential and financial power.

By using the advantages of relying on a manufacturing base established through years of experience as a subcontractor and being able to source good quality denim fabric from domestic suppliers, Erak Clothing has made a right move to try and upgrade at least some part of its operation by building an original brand and thus moving into bigher added value activities. By implementing a design strategy which differentiated the products of the Mavi Jeans from its competitors and supported that strategy with a suitable brand building and retailing strategy, the brand became successful at local and global scales. In this process, tailoring of product design, retailing and brand communication activities for different target markets has been the main influential factor to the success of the brand. Positioning the design and brand communication activities according to the specific features of target markets without loosing the core identity of the company has been tbe source of the local but at the same time global appeal of the Mavi Jeans brand.

In addition to these factors, one should cite the entrepreneurial sprit of Sait Akarlılar with his desire for developing new products as the main driver behind the development process of Mavi Jeans. The founder of Erak Clothing and Mavi Jeans, explains the main components behind the success of the brand as follows:

"Techology, experience and financial power. If you lack any of these elements, it might not be possible to create a new brand. Technology is a must for competitive power. Experience is key to sustainable development to meet the demands. Financial power secures when you can not make any money for many years while investing on brand. However fulfilling all these requirements might not be enough. Creating a brand requires creativity." (cited in Calislar, 2001: I, translated by the authors).

The case of Mavi Jeans illustrates the importance of strategic actions of individual firms in the process of upgrading to high value added activities. Further study can be conducted to understand how success of the brand can be sustained under the rapidly changing dynamics of the global ready-to-wear industry.

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A DESIGN FOR THE BRANDING OF HIGHER EDUCATION: A SOUTH AFRICAN PERSPECTIVE

Garth A. Van Gensen [1]

Abstract

In this article a proposed design for the branding of higher education institutions is provided. The model describes, among others, the internal practices that have a profound impact on branding and on an institution's overall reputation and image. The author argues that a strong internal focus is necessary before a meaningful brand experience can be embarked on that will ultimately result in unprecedented benefits, even for relatively new institutions.

In South Africa the need for more scientific approaches towards the branding of higher education is enhanced by a number of realities, such as a history plagued by inequalities; new policies directed to eradicate the very same inequalities; private higher education; increased diversity in types of institutions; increasing reliance on partnerships and alliances; increasing competition between institutions; increasing reliance on private funding for public higher education; a demand for quality; pressure to find solutions to the growing financial problems faced by institutions; and the merging and incorporations of higher education institutions. The proposed model is based on two overarching fundamentals, namely the experience economy and its relatedness to brand, as well as relevance and branding, which should follow an integrated approach that could ultimately lead to successful external branding of higher education institutions.

Keywords: Branding; Internal practices; Reputation; Image; Internal Focus; Experience economy

1. Introduction

During the last couple of years South African higher education has undergone unprecedented transformation. This need for transformation received impetus from other forces such as the emergence of private higher education; the notion of quality assurance; mergers and incorporations; funding; globalisation; the idea of an entrepreneurial university as an alternative; enrolment capping; as well as programme and qualification mixes. One of the driving policies behind this transformation was the National Plan for Higher Education (NPHE) (RSA DoE 2001). This particular policy has impacted on how higher education institutions would market and brand themselves. Branding of higher education in South Africa has, however, until now not been an area of priority because it has always operated in a protected, regulated market with a steady income. Subsequently the thesis statement for this paper is the lack of proper marketing and branding strategies at higher education institutions in South Africa in view of a new unfolding national and international landscape. Critical to this thesis statement is what kind of strategies, given the higher education scenario in South Africa, should be adopted in order for them to make meaningful inroads in what is deemed to be an institution's most valuable asset, namely its brand.

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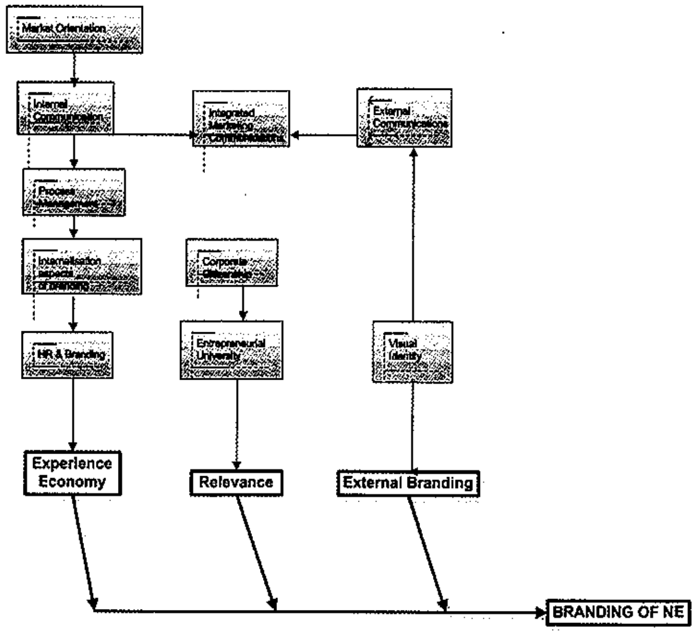
Figure 1. Proposed design for the branding of higher education institutions in South Africa



As outlined in Figure 1, the proposed design is based on three pillars, which are the so-called experience economy, relevance and external branding.

2. The Experience Economy

In his ontological theory Leberecht (2005) proclaims that idealists about brands see perceptual or cognitive acts of consumers being grouped under the headings 'brand image' and 'brand awareness' as constitutive for the existence of brands so that, in their view, tools of the marketing mix can influence relevant mental dispositions and attitudes. Idealists see brand value as being anchored in customer awareness, as intangible assets, constructed in consumers' minds by the function of brand management (Leberecht, 2005). Brand materialists, on the other hand, oppose this idealistic concept of branding as 'the creation of human meaning' and reject the idea of branding as an added psychological value to a product (Lepla and Parker in Leberecht, 2005). Brand materialists also argue that companies make the mistake of developing a grandiose brand promise that they cannot keep [Aaker and Joachimsthalter, De Chernatony, Keller, Tosti and Stoz (in Leberecht, 2005)], as brand materialists are more concerned about the internal reality of a brand. Yet the author postulates that a combination of the idealistic view of branding and the materialistic view with the emphasis on the latter, be the ideal for higher education institutions in South Africa. The author argues that branding can form an added psychological element of a product or service in higher education the idealistic way, given that the materialistic view of branding was prioritised.

2.1 Human resources and branding

Branding usually starts from the 'inside out' and staff's behaviour with brand values needs to be aligned as a very important aspect of internal branding. However, it is going to be the CEO that looks beyond his/her own personal short-term gains to long-term institutional excellence. Unfortunately, higher education institutions are much more concerned about the external element of the branding process. According to Vallaster and De Chernatony (2003), there has been intense debate for years about what a brand is and how it can be established in the hearts and minds of consumers. This strong external focus has been challenged by authors of organisations who tell their consumers what great organisations they are. Higber education institutions particularly in South Africa and elsewhere are culprits in this regard and the author is of the opinion that institutions who regard themselves as 'excellent', for example, exploit the immeasurability and vagueness of concepts like these by the stakeholders, e.g. prospective students, parents, donors, etc.

2.2 Internalisation aspects of branding

For higher education institutions to change employees' behaviour to that of brand ambassadors and eventually to obtain the desired culture of quality teaching and learning, research and community service, a few internal practices are proposed.

2.2.1 Collaboration between human resources and marketing divisions

Despite the historically weak links between HR and branding, according to Martin, Beaumont, Doig and Pate (2005), there is a growing realisation by companies and HR professional bodies that aligning the external, corporate image of organisations should be aligned with internal employee identity. This realisation is also needed in higher education. The brand promise e.g. of a preferred higher education institution must be linked to performance management of higher education staff in order to create brand champions across the institution.

2.2.2 Having a clear purpose and identity

Before looking at getting the higher education institution to work, living and interacting 'on-brand', it is rather critical that the brand should be clearly articulated. Unfortunately many higher education institutions try to develop an internal dynamic around their brand that does not have a clear identity. Sullivan (2003) reiterates that companies spend millions of rands crafting corporate branding or 'identity' strategies and updating their mission and value statements. They then work with marketers and advertisers to fine-tune and communicate the new perspective to customers – in the case of higher education institutions, their stakeholders such as donors, the community, government, parents and students. The same author continues by noting that in all organisations employees serve as the primary 'channel' used to characterise the brand during direct contact with the customer, but in most companies employees do not understand the corporate brand elements or what is needed from them to help customers experience the difference. It even becomes more challenging when Vallaster and De Chernatony's (2003) view is considered. They maintain that the process of developing a shared brand understanding among staff becomes more problematic as service brands expand internationally and need to draw on multicultural workforces in different parts of the world. This is particularly true for higher education institutions in South Africa and is exacerbated by multicultural staff members.

2.2.3 The CEO as institutional advocate

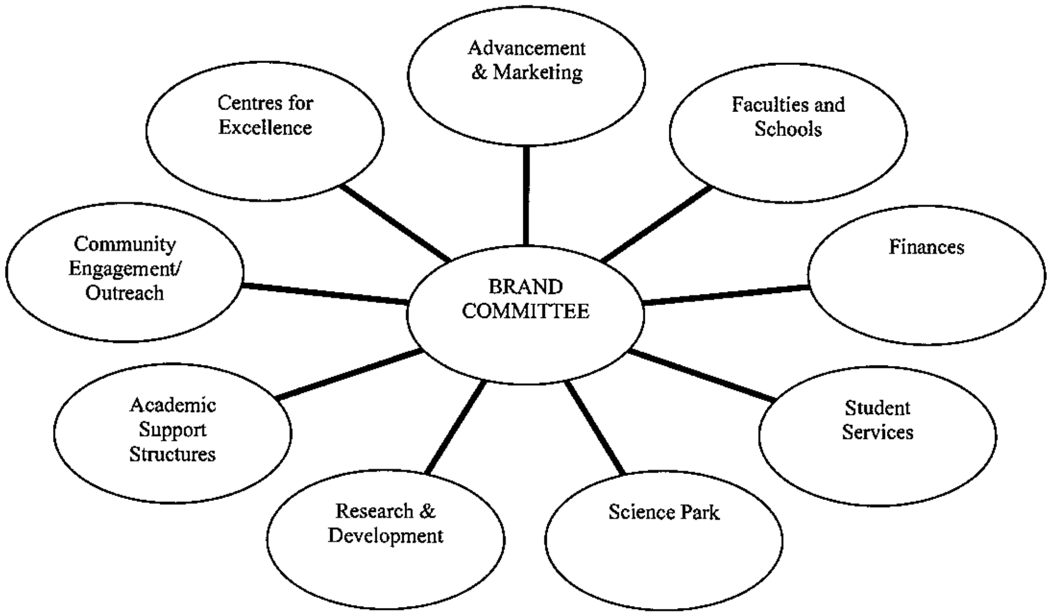
Idea Engineers (2005, 2 of 4) constitute that without 'top level evangelists' who clearly articulate the significance of 'Living the Brand', internal brand mobilisation will defuse. The one thing all successful brands have in common, is passionate CEOs who understand the meaning of the brand experience, internally and externally. At institutions of higher education the CEO's role should be more of a strategic, outward management. The author is of the opinion that it is not easy to fulfil this kind of role at higher education institutions. Where else would one find so many managers in one organisation? There are, for example, Deputy Vice-Chancellors, Registrars, Deans of Faculties, Directors of Schools - to name but a few. These people are normally highly qualified and highly skilled managers who do not need a CEO to watch what they are doing. Research findings of 'CEO Reputation Survey 2001' carried out by internationally-active communications consultants Burson-Marsteller (Burson-Marsteller, 2001) reveal that the reputation of a company as a whole depends 48% on the reputation of its CEO.

2.2.4 A branding committee

Another role that cannot be executed without HR planning and driving is the organisational structure of the institution of bigher learning. Like all large organisations higher education institutions consist of various departments ranging from student recruitment to finances. A cross-functional team structure is essential if the institution is going to orientate itself around an 'on-brand' ideology. Cross-functional in this regard is described by Robbins (1998) as teams made up of different employees from about the same hierarchical level, but from different work areas, who come together to accomplish a task. These teams should consist of staff members from across the internal hierarchy and thus become the only method through which to place the brand itself at the heart of the business. Sucb a Brand Committee can work through internal dynamics and power plays inherent in any institution and focus on the health, relevance and role of the brand itself within the company (Idea

Engineers, 2005). Martin, Beaumont, Doig and Pate (2005) agree to this when they state that a branding message, which will effectively result in external and internal identity, should be facilitated through the establishment of a comprehensive and coherent cross-functional branding team. Figure 2 indicates how this cross-functional team can operate within an institution of higher learning. (The elements included are examples of different divisions that can be included at higher education institutions.)

Figure 2 .How a cross-functional team can operate in higher education



Source: own

The Branding Committee can be assisted in its tasks if the 'Touch Point Analysis' is used by higher education institutions.

2.2.5 The touch point analysis

Internal brand programmes must always be designed around an understanding of where, how and when customers are coming into contact with the institution. There is a belief that the marketing division of a higher education institution is the window of the institution. The author strongly disagrees with this because stakeholders / clients / students / parents can communicate, contact and require a service from almost anyone at an institution of higher learning. If the higher education institution understands each point of interface of all stakeholders, it means that an impact can be made at each point of contact with the stakeholders - consistently. This is referred to as the 'touch point analysis' and requires a different approach to each point of interface with the higher education institution. Prospective students contact institutions with regard to fees, application forms, registration dates, etc. These enquiries could e.g. also be channelled through to a One Stop Helpdesk for these prospective students.

2.2.6 Evaluation

True to the nature of higher education, namely evaluating, debating, questioning and reflecting, among others, internal practices which could enhance the brand should also be evaluated and measured. The author is of the opinion that this kind of exercise might be considered by some as too 'sales-orientated' and industries involved in selling should embark on it. However, there is a belief that if you cannot measure something, it is non-existent. Although highly debatable, there is some truth in this. A 'living the brand' programme should be a dynamic intervention and as such the brand needs to clearly define its position and clear sets of goals should be set. This programme can be measured and managed by the Branding Committee as a cross-functional team (indicated in Figure 2).

2.3 Process management and branding

To align organisational competencies around a vital few core competencies has become a competitive strategy and by doing so most visionary business leaders are recognising that processes - not functions or departments - deliver customer value and satisfaction. Several different activities are being performed in a typical day in a higher education environment. It ranges from enquiries for admission, examination results, students accounts, different kinds of events, sport and student life, to name but a few. From tbe author's experiences as well as from the empirical investigation, it seems that all these activities at higher education institutions in South Africa are loosely managed. Eacb is managed individually by different heads of departments and of course this would imply that its character and message will also be just as different from one another as the activities.

2.4 Internal communication

Organisational communication is considered a vital tool for binding an organisation, enhancing employee morale, and promoting transparency. Everybody seems to understand the significance of organisational communication, but very few higher education institutions in South Africa seem to manage it effectively. Express Computer (2001) alerts us to the fact that both the long-term and the short-term fallout of ineffective organisational communication can be damaging for an organisation. It may start from the spread of rumours to disillusionment among employees to a gradual destruction of the organisation's brand image. Internal communication ultimately influences the organisation's interaction with the external environment. If staff members are communicated to by management on a regular basis regarding relevant issues at tbe institution, they will have relevant knowledge to interact the same knowledge to the external environment, e.g. prospective students, parents, etc. This organisational communication is also aimed at influencing employees and motivates bebaviour.

3. Relevance

Any branding issue, any business principle, and any organisation or higher education institution bas to be relevant for survival. If customers are not interested in one's product, it means there is no demand, thus no relevance to the market. However, there are two other elements wbich make the above not so simple: an organisation can make itself relevant, even if it is not. Clever marketing strategies actually force the customers to think that they cannot go without a product or service. The other element of relevancy and the market, and thus brand, is the issue of staying relevant. Some service or product simply did not change with the demands of the time, consequently becoming irrelevant and distinct. In order for higher education institutions in South Africa to be relevant or 'staying relevant', the institutions bave to comply with the various policies initiatives that bave set the pace for transformation, e.g. equity in staff transforming to institutions that deliver competent students to a demanding and changing regional, national and global environment. The issue of relevance should furthermore be emphasised by South African higher education institutions in taking the entrepreneurial route.

3.1 The entrepreneurial university

The challenges facing higher education institutions in South Africa bave been mentioned earlier in my presentation. One of these challenges is the very idea of relevancy. This is the reason why the idea of an entrepreneurial university was mentioned and an empirical investigation was done with this specific possibility of relevance. The connectedness of brand to relevance cannot be treated lightly and the connectedness of relevance to the entrepreneurial university forms a key element of this study. This also links up closely with the experience economy because the whole nature of the entrepreneurial university is real; it can be seen, it can be experienced.

3.2 Corporate citizenship

The author asserts that no meaningful branding of higher education institutions can be done without a strong connection to relevancy, of which corporate citizenship could be added. During tbe past few years there has been growing interest in issues relating to corporate citizenship. Stakeholders are increasingly expecting higher education institutions to be economically, environmentally and sociably sustainable; to be accountable and transparent; to be inclusive; to be ethical and more equitable. In South Africa, with its history of inequitable distribution of wealth and a backlog of the majority of South Africans with regard to education, as well as other social issues, the case of corporate citizenship is even more compelling.

Higher education institutions in South Africa are not in a position to choose whether they will engage in corporate citizenship; they are compelled to do it based on the core functions of higher education, that is teaching and learning, research and community service. It has become clear to higher education institutions that the social wellness of the community has to be incorporated, not as an add-on to their other activities, but as an essential, integral, more social redefinition of higher education, in order for the imbalances of the past to be addressed.

3.3 Integrated marketing communications

Due to the nature of higher education (loosely managed faculties, divisions) as well as its unusual combination of its stakeholders an integrated marketing communications approach is proposed where the alignment of activities is of its elements.

4. External branding

The concept of the external branding of an organisation and its connectedness to brand as a whole is a highly contentious one. Many view this external branding as the brand – at worst - itself, or - at best – as the manifestation of the brand. The concept of external branding in the context of this proposed design cannot be viewed in isolation. This paper proposes that there is no such concept as external branding in view of what should be done *internally*. The elements of internalisation in order to brand, outweighs any 'external' activity and the author would thus prefer to use concepts like 'outward communicative activities' or 'external communication'.

In the higher education sector in South Africa, little connection is made to the 'external branding' and internalisation. From the formal and informal discussions undertaken by the author, and as participant observer, it became clear that the 'external branding' aspect is regarded by many at higher education institutions as *the* branding exercise itself. Based on this, the author purposefully decided to place this part at the end of this paper, because that is where it belongs. It should be a sealant on the branding exercise and can only enhance the branding of higher education institutions.

Most higher education institutions in South Africa, along with their merging/incorporations and new status of universities or universities of technology, have fallen into the trap of first developing a visual identity and thereafter some of them will embark on aligning the external visual identity with their values. It should be the other way around. The elements of outward communicative elements would be the visual identity as well as the traditional external communications.

5. Conclusion

This paper focussed on what higher education institutions in South Africa should be doing internally before they spend millions on external branding. These internal aspects should be embedded in such a way that they become behaviours and the institutional culture of the higher education institutions. Whilst turning internalisation into employee behaviours, an external focus can be operationalised. The ethically and truly honest approach hereof will help tremendously with a 'buy-in' by employees, and moreover, it could make all employees proud of the institution and should convert them from 'brand saboteurs' or being neutral to 'brand ambassadors'. Conversely, no effective branding can take place without a total commitment by executive management - firstly to recognise institutional processes that may effect branding; secondly, to recognise concepts, for example relevance that may effect branding; and, thirdly, to vigorously deal with processes and concepts to enhance branding of South African higher education institutions.

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VALUE CHAIN MANAGEMENT FOR SMES

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Abstract

Supply chain management integrates industry partners, from the supplier to the end user, in order to maximize profit and efficiency throughout the levels involved. To remain competitive, enterprises resort to various value adding approaches. Usage of technology, sourcing strategies and buyer supplier relationships are among several approaches that help enterprises remain competitive against local and global competition. The role of small and medium-sized enterprises (SMEs) has been neglected in the value chain. The chance to introduce innovative value added services and/or products by leveraging supply chain concepts can create significant value for SME's. By properly integrating SMEs in the supply chain, barriers to internalization and competitiveness maybe eliminated and pave way for collaboration among supply chain partners. In this study the role of SMEs' in the supply chain is investigated through a literature survey and a road-map is proposed to integrate supply chain strategies with the competitive strategies of SMEs for effective value chain management.

Keywords: *Small and medium-sized enterprises (SMEs), Supply Chain, Value Chain*

I. Introduction

Small-and-medium size enterprises (SMEs) are fundamental for national economies and are important at micro and macro levels. SMEs, being independent economic units, provide products and services, and act as subsidiary industries for large enterprises (LEs) (Yonar, 2007). Although it varies from country to country, the rate of SMEs is almost above 70% in overall business enterprises. Table 1 summarizes SMEs' effect to the overall business for various countries.

Table 1. Rate of SMEs in countries
(Source: KOSGEB (Small-and-medium Sized Industry Development Presidency)

Country	Rate in overall business enterprises (%)	Rate in total employment (%)	Rate in total investment (%)	Rate in adding value (%)
USA	97.2	50.4	38.0	36.2
Germany	99.8	64.0	44.0	49.0
India	98.6	63.2	27.8	50.0
Japan	99.4	81.4	40.0	52.0
England	96.0	36.0	29.5	25.1
South Korea	97.8	61.9	35.7	34.5
France	99.9	49.4	45.0	54.0
Italy	97.0	56.0	36.9	53.0
Turkey	98.8	45.6	6.5	37.7

To manage the supply chain right, there are various number of inputs and outputs to the system. These inputs and outputs should reach the right person, at right time and place. The objective of SCM is being efficient and cost effective from transportation to distribution, to the management of inventories of raw materials, work in process and finished goods. However, during the theoretical planning stage, SMEs are not considered, although they constitute an important role in the main pie. Global manufacturers recognize that supply chain efficiency is critical in gaining competitive advantage, however the system is tried to be optimized in terms of efficiency and profitability ignoring the size of the organization.

Arend and Wisner (2005) have investigated the fit of SMEs within supply chain applications. Their study shows that SMEs do not utilize the supply chain to a full extent, these enterprises have deficiencies in their strategies and

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tbe role of SMEs in the chain are not defined clearly and are often open to manipulation by larger enterprises . This leads to loss of control and diminishes the core advantages of SME's. Accordingly, nowadays, SMEs play a more active role in the supply chain; they try to reorganize the chain according to their customers personalized demand (Davidrajuh, 2003) which enhances their unique capabilities. This provides advantages and disadvantages sucb as shorter response time, increase in variety in the product and service provided, decrease in product lifecycle, having a risk in making investment to new equipment, material and technology due to the rapid cbanges in the market (Hvolby and Trienekens, 2002).

Besides the activities performed and the necessary precautions taken, government support is necessary for SMEs. But, since this could not be controlled by SMEs, this is not considered within the scope of this study.

This study proposes a descriptive, not prescriptive, stage model for SMEs to be part of a supply chain. The model is going to describe the logical evolution of SMEs where the previous stage is going to be an improvement stage for the next stage. This model will be a roadmap for SMEs to improve themselves in the supply chain. Various studies have been investigated to determine the important aspects of SMEs in supply cbain from different perspectives.

In this study, first the differences between LEs and SMEs are put into perspective to make the study more clear. Next, the role of SMEs and difficulties they face in the supply chain is summarized. Then the model formed by the help of the research is introduced.

2. Differences Between LEs and SMEs

There are differences between SMEs and LEs in terms of organizational structure, management and resource capitalization and usage. Studies from Levenburg (2005), Faisal (2006), Laukkanen (2007), Bilili&Raymond (1993), Hong and Jeong (2006), Arend and Wisner (2005), Çalıpınar (2007), Rao et al. (2003) and National Research Council Staff (2000) are summarized to determine these differences. First of all, since SMEs lack skilled human resources, competences and financial resources to increase their participation in value chains, networks or clusters or to meet new product and process standards requirements, SMEs are more open to environmental effects and misjudgments. These lack of resources make them stay away from high investment as well as risky and complex businesses. Secondly, small operating capacity and sensitive structural features causes big losses in case of any turmoil within the supply chain which indicates having limited cushion for failure. Hence, SMEs are in the risk of closing business. Thirdly, SMEs generally deal with in-house experience due to lack of trust, not defining its place in supply chain on its own. In the managerial side, SMEs have a short-range perspective. They are centralized and semi-structured and moderately specialized and have specific core competencies. The decision making is day-to-day. Accordingly, SMEs do not deal with long-term planning. Also, SMEs try to adjust rather than predict and control the environment they are in. They should decide whether to be a product or service component provider or producer. Unique competencies and effective customer/supplier management is limited to specialized markets in SMEs whereas LEs have effect and dominance on both downstream and upstream partners. Finally, due to the existence of scale, scope and learning economies in the industry, SMEs can differentiate themselves rather than focus on cost-lowering strategies. Besides these disadvantages, SMEs are flexible, adaptive and innovative organizations compared to LEs due to:

- Organic organizational structure compared to LEs more bureaucratic structure,
- Horizontal organizational structure,
- Nonstandardized and informal working relationships,

Flexibility helps SMEs adopt to changes and apply new things more easily. This also make SMEs more innovative compared to LEs.

3. SMEs Place in the Supply Chain

Porter's (1985) value chain model is important in determining specific activities to help organizations in gaining competitive advantage and building their value. These specific activities are divided into two: Primary and support activities. The primary activities define the activities for the firm to fulfill its role in the industry so its customers are satisfied; the support activities are necessary to control and develop the business to indirectly add value. These two activities should be managed effectively in order for the product or service delivered to the customer to add value to the activities of the organization to gain profit and competitive advantage. Thus the organization should search for the areas to create value within the firm. The value chain "governance" comes up into area where the main aim is to decrease any kind of uncertainty in supply and demand through cooperation to have improvement in the information and trade flows and reduction in overall costs. The governance will help the reorganization and development of global value chains so an opportunity for SMEs will occur to expand their businesses (OECD, 2007).

Sravistava et al. (1999) includes the activities in SCM process as screening vendors, purchasing, set up and maintenance of production technologies, pricing, order processing and internal order communication, cost control, production, order fulfillment and service, distribution and delivery and payment administration (taken from Arend and Wisner, 2005). In the supply chain, upstream (such as supply and manufacturing) and downstream (such as logistics and distribution) activities are critical in the value chain. Kukalis (1989) suggests that the integration of upstream and downstream forces is necessary for the cooperation and collaboration between supply chain agents. Collaboration is the core issue for SMEs and SMEs are value creating agents in the supply chain. Lambert and Cooper (2000) say that SMEs' competitive priorities are by protecting their specialized niche market. SMEs, if in a mature manufacturing industry, produce products or services at competitive rates (at low cost); if in knowledge-intensive industries, have to provide innovative products or services (Hong and Jeong, 2006). Moreover, true vertical integration is not true for SMEs (Arend and Wisner, 2005). SCM implementation of SMEs is not for improving the chain's performance. According to Arend and Wisner (2005), LEs compared to SMEs, improve the integration in the chain and extend the chain, search new ways to integrate the chain's activities and have more time efficient activities. On the other hand, they realized that SCM has a negative effect on SME performance. Since SMEs are not deeply involved in supply chain activities as LEs are, they receive less benefit from the partnership. On a survey done by OECD (2006), the type and intensity of barriers in accessing international markets perceived by SMEs are searched. In Figure 1, the internal (high level financial management skills) and external (business environment considerations and political risk) problems listed that prohibits SMEs to fully participate in the globalization process. Trust, dealing with foreigners and lack of information sharing are the top problems.

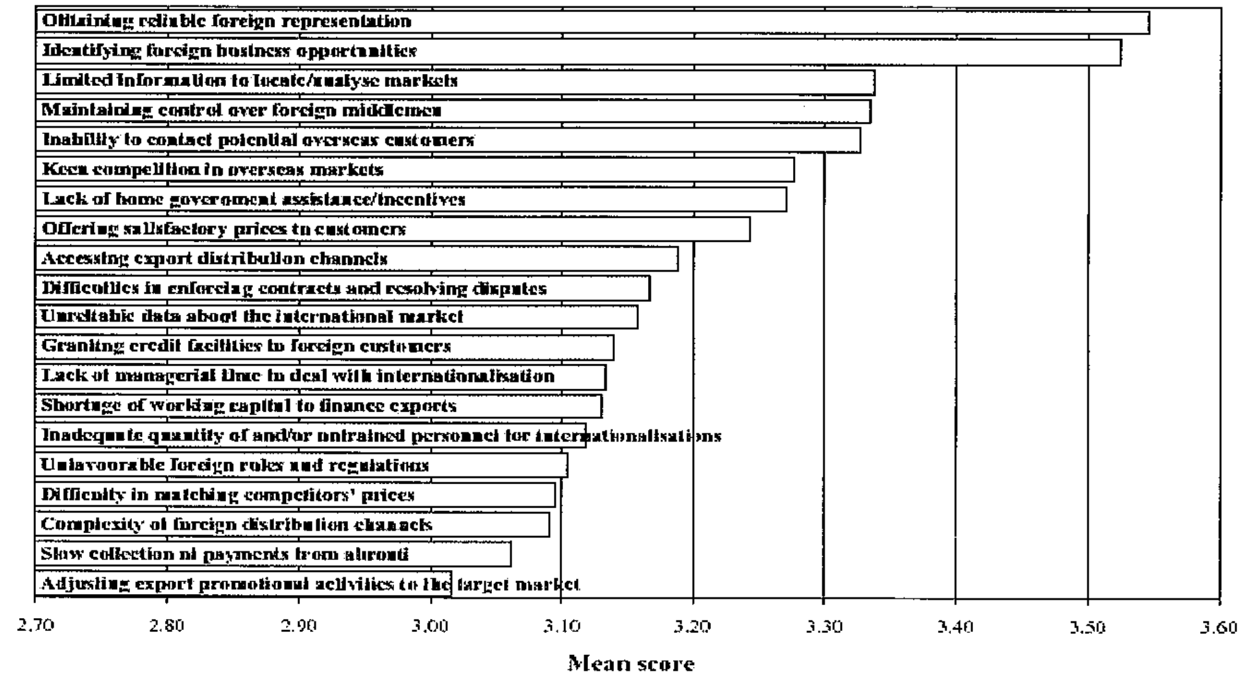

Figure 1. Obstacles to internationalization as perceived by SMEs
(Source: OECD WPSMEE, Removing Barriers to SME Access to International Markets, 2006.)

One of the advantages provided to SMEs by SCM is the ability to alter the core competences such as in product design and radical process innovation, by reaching complementary partner assets (Arend and Wisner, 2005). New product development, quality and customer service are the strategic focus areas of SMEs which are not seen as important by SMEs although they affect the chain positively. High level of SCM practices will help SMEs to have high level of operational performance. Hong and Jeong (2006) define two dimensions for SMEs characteristics: Strategic focus to decide how to compete and supply chain relationship position to decide where to compete. For a SME to have sustainable competitive position, value added competition and high position in the chain is suggested by Hong and Jeong (2006). In that case, SMEs will come face to face with the closure of their business. To avert that fear, innovation is utilized since it will be hard for them to compete in low-cost strategy due to their limited constraints.

Innovation together with design will bring differentiation. Differentiation and value added services will create branding. These two actions will form the primary competitive advantage of the organization and make the organization move through branding. Hemtasilpa (2005) indicates that to build a strong brand, SMEs should differentiate products and services and insist on brand building. This means that long-term planning is required for branding. Branding reflects the culture and purpose of the organization and is important in terms of creating organization's unique characteristics. It is also connecting the organization and its customers to each other. Differentiation and branding will enhance the value of the product and services (Aaker, 1991) but it requires following the changes and trends in the sectors. Keller (1998) offers designing a "push" campaign that aims to build the brand, and a creative "pull" campaign that will attract the attention to the product or service provided by the SME (Krake, 2005: 229). There are some other models in the literature (Çalıpınar, 2007; Udomleartprasert et al., 2003; Higuchi et al., 2005) for SMEs to participate in the supply chain. All the models indicate different stages, however, all of these models indicate an integration in their first stages.

4. Key Process Areas for SMEs in the Supply Chain

Supply chain structure, business processes and management components are the elements of supply chain (Lambert et al., 1998). For SMEs being effective in the supply chain, they should know their supplier, buyer, substitutes, potential entrants and rivals (Porter, 2008). Besides that, SMEs should complete their duties on time, within budget and at a required quality. The SMEs should have a concrete infrastructure and define well their business processes in the competitive environment to collaborate in the supply chain. In this section, the key process areas that are seen important in supply chain for SMEs are summarized.

4.1 Supply Chain Strategy

The customer needs should be satisfied through products and services. The competitive strategy of the organization defines the set of customer needs. A supply chain strategy is started from the initial activities (procure orders) to manufacturing or the operation of the services. Supply chain strategy includes supplier strategy, operations strategy and logistics strategy. To achieve strategic fit for the organization's success, the supply chain strategy and competitive strategy must fit together. For SMEs, virtual enterprise is possible at the beginning, then boundary-less culture and finally introduction of innovative products or services (Jabekar&Pelc, 2002). Virtual organizations provide agility to the supply chain environment and it is one of the major determinants for competitive strategy (Gunasekaran et al., 2007). Virtual organizations are reactive and flexible which are suitable for SMEs nature.

Supply chain strategy should define strategies and objectives to control the supply chain operations to reduce costs and compete (UPS Supply Chain Solutions, 2005). To develop the supply chain strategy, the business strategy and the overall direction of the organization, (such as low cost provider, differentiation, focus) should be understood first since supply chain strategy is going to be derived from it.

4.2 Technology and Information System Usage

To better control the supply chain, as well as decrease cost and manage the flow of information, LEs utilize electronic B2B marketplaces. Electonic Data Interchange (EDI) helps closer collaboration between suppliers and customers by direct transformation of information between organizations. Cost of ordering and tracking parts and supplies are decreased while being a part of just-in-time (JIT) manufacturing is possible (Straub and Klein, 2001).

Having limited resources, SMEs have difficulty in reaching information systems (IS) implementation and IT growth. IS usage will provide responsiveness, better customer service and increase in turnover. Threats to information security, resistance to change, fear of breakdown and lack of funds are barriers for IS implementation. It is difficult to be up-to-date in technology. Due to that, Bilili and Raymond (1993) indicates decision making structure of SMEs as reactive, informal, daily and intuitive and management skills are limited for planning and organizing IS. That short-term, survival strategies will cause SMEs in cost reduction.

Decrease in prices and saturation of LEs to ERP (Evendirgen et al, 2000; Gable and Stewart, 1999), SMEs encouraged to integrate ERP to their information systems. The ERP system should be compatible with the business processes and requires extensive usage of resources (time, money and knowledge). That situation may effect the SMEs core business (Laukkanen et al., 2007). On the other hand, Levy and Powell (1998) indicate that SMEs having less structures and policies and being more flexible, it will be easier to adopt ERP. The main reason in the adoption is to develop business and integration and replacement of old information systems. According to the survey done by Laukkanen et al. (2007), without taking the size of the organization into consideration, schedule and budget overruns are indicated as a risk in ERP implementation and as discussed, IT competence is a risk factor especially for small enterprises since small enterprises have more knowledge constraints than medium sized enterprises. The results indicate that the small and medium sized enterprises should be evaluated separately in ERP adoption. The intra and inter organizational integration success is less in small enterprises than medium sized enterprises. If small enterprises find ERP adoption feasible, then it is suggested to deal with external experts such as consultants and IT vendors.

Since IT investments need large capital, SMEs may not have sufficient infrastructure so suffer from limited IT competencies and poor understanding of IT capabilities and the risks involved (Doukidis et al., 1994). However, an infrastructure suitable for SME will help to eliminate bottlenecks for the information flow within and between the organizations.

4.3 Networking

According to Sakai (2002), since multinational enterprises (MNEs) outsource and subcontract the non-core business activities, SMEs gain business and learning opportunities; besides, any kind of networking (informal, formal or electronic) helps SMEs to overcome their size constraints and improve their competitive position (UNIDO, 1999). SMEs also benefit from the research capabilities of institutes and universities at the moment. Similar to MNEs and LEs, SMEs outsource their activities to gain competitiveness. Outsourcing will effect the organization's financials in terms of IT applications, managing IT infrastructure, managing benefits, providing services in accounts receivable or accounts payable (Wagner and Dittmar, 2006). However, as depicted in Figure 1, different languages and cultures may form cost and risk so become a barrier for SMEs. But outsourcing from a different country can be a success (Value Leadership Group, 2005) with a meaningful strategy. If an activity is outsourced, then there is risk of the dissemination of differentiation information. To reduce the information risks, trust for longer term relationships and the confidentiality of the information is necessarily bridged.

Networks will also help SMEs to deal with uncertainty and improve efficiency. By the coordination of networks, new knowledge creation is possible. During the growth and innovation phase, the previous internal and external expertise is helpful which requires high level of trust and collaboration that creates synergy.

SMEs benefit from the cooperation with the same size organizations, since their capacity will increase and accordingly benefit from the economies of scale to satisfy larger amount of orders. Cooperation with smaller size organizations help SMEs specialize in their core businesses (Sakai, 2002). Also, the intellectual properties (technologies, knowledge and expertise) and niche products and services of SMEs are enhanced and help the enterprise grow.

4.4 e-Commerce and e-Business

SME's that leverage Internet and its emerging technologies develop global and cost effective platforms for the businesses to communicate (Rao et al., 2003). SMEs will of course want to take the advantage of increase in competition, decrease in transaction costs and increase in business performance since they could reach more customers ever with the help of e-Commerce. The main focus in the success of e-Commerce is the coordination of e-Commerce with the overall business strategy. e-Commerce starts from introductory web site through sophisticated business interactions. At the beginning, web site is the only communication way with the organization and the customer so the web-site usability and comprehensiveness are the two main measures for the effective use of it. The implementation of the ICT technologies and gathering customer data is important since organizations are going to end up with useful information by processing the customer data. Rao et al. (2003), Straub and Klein (2001), and Krammer et al. (2000) introduced models for the maturity of e-Commerce. Although the number of stages are changing, all three refer to the same thing; moving from brochureware pages to transformed e-world businesses.

SMEs and LEs may use similar supply chain management processes in the areas of customer relationship/service management, demand management, order fulfillment, manufacturing flow management, product development and commercialization, quality management and returns management. Logistics is important for e-commerce success or failure (Golden et al., 2003). Business opportunities utilizing SME's logistics capabilities are critical in maintaining value-added services. SME's are able to be seen as strategic partnerships that are more apt in meeting customer expectations. The scope of activities conducted enhances the role of SMEs as well as creates opportunities for improving value-added services.

According to the study of Karagozoglu&Lindell (2004), e-Commerce strategy of customer-base expansion is related with differential/hybrid strategies which are strengthened by online customer service. But, fully integrating purchasing management is not possible for SMEs since it requires costly intranet and extranet applications and supply chain solutions. But the maturity of the market and entrance of substitute products will cause the decline in prices and become applicable for SMEs. Having a small size allows flexibility and agility to SMEs. By using internet, SMEs can find new suppliers, communicate with customers and partners. Three items are found important for a successful e-SCM integration (taken from Levenburg, 2005):

- Adequacy and parity in resources
- Partnership between firms of equal size and similar ethics
- All partners benefit from e-SCM

In the e-Commerce or e-Business, interoperability is important for the communication of the systems. SMEs are moving through the e-Business era by taking the technology into their focus. For SMEs to be at the transformation stage, integration of e-Commerce, SCM and customer relationship management (CRM) applications are required to connect and analyze the internal and external partners of the system.

4.5 Information and Knowledge Management

Customer needs and demands are changing quickly. To minimize uncertainties and have the right amount of inventory, the information flow for customer preferences and product quantities should be two sided and reach as soon as possible to the partners of the supply chain (Faisal et al., 2006). So collaborative intra- and inter-business activities could take place instead of competition. The interaction between organizations having a deep, quality and diverse network will be added to the innovation process for the improvement and expansion of competencies and competitiveness (taken from Macpherson et al., 2003). Especially for SMEs, the deficiencies of having limited resources will be eliminated in the sense of skill, information and knowledge; the borders of the organizations become seamless and gain a power by collaboration at all levels of supply chain; between suppliers and customers.

Pedler et al. (1988) suggests that regardless of the size, an organization has the ability to learn and transform by learning from its environment by networking, problem solving and mentoring. The aim is being a learning organization. The main benefit of learning will be the transformation of organization and continuous improvement. But for collaborative learning to be possible, trust, openness and flexibility is required (Slater and Narver, 1995).

SMEs do not use knowledge management at the moment (Koh and Maguire, 2004) although knowledge management will provide to develop new high value products and services, add value to existing products and services, reduce costs, develop new export markets and add value to existing markets. In case of using and adopting ICT effectively and efficiently, the benefits of knowledge management will be seen more.

4.6 Management

Management development is not as crucial as time and cost for SMEs. Especially in new knowledge formation and exchange, management is an important issue. Macpherson et al.'s (2003) research implies that legally defined exchange of rights (contractual coordination) and formation of necessary structure (procedural coordination) within the responsibility of business unit managers and functional unit managers are necessary for proper implementation. Management inclusion and support is important for the success of the strategies applied. Manager should realize the benefits of IT and define a formal e-commerce strategy with objectives; the web-based activities should be planned. Project management activities to set deadlines, targets and specifications for the projects should be activated. Also, integration of business processes and web-based activities is necessary. IS support is an enabler to support business strategies.

4.7 Quality and Customer Satisfaction

Compliance with quality standards are required by large enterprises (LEs) (UNCTAD, 2000). In the supply chain, due to integration abstract quality standards are necessary so the business is run in a systematic way, especially to decrease the inventory levels. For SMEs, quality considerations are important both for being a requirement of supply chain participation and a strategic capability (National Research Council Staff, 2000). The quality improvement efforts should be discussed by supply chain partners to identify and prioritize actions. SMEs should have metrics for measurement process success to determine the wellness of the current situation and determine gaps for improvement. It doesn't matter what kind of a sophisticated product or service is produced, Higuchi et al. (2005) states as "the dominant design is the first to satisfy the latent customer needs and then is adopted widely".

5. SME – Supply Chain Management Model

Organizational (previous organizational IT expertise and logistics, and suitability of the product on the web), management (have a champion, e-Commerce strategy, integration of web with business) and implementation (planning and usability of web, security, outsourcing and website marketing) factors are required for SMEs to be successful in the supply chain (Golden et al., 2003). The SME-SCM model will provide a roadmap to SMEs to help develop a SCM strategy to have a strategic fit in the supply chain. The objectives of SME-SCM model are to:

-improve the capability of SMEs by increasing the capability of processes,
-help to act SMEs to be a partner of supply chain,
-ensure that the capabilities of SMEs are understood clearly,
-develop integration and collaboration of the processes within and between the organization.

The SME-SCM model aims to:

-set priorities for immediate actions to be taken in the supply chain,
-establish a culture of adoption to change.

The SME-SCM model is a staged model so that the key process areas defined in each stage should be satisfied completely to move to the next stage. By that way, the internal capability of the organization and external capability with partners and customers of SME will increase; the processes will be well defined and improved; measurement of success and failure will occur and innovation of processes will take place. Top management commitment is necessary at all levels for ownership.
The SME-SCM model is formed at four levels and includes key process areas (KPAs) in each level.

LEVEL 1: Initial Level

Level 1 is accepted as the initial point for SME to be a partner of the supply chain. These are ad-hoc processes. Cost reduction and productivity improvement is tried to be driven by internal processes of the organization. The SME has a brochure ware web site; product information, building brands, advertising and mailing. The organization is reaction drive; in case of any problem, sudden decisions are taken depending on the experience of the individual. The bigger partners direct the SMEs. Cost deductions dictated by the customer are accepted. Daily problem are tried to be averted. The future of the business is not so clear.

LEVEL 2: Value Creation Level

SMEs may serve very different industries and have limited knowledge about the supply chain structure. If an organization is not able to identify its competitive advantage, then it cannot find its place in the chain. SME in level 2 should develop its business and supply chain strategy with its objectives for value creation processes. Then, it is better for them to favor differentiation strategy instead of cost leadership strategy (Miller&Toulouse, 1986). To do that, core competencies (product/service provider/producer) and the business strategy of SME should be defined.

Market growth and operational strategies (what, when and how to offer the products or services) are decided as a competitive plan.

Integrating with SMEs in the supply chain for collaboration is searched to eliminate the poor skills. Thus being a part of a networks can allow SMEs to combine the advantages of small scale with the benefits of large scale value creation. Closer relationships are developed with partners since the partner characteristics influence SME performance.

Project management activities are initiated to determine the resources required. Online selling between the organization and customers without transaction is constructed. Customer services such as warranty information, return policies and procedures, frequently asked questions, are given through internet for higher sales growth and cost saving. A question and answer database is formed. Information security is satisfied for simple and secure online businesses. Simple intranet is constructed for starting information and knowledge management within the organization. The infrastructure for decision making, import and export SCM data and IT usage is constructed. This will also help to get the real time information to work jointly with suppliers and lastly a quality plan should be developed for problem identification and solving capabilities.

LEVEL 3: Transformation Level&Brand Management

Quantitative goals are set for the evaluation of success and failure within the organization and supply chain. The knowledge dissemination within the organization and partners is transparent. Performance management activities are held to determine success factors and weaknesses. Customer relationship management system (CRM) is integrated and brand awareness is enhanced. Documentation of processes and activities are be standardized. Control activities and implementation techniques; such as six sigma, ISO, process controls are taken into consideration. Collaboration and networking, information sharing, learning and knowledge management takes place. Which data to collect and how to use is decided on this level. Simple extranet is constructed to start information management activities. Also extranet provides immediate and accurate view of demand together with partners to give rapid and synchronized response. Innovative processes, products and services are increases.

LEVEL 4: Continuous Improvement Level

At level 4, the focus is on the continuous improvement of the processes through innovative ways. Technological changes are followed and evaluated. Detection of defects are considered and necessary precautions are taken into account. Coordination of organizational activities is required. Changes in technology and the supply chain are continuously monitored. Full integration of e-commerce, SCM and CRM takes place. Competition will be on innovation. The SME will be one of the dominant innovative competitors and have ability to initiate new products by generating a continuous improvement to satisfy customer expectation. This will increase the SMEs' role in the supply chain and contribute to the value added activities.

6. Discussion and Conclusions

The models or the activities suggested for the globalization of supply chain management are mostly suitable for large enterprises. Although small and medium size enterprises form the fundamental of national economies and their rate is undoubtedly incomparable with large enterprises, fitting these enterprises into supply chain activities is not a primary consideration in most research and implementation.

SMEs are critical in value creation in the supply chain. They foster specialization and are vital in leveraging resources. However, the value-added services of SMEs are underestimated and are not properly integrated in the supply chain. This is a hindrance in value creation and utilization of varying resources, as well as making it difficult to understand and manage the customer. The aim of this study was to relay the importance of SMEs in the supply chain and define their unique roles in various contexts such as product/process design, brand awareness and service fulfillment, in areas such as e-business and logistics.

In this study, a four level model is developed for small-and-medium sized enterprises. There is no proper link integrating SMEs to supply chain structures in the literature. Most of the literature is on e-commerce activities, which generally talks about web-site status. However, an organization has various amounts of processes and activities to be successful. In SME-SCM model, the organization may have different key process areas for different levels. Excluding the web-site applications, other key process areas should be integrated in each step since the previous level satisfies an improvement to the next level. The model identifies the current situation of the organization firstly, secondly, whether to move to the next level, and finally what is to be done to be in the next level. In further studies performance indicators for the activities should be developed. The main concerns in various key process areas were mentioned and finally a brief road-map was given to act as a guide in proper integration and implementation. A limitation of the study is the following. Only a descriptive model is developed for SMEs to be successful in supply chain implementation. No further analysis is applied for the verification of the study. The key process areas may change within the levels, may become idle or new ones may be added to the model. For that reason, for the generalization of the result, a sample should be selected. A true result can be seen after the application of the model to different markets/sectors.

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EXPLORING THE IMPACT OF BRANDING AND DESIGN ON SUPPLY CHAIN MANAGEMENT

Oznur Yurt[1]

Abstract

The focus of this paper is to explore the impact of branding and design on supply chain management. It is aimed to give an emphasis on the integration of logistics, branding and design as the main competitive tool for the companies. The need for these processes to be managed in an integrated manner has not been fully explored. Therefore, a systemic and integrated approach is proposed and emphasized in this study.

Keywords: Supply chain, logistics, design, branding

1. Introduction

Fierce competition in each market leads companies to strive to find new methods to create value and gain competitive advantage. Potential areas for companies to create and maintain value as well as to differentiate their products/services are branding, design and logistics. Supply chain management is a concept has a direct or indirect effect in all these areas. However, the research on the integration of these processes especially related to the supply chain management area is extremely limited. Therefore; firstly the concepts of value chain and value chain management are emphasized in this study. Then; creating maintaining value during supply chain management is mentioned. Accordingly, dual intersection areas between design, logistics and branding are revealed and finally full intersection as well as the need for a systematic and integrated effort is highlighted.

2. The Concepts of Value and Value Chain

Value concept can be defined as the benefit created for the user of a product and/or service. "Value" has been a critical issue for every company, regardless to their size, type and sector. There are many studies in the literature focusing on the determinants of "value" (e.g. Zeithaml, 1988, Christopher, 1992; Ferrell, et al. 1998; Voss, et. al., 2003). Accordingly, the research on value concept is various, since it is significant for different areas of study including; marketing, psychology and economics. It should be noted that customer value is a similar concept to "customers' perceived quality of the product/service", "customer satisfaction" or brand value; and these terms have been used interchangeably in recent times.

As with value, value chain is a significant concept, because it is one main source of competitiveness. In 1985, Porter identified the conceptualization of the value chain and value system. He made a great contribution to the literature by defining value chain as the basic tool for achieving competitive advantage. Porter's value chain is depicted in Figure 1.

Kaplinsky and Morris (2000) define value chain as "...the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use". They determine four key processes in the chain as: Design and product development, production, marketing, consumption and recycling. Although the contexts and components of those processes may be disputed, it can be said that such a classification of processes clearly describes the basic courses along the value chain.

The value chain concept has lead to two relatively new concepts: "supply chain" and "supply chain management". Supply chain (sometimes called the 'value chain' or 'demand chain') has in fact always existed throughout economic history.

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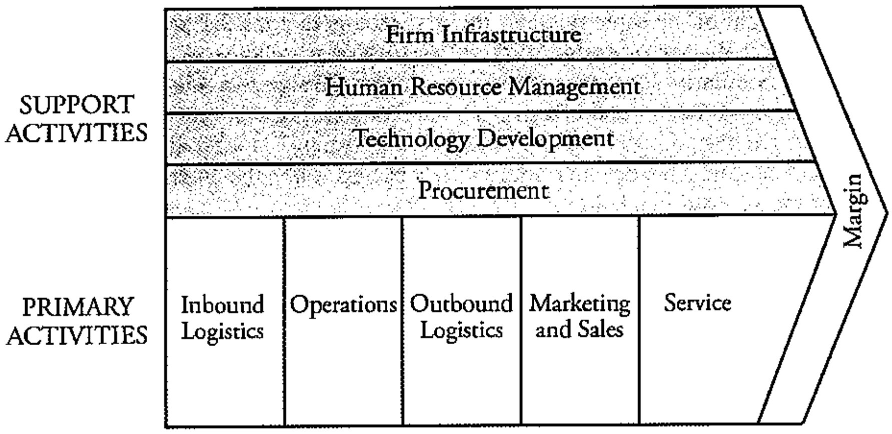

Figure 1: The Generic Value Chain
Source: Porter, 1985

3. Supply Chain Management

Two main approaches emphasized the need for supply chain management concept, which are: "the value chain concept"- which is abovementioned - and "the systems approach". Porter (1985) stated that the "...differences among competitor value chains are a key source of competitive advantage". Approximately one decade later, Christopher's (1992) frequently cited statement: "...competition takes place between supply chains rather than between individual companies" supported Porter's view and transmitted his view to the supply chain management literature. These two statements best explain tbe consecutive relationship between two concepts.

The second important approach that leads to development of supply chain management view is the "systems approacb", first proposed by Von Bertalanffy (1968). A supply chain is a complex system in which subsystems can be formed by any two or more entities. Also, since a firm can simultaneously be a unit in a number of different chains; the management of such chains is complex. Actually, supply chain management is an approach of viewing supply chain as a single entity, rather than as a group of different units (Houlihan, 1988; Ellram and Cooper, 1990; Mentzer et al., 2001). Supply chain management is a system in which each firm directly or indirectly affects the performance of all other entities in the chain as well as the performance of the whole chain (Cooper et al., 1997, Lockamy III and McCormack, 2004). The main and shared aim of all entities in the supply chain is create value for the customer(s). Indeed, each member of the supply chain is a customer of -at least- one entity in the chain. Also, end-user is the final customer of the chain. Value is created by effective management of materials, service and information flows along the supply chain (Lambert et al.1998). In this context, "the value" perceived by the customer(s) depends on the "logistics utilities" that are created by an effective supply chain management.

The utilities created by effective logistics management and successful supply chain management are the main sources of value in the supply chain. These consist of: form utility, place and time utility and possession utility (Lambert et al. 1998; Bloomberg et al. 2002). These utilities can be realized by fulfilling the mission of logisitics, which can be described as "...getting the right items, needed for consumption or production to the right place, at the right time an in the right condition at the right cost" (Gecowets, 1979:5). As stated in Lambert et al. (1998); form utility adds value by "putting item in the proper form for the customer to use", time utility creates value by "having an item wben it is needed", place utility provides value througb" having the item or service where it is needed", and finally, possession utility is "the value added to a product or service because the customer is able to take actual possession". In this context, this study proposes that perceived value in a supply chain is dependent to the level of utility creation by the effective logistics management. Moreover; it is proposed that design and branding have to be jointly managed by logistics activities in order to reach the highest level of value creation. Accordingly, sustainable value chains may be created and maintained. It is also suggested that the companies have to emphasize on the integration of all activities and operations undertaken inside and outside of the organization. It is consequently proposed that the main source of competitive advantage for the companies is the integration of design, branding and logistics management concepts. Therefore, firstly the dual interactions within three concepts are emphasized and then the interaction between three concepts is considered in this study.

4. The Need for Integration between Design and Logistics

When design and logistics are thought of the same manner, the first factors to consider are: systems design such as design of logistics network, supply chain and/or design of facilities such as warehouse or retail layout as well as logistics information systems design. Similarly, logistics information systems design is a related concept. Although such aspects are critical to increasing productivity and effectiveness and decreasing the total cost, design concept is mostly emphasized as a product/service design aspect in this study. Since "design" is a broad concept that includes systems design, production process design, and product and service design, only the intersection areas between product/service design and logistics are considered below.

4.a. Manufacturing Interface between Logistics and Design

In order to gain competitive advantage through low cost, high cost and/or reduced lead times, the manufacturing process plays an important role between design and logistics processes. During the manufacturing process and inbound and outbound logistics operations, the need for design and logistics integration becomes clear. Therefore, manufacturing implementations and logistics strategies should be managed in an integrated manner. For instance, implementing JIT strategy and Kanban system require the integration of supply chain design, manufacturing process design and appropriate inventory management as well as the productive manufacturing process. Some other examples of such implementations and/or strategies are: Total quality management, lean, agile strategies and le-agile, manufacturing process design, and cellular manufacturing.

Total cost and time can be minimized by the changes in product design. Also, changes in product design will lead to manufacturing and logistics process optimizations. For instance; the new product design may enhance transportation and storage capability. The product related factors influencing transportation cost and capability are mentioned by Lambert et al. (1998) as ; density, storability, ease or difficulty of handling and liability. Therefore, total cost and total time can be minimized by a more suitable product design process in which, the above-mentioned functions are taken into account.

4.b. Supplier Development and Early Supplier Involvement

Sourcing decisions directly affect both the design capabilities and logistics strategies. Basically, the needs for production such as raw materials, semi finished goods related services and equipment are determined based on the product design. Therefore, sourcing decisions are structured according to this. Accordingly, both the supply management, a critical sub-process of logistics management, and design management should be integrated.

Early supplier involvement is an example that explains such a need. Early supplier involvement mainly depends on the idea of "supplier's participation in the purchasing process of buyer". Each stage of the acquisition process offers a value creation opportunity for the purchasing company. Such an opportunity is more significant in the early stages than in later ones. Therefore, involving the supplier and the buyer in these early stages will lead to value creation especially by the improvements design activities. Including suppliers in purvhasing company's processes during the product design stage creates mutual benefits. Both the supplier and buyer can benefit from making adaptations in product design, cutting cycle time, improving competitiveness, and reducing total cost (Leenders et al., 2005). For instance, supplier experts' advice during the new product design will enhance the quality and decrease the acquisition cost. Such an implementation provides the advantage of critical information sharing for both parties.

Supplier development activity requires process integration for reasons similar to early supplier involvement. Through these activities, buyers can help suppliers to meet their needs in terms of form, location, time and conditions. The definition of supplier development proposed by Krause and Ellram (1997:39) is "any effort of a buying firm with its supplier(s) to increase the performance and/or capabilities of the supplier and meet the buying firm's short- and/or long-term supply needs". If supplier development is implemented by a buyer company, personnel from a buyer may be involved in the processes of the supplier and work for a period in that company. Company, thus, supporting the suppliers development. If such a development is needed because of the buyer company's new product launch to the market, related semi-finished good production processes should be enhanced and adapted to the production processes of buyer firm. Both firm's processes will be improved according to the new product design processes.

4.c. Design for Reverse Logistics

Reverse logistics includes the management of reverse flow of materials, services and information along the supply chain. Main reverse logistics activities include collection, disassembly and processing of removal and disposal of waste materials. Therefore, all key logistics activities including warehouse management, transportation management, inventory management, should be fulfilled properly in the reverse direction along the supply chain. Reverse logistics has gained more importance especially in the recent years due to the increasing interest in environmental sustainability and related implementations such as recycling, remanufacturing, reprocessing and re-usage. Therefore, efficient management of reverse flows becomes more important (Lambert et al. 1998). In this point, sustainable design, which is also called green design or ecodesign, plays an important role.

Karlsson and Luttropp (2006:1291) defined ecodesign as "a concept including human sustainability priorities together with business interrelations". Through sustainable design implementations design and environmental aspects are considered together. Ecodesign aims to provide solutions that enhance economic, environmental, social and ethical influences while satisfying environmental needs (Charter and Tischner, 1997). Since the design process shapes the whole product life, key logistics activities including transportation, storage, materials handling will be affected as well. Thus, reverse logistics through sustainable design concept, is an area in wbicb is logistics and design intersect by sustainable design concept.

4.d. Package Design

Packaging is a extremely effective tool for the companies. It is critical for marketing as well as logistics. Marketing aims to attract customers, inform them on the product and promote the product by the appearance of package. Accordingly, the aesthetic aspect of a package is significant for the marketing function. On the other hand, packaging also serves logistics in terms of organizing, protecting and identifying the materials. Due to the different priorities on packaging issues, there may be a contradiction between logistics and marketing functions Therefore, during the package design process many factors should be considered including; standardization, cost, product/package adaptability, protective level, bandling ability, product packability furthermore reusability and recyclability (Lambert et al. 2008). Packaging has an important position in sustainable design process as well. Packaging design and product design activities sbould be managed in a coordinated manner. In order to enhance sustainability, green design, taking reusability and recyclability into account, is vital. Moreover, the increasing usage of RFID and bar-coding technologies; packaging's identification role has been highlighted.

Due to abovementioned concepts, it becomes clear that there is an inevitable need of logistics-design integration to enhance the value creation abilities of the companies.

5. The Need for Integration between Logistics and Branding

The branding concept has been gaining importance in supply chain context in recent years. Since power has shifted from manufacturer to the retailer, the nature of supply chain integration and the dominance along the cbain have also been changed. As Christopher(1992) mentioned, during "the competition takes place between supply chains", brands of the focal companies in the supply chains compete as well. Therefore, the influence of the branding concept is widening. Since the companies cannot operate in an isolated manner; branding activities of other supply chain members directly affect each other.

A strong brand is one of the main competitive tools for the companies, minimizing risk, enhancing purchase confidence and increasing customer loyalty (Aaker, 1991; Chaudhuri and Holbrook, 2001). It is valid in consumer markets as well as the industrial markets. Thus, the branding activities of each member in the supply chain will affect the attitudes of its customer regardless of whether it is a business or end user.

All members' branding activities have become more important in the supply cbain. Beside the brand of focal company, wbicb is usually the manufacturer, the brand of other entities including supplier, service provider and retailer are also critical. For this reason; supplier and intermediary selection processes have become complex practices. Importance and number of qualitative and quantitative criteria; including quality, lead time, price, firm's image and reputation, production capabilities, customer portfolio, capacity considerations, availability of raw materials thus increase. Accordingly, supplier certification processes and quality assurance programs (Leenders et al., 2005) emerge as to be valuable tools. Supplier selection and evaluation process is an important part of logistics management.

A brand is a special name and/or symbol (such as a logo, trademark, or package design) intended to identify the goods or services of either one seller or a group of sellers, and to differentiate those goods or services from those of their competitors. A brand thus indicates the source of the product, and protects both the customer and the producer from competitors who might attempt to imitate the products (Aaker, 1991)

Although there has been a great interest in branding and its potential benefits for achieving competitive advantages in the long term, the focus is mainly on the consumer markets (Kim et al., 1998; Michell et al. 2001). Though, effective branding efforts lead to achieve long-term relationships and thus, reacb more potential customers using highly cost effective and targeted tools for the industrial customers. Therefore, being a "branded supplier/retailer/service provider" should become a basic priority for businesses trying to achieve and maintain competitive advantages in the markets.

In this context, there is a great source of competitive advantage in the interaction area of supply chain and brand management which should be managed in a coordinated and integrated manner.

6. The Need for Integration between Branding and Design

Brand creates an identity and image for a company. Since the main branding elements are brand name, logo and slogan, design management processes of these elements are one of the most important determinants of branding efforts. It is only possible to reflect the branding strategy by an effective design of branding elements.

Design management serves for brand differentiation and brand management. Tbus, design management bas the potential to create benefits for the customers (Mozota, 2003), both in the consumer markets and industrial markets.

In this context, tactics and strategies focusing on the "product" element of marketing should be based on product design and branding in the same manner. Thus, the need for integration of design and branding processes is essential for the company's success.

7. Integration of Three Processes: Logistics, Design and Branding

As mentioned in the previous sections, the integration of at least two of the following processes is essential for firm success: logistics, design and branding. Although it is possible to gain competitive advantage by the management of any two above-mentioned processes in an integrated manner long term, wide-ranging success will not be guaranteed. Since the product life cycles are shortened for many reasons, including relatively higher level of information sharing, lower labor and material costs, more invisible market barriers; an holistic approach is needed which is the integration of logistics, design and branding.

Although, the number of such companies is not so high, there exist some firms implementing strategies and fulfilling management processes in such an integrated manner, such as Ikea, Nike, and Toyota.

8. Conclusions and Further Research

Full integration of logistics, branding and design will lead to more value creation by all members of the supply chain including suppliers, manufacturers, intermediaries and retailers and end-users. Moreover, such integration provides sustainable value creation along the supply chain. Therefore, it should be emphasized that a systematic, holistic and integrated approach is required within logistics, branding and design management processes in order to create value. Obviously, such a view requires new integrated strategies and shared aims of all supply chain members.

Although this study offers a general view of integration need within the three processes, future research should focus a detailed analysis of such a need. The starting point for this research should consist of qualitative research including in-depth interviews, Delphi technique and focus groups should be conducted with the members of different departments in companies or cross sectional teams as well as different entities in the supply chain.

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CREATING SUSTAINABLE GLOBAL PRODUCT CHAINS: A THREE LEVELS GAME

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Abstract

This paper discusses the conceptualisation and existing empirical research on creation of sustainable global product chains. This papers sets steps in moving from normative prescriptive approaches towards an empirical descriptive approach, comparing available research in various forms of global markets and types of commodities and lifting the analysis to the level of 'product channels' (the collective level) instead of 'product chains' of collaborating individual businesses. It explores various strategies employed by businesses in international collaboration in product improvement and competitive mechanisms that may support the change towards more sustainable products sourced from developing countries. Recent research in the Dutch - South African value chain of fruits and wine are used as examples to illustrate the virtue of this three level approach. For a full understanding of dynamics in achieving sustainability in global value chains a multi-level theoretical approach is required combining empirical studies at firm level, at global value chain system level and at the level of global dynamics.

Keywords: Supply Chain Management, Sustainability, Governance, Developing countries

1. Introduction

Like in other North-western European countries, Dutch industries have substantially reduced their environmental impacts at home (60-80% in 1990-2005), while also strongly contributing to economic growth (+63% value added) (Vermeulen 2007). However, a large share of all environmental impacts (30-55%) caused by Dutch *consumption* is allocated in developing countries, because products or their resources are imported (Nijdam and Wilting 2003). This share is actually growing fast due to increasing imports (for example China's share of all EU-imports grew in 2001-2005 from 8,3% to 13,4%).

Western governments can not prevent this shifting allocation of impacts, as they are not entitled to address production conditions in developing countries. They have to walk the long route via supranational institutions (UN, OECD) with their weak implementation powers and await effective implementation of UN agreements by national governments. But actors in the market and civil society (NGO's) have been filling this 'regulation vacuum'. Early examples are *eco-label* and *fair trade* certification systems (since 1980's/1990's), mostly originating from NGO's and small businesses serving an ideological/ethical cause. They have not succeeded in conquering the mainstream of consumer markets (shares < 1-3 %).

More recent after 2000, other firms developed their own supplier control systems (Eosta, Tesco, Patagonia). The common feature of such systems is that various market and often non-market actors cooperate in improving the environmental and social conditions of production operations in developing countries. We call these *'sustainable supply chain governance systems'* ('SSCG-systems').

The emergence of these systems in itself is remarkable. Common sense suggests that profit driven businesses focus on cost reduction and that highly competitive world markets don't allow any corporate philanthropy (Porter and Kramer 2002). Lack of experience with environmental management by firms in Developing countries further complicates communication between market actors. Still, these SSCG-systems do emerge, also in the mainstream of global markets.

This brings us to our key question: *"To what extent and under which conditions is business-to-business cooperation in world wide* 'sustainable supply chain governance systems', *together with civil society and governments, effective in improving environmental and social conditions of production operations in developing countries?*

The analysis of key conditions for such non state governance systems to breakthrough and their effectiveness is relevant both for economic and (environmental) policy sciences. These SSCG-systems represent a ***double shift in governance:*** from ***state*** towards ***market*** and from ***national*** towards ***global*** (Kersbergen and Waarden 2001). In

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political sciences the ***governance concept*** is about "autonomous self-governing networks of actors", where "governments recognize that the capacity to get things done does not rest on the power of government to command or use its authority' (Stoker 1998). Others referred to this as 'governance without government' (Rosenau and Czempiel 1992). In addition, the 'global value chain theory' in economic geography explains the growing variety of network forms of *value chain governance* (described as 'markets', 'modular chains', 'captive chains' and 'hierarchies') (Gereffi, Humphrey et al. 2005) as crucial means in the global competition. The SSCG-systems are new forms, hardly studied yet and they differ because of their:

- focus on environmental and social-ethical goals;
- their varying modes of NGO involvement; and their;
- various forms of third party coordination and control.

In this emerging practice the various actors involved (from market, NGO's and governments) implicitly or explicitly apply the *basic assumption* that business-to-business supply chain cooperation, geared by western consumer and civil society pressures, can be effective in improving environmental and social conditions in developing countries (see Figure 1).

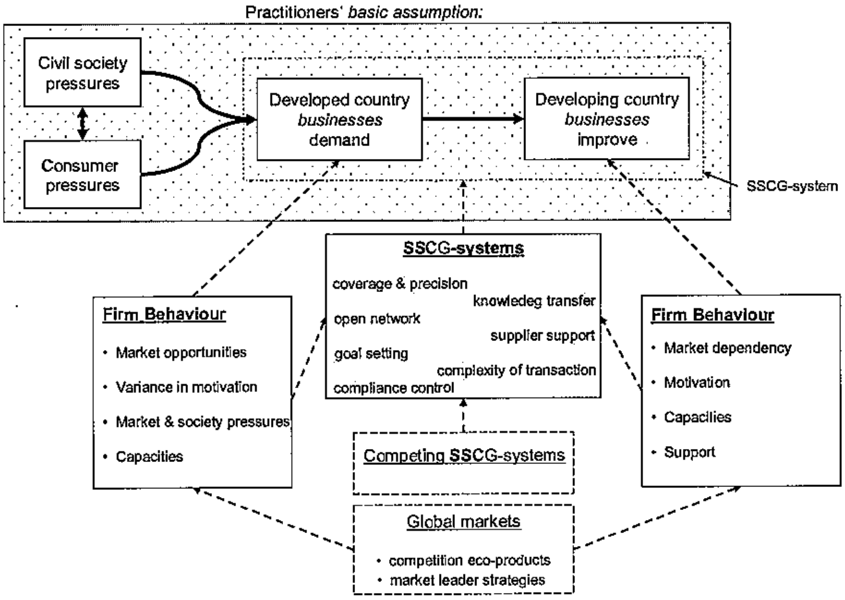

Figure 1: Main sets of conditions for the effectiveness of sustainable supply chain governance systems.

In this article we will elaborate this line of thinking, transforming it towards testable theory, using first results of exploratory studies and cases reported in literature. This is a complicated assignment as the phenomenon has gained attention in various disciplines, all with their own key questions and connected ways of reasoning. It is referred to as 'global trade value chains' as an economic and an economic-geographic phenomenon (Gereffi, Humphrey et al. 2005), while it is also presented by environmental scientists and environmental business management as an ecologic and logistic challenge (Quakernaat and Weenk 1993; Sarkis, Darnall et al. 1995; Seuring 2004). In this article we intend to make steps beyond these various perspectives in order to get a comprehensive set of assumptions explaining the level of success (in the sense of speed, impact and diffusion).

2. Global supply chains and market governance

As we stated in the introduction, the emergence of *'sustainable supply chain governance systems'* ('SSCG-systems') in itself is remarkable. Why would economic actors take up such public interests (abating environmental degradation and social injustice)? Although economic theory states that wealth is created through the market, one would not expect public goods (like a healthy environment) to be an issue to be addressed in market transactions. The concept of the market implies entrepreneurial producers to create needed goods and services and present these on the market to be sold to the best bidding costumer. Sellers and buyers compete on a crowded open and free market place and those that are able to combine the lowest price with the highest profit will survive. Though this 'image' of the marketplace is a core element in welfare economics, it presents a very rough simplification of reality. The process of serving consumer needs by producing and selling commodities is not by far a two actor game, but a much more complex social system.

Porter states that "every firm is nothing but a collection of activities that are performed to design, produce, market, deliver and support it's product" and the value chain is "the whole series of activities business firms undertake to convert the raw materials or input resources to the goods and services required by a customer". How efficient and effectively a firm performs these activities determines what quality of goods and services and at what cost the firm will be delivering to the consumers (Porter 1985).

From our perspective of understanding governance for sustainability in global product chains we use the concepts *'value chain'*, *'supply chain'* and *'product chain'* as synonyms, with the first two in literature often having a more limited scope, excluding consumer and post consumption activities (see also Vermeulen and Ras 2006, p. 247).

In his classical work Williamson already distinguished various basic forms of dealing with costs of transactions, depending on the type of product traded, with repeated case-by-case bargaining (*spot markets*) on the one hand and relationship-specific *contracting* on the other hand. Also strategies of backward and forward integration are used: getting full control by taking over supplying firms or firms engaged in the production or selling of products). These strategies, also called verticalisation, are seen as comparative strategies in the value chain creating *hierarchy* (Williamson 1975; Williamson 2008).

So, in practice value chain systems are structured in different ways, varying from systems as a sequence of anonymous markets, with firms in each step communicating only via market transactions to fully controlled and centrally managed relations. In their article on governance of global value chains Gereffi et al. distinguish 5 types of global value chains:

1. *Markets*: the various links in the chain are sequences of market places, all having the nature of a market, were both parties, seller and buyer can easily switch after each transaction;
2. *Modular value chains*: where suppliers produce products on suppliers' specifications, but the supplying producers take full responsibility for the organization of their link in the value chain;
3. *Relational value chains*: with intensive interactions with mutual dependency for both seller and buyer and concerning products with a high level of asset specificity;
4. *Captive value chains*: with many small suppliers dependent on small numbers of much larger buyers;
5. *Hierarchy, vertical integration*: implying all supply activities being owned by the final product manufacturer all interaction taking place via management control from the headquarters to subsidiaries. (Gereffi, Humphrey et al. 2005)

In an earlier article Gereffi 1999 distinguished between producer-driven and buyer-driven value chains, showing that the issue of structuring the value chain and taking the lead is actually a key strategy in the global competition (Gereffi 1999). Hughes suggested an addition to Gereffi's typology, where *developmental supply chains* add to strong cooperative relations also the implementation of ongoing programmes of mutual learning on the part of retailers and overseas suppliers, and apply inclusion of local stakeholder groups into the governance systems (Hughes 2005, p. 1158).

The issue of global competition between value chains clarifies that the concept of value chains, or supply chains, is rooted at the level of cooperating individual firms. This puts the analysis of the strategies, capabilities and performance of each of the interlinked firms on the agenda.

However, for a proper understanding we do have to look at the full spectrum of these value chains in a specific sector, or in other words, for a specific group of products. For this we use the concept of a ***product channel***, as consisting of a collection of different product chains. In specific global product channels we can see competing value chains, each structured in a different way. Focussing on the full product channels (instead of individual chains) connecting specific countries in Europe with specific countries in the developing world, we often see a small number of dominant market leaders, cooperating with a limited number of exporters in the developing countries. In various agro-markets global trade is actually dominated by very small numbers of businesses, like 80% of the global banana and the cocoa trade each being dominated by just 3 firms and 85% of the global cereals trade by 6 firms (Auroi 2003, p 27). These mayor players possess strategic positions in global trade. Any communication on improving production conditions requires their cooperation and commitment.

This is actually where the *history* of global sustainable supply chains has started. Small 'enlightened' entrepreneurs, often with a history in civil society, started at first to bypass these dominant mainstream value chains. Fair trade initiatives started to create new and shorter value chains, more directly linking small producers in developing countries with western consumers, first in the late 1970's and 1980's. For this, new cooperatives have been created and new distribution systems in countries like the Netherlands. In the same way trade in organic products has been organized in separate value chains, bypassing mainstream firms. In both cases control systems for securing quality, both related to product quality and environmental and social responsibility throughout the value chain have been developed and implemented (like Max Havelaar and EKO), including better prices for small farmers in developing countries (Kilian, Pratt et al. 2004; Ims and Jakobsen 2006; Raynolds, Murray et al. 2007; Bitzer, Francken et al. 2008).

3. Variations in SSCG-systems

In this article we focus on *Sustainable Global Product Chains*, excluding verticalised hierarchical value chains[1]. In the emerging practice we can distinguish three types of supply chain governance: single firm approaches, joint product sector approaches, and cross sector approaches.

Single firm approaches: first generation

Some individual firms are taking the lead in improving both social and environmental conditions in all steps of the value chain. In doing this they have to take a series of steps: identifying relevant issues in each link of the chain, which requires analysing these conditions at all suppliers. Based on this, one needs to identify possible improvements and elaborate feasible forms of implementation of these and finally a form of control on the compliance to agreed improvements needs to be organised (de Groene and Hermans 1998).

In an previous article we discussed experiences of a Dutch shoe manufacturer Van Bommel discussing improvements with his Indian leather suppliers (Vermeulen and Ras 2006, p. 253-254). This globe wide interaction is often a difficult job, as supply chains in most cases consist of large numbers of suppliers in various developing countries and such inquiries about social and environmental conditions are often misunderstood by suppliers and seen as unwelcome interference with their business.

Yet, the early examples of Fair Trade have shown how improving production conditions can be achieved, also by organizing collectives of smallholders and creating independent export companies (Kessler, Romijn et al. 2003; Parrish, Luzadis et al. 2005).

Also examples from more mainstream firms do exist, like in the cases of the outdoor equipment producer Patagonia or online shop OTTO, that converted it's cotton supply into organic produce (Chouinard and Brown 1997; see also Goldbach, Seuring et al. 2003; Kogg 2003)[2]. For individual firms this implies substantial extra transaction and control costs.

In another case, the Dutch coffee producer Peeze, mainly supplying the catering industry with high quality coffee with their own ecolabelled product, these control costs seem to be manageable, because this company directly surveys its own suppliers already for quality control purposes. In this control an additional assessment of sustainability issues can easily be added. However, in many cases other agencies are used to perform such logistic tasks in the sourcing countries (Hughes 2005). These other actors have to be motivated and it raises extra costs.

Yet, even further going forms of individual supply chain cooperation are a possible. In the Netherlands a price winning import firm of organic food, Eosta BV, has proven the feasibility of full farmer to consumer transparency on social and environmental issues[3]. This firm uses existing ecolabel systems as minimum requirements for their suppliers, but created its own additional environmental, social and quality standards, connected to its own certification scheme 'Nature&More'. Consumers can, by using a code on the product, see the individual stories on these issues for every individual supplier in the developing world. Eosta also works with their own representatives, who regularly are visiting all farms in numerous countries around the world. In addition, the firm works with different premium prices connected to the farms performance on these issues (environment, social ànd product quality).

One of the disadvantages of these individual firm approaches is the reliability of the business to business self control and their claims on sustainable practices, which might easily be questioned by individual consumers or NGO's.

Joint product sector approaches: second generation

Joint approaches have been developed in different ways, which may reduce the problem of reliability. Originally, forms of eco-labelling assured independent control and do have other advantages for individual firms in their interaction within the value chain. Improving sustainability of specific products has been seriously addressed in the environmental policies of many Western countries since the 1990's (Tukker, Eder et al. 2001; van Hemel and Cramer 2002), and as a part of these policies, environmentally friendly products have been supported with ecolabelling systems since the mid 1980's (Cramer, Kok et al. 1995; OECD 1997; Vermeulen and Weterings 1997; Vermeulen 2002). These systems for ecolabelling include environmental requirements in all relevant steps in the value chain applying the environmental life cycle approach (Heijungs and Guinâee 1992; Guinee 2002). These are all early forms of value chain governance, mainly initiated by third parties (often representing state, environmental organisations and market) and including independent auditing.

In the case of governance with third party eco-labelling two new actors emerge in the producer-buyer relations (the 'buyer' might now be the end producer or the retailer): the eco-label organisation and the audit-

[1] These are (nearly) one firm value chains, where improving sustainability is a intra-organisational activity, requiring another theoretical and empirical approach.

[2] Here actually we could also discuss the literature on sustainable purchasing practices, as a step towards addressing these issues at least one step back in the supply cbain, but for reasons of paper size we ignore this.

[3] Eosta won the Dutch Corporate Social Entrepreneurship Award in 2004 and the Investors in People Award in 2005 (see www.eosta.nl). See for their farmer-to-consumer information system www.natureandmore.com .

organisation. The advantage for the buyer is that he does not have to make all the steps described under the single firm approach. In practice, for the retailer to purchase ecolabelled products (also from developing countries), the firm doesn't have to inspect all suppliers himself, but he can expect to rely on a well established third party control of the supplier. The existence of independent third parties also provides legitimacy and trust. In these cases the producer is actually paying for this control to the ecolabel organisation and their accredited auditors, so the buyer can transfer transaction costs down the supply chain. However, in the case of organic or ecolabelled produce, extra costs maybe included in higher prices sold, but this depends also on the mechanism of pricing in these specific markets. In theory, the suppliers' advantage is that a better product price can be achieved. In Eair Trade systems these higher prices for (smallholder) producers is actually part of the transaction agreements (Ims and Jakobsen 2006).

This mechanism of reducing transaction costs with joint third party approaches has been developed in various ways and has also penetrating in the mainstream of product channels, where market leaders have started creating their own value chain governance systems, sometime separately, some times jointly with some competitors and sometimes sector wide. One example is the introduction of Marine Stewardship Council, by Unilever, in cooperation with World Wildlife Eund, regulating sustainable fishery, which successfully gained recognition and support by leading supermarkets (Constance and Bonanno 1998; Cummins 2004).

In the Dutch coffee market, after the initial Max Havelaar Eair Trade and EKO coffee initiatives, various mainstream retailers and coffee producers in the Netherlands introduced Utz Kapeh, as their competing firm-based certification system in 2000, with less strict requirements[1]. After initial success the scheme has been renamed Utz Certified and is being extended to cocoa and palm oil.

This sequential emergence of certification schemes is just a small part of the story: in the world wide coffee market many competing coffee schemes have emerged, each creating a different governance system (see also Kilian, Pratt et al. 2004; see also Raynolds, Murray et al. 2007; Bitzer, Erancken et al. 2008).

These examples clarify that value chain governance is getting more and more diverse, also including more then just market actors. Additional players in the game are the ecolabel organisations and their auditors. The first of these are sometimes government initiated organisations (in Germany), sometimes mixed government, market and civil society organisations (in the Netherlands) and sometimes civil society or market based organisations (in Australia)[2]. The auditors are mostly commercially contracted firms. Einally, we see an increasing number of market based certification systems, sometime with connections to NGO's.

It would be a misconception to assume that these developments are mainly occurring in the developed countries. The long list of ecolabel organisations includes also many cases in developing countries, including India, China, Brazil, Philippines, Indonesia and Thailand. Also sector specific examples exist in developing countries. One such an example is the Integrated Production of Wine scheme in South Africa, a sector wide form of environmental self-regulation of wine producers. Participating wine producers have to comply by handing in an annual self-assessment report on their practices and are externally audited on a 2-3 years base. With this system, South African wine producers are mainly addressing the European wine vendors, communicating about both quality and issues of environmental and social responsibility[3] (McEwan and Bek 2006; Ras, Vermeulen et al. 2007, p. 410).

Cross sectoral approaches: third generation

A third form of sustainable supply chain governance goes beyond specific products and sectors and has been designed to be widely applicable in a uniform way. The most extensive example of this is **GLOBAL**G.A.P. It is a voluntary global partnership of market-based members, aiming at world-wide harmonising the application of Good Agricultural Practice (GAP). It was initiated in 1999 (as EurepGAP) by Western European retailers in response to civil society and media attention to sustainability issues related to food consumption. It developed voluntary standards for the certification of agricultural products around the globe, to be used by retailers and their sourcing agencies in the contracting of producers of specific produce. Producers are audited for compliance on a yearly base. It aims to reassure consumers about how food is produced on the farm by minimising detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare. It claims to work on the basis of an equal partnership of agricultural producers and retailers who wish to establish efficient certification standards and procedures. **GLOBAL** G.A.P. covered over 81,000 certified producers in more than 80 countries in 2007, a fast growth compared to the 18,000 producers in 2004. Certification schemes have been developed for crops (fruit,

1 On their website they write: *"Fairtrade is a poverty reduction program that invites consumers to choose Fairtrade-labelled products and actively participate in social and environmental improvements by paying a premium price. The price paid by consumers for Fairtrade coffee goes to disadvantaged farmers to make them more prosperous. Market statistics show that the majority of consumers and companies are not willing to make this active contribution. UTZ CERTIFIED believes people want to continue buying their favorite brand for its quality, taste and price, while knowing that it is being produced in a sustainable way. UTZ CERTIFIED is about professionalism in coffee growing and traceability to ensure this."*
Source: http://consumer.utzcertified.org/index.php?pageID=211# . See also http://www.utzcertified.org/

2 See http://www.gen.gr.jp/

3 See http://www.ipw.co.za/

vegetables, green coffee, tea and flowers), cattle (sheep, pigs, dairy and poultry) and aquaculture products (salmon, trout and shrimp)[1]. In the development of the standard documents they have invited both producers, civil society (development and environmental NGO's) and scientists.

The various examples of sustainable supply chain governance clarify two aspects that have hardly been addressed in the general analysis of value chains: *first*, these varying forms of interaction, cooperation and compelling rules in the value chain are an instrument of competition, partly based on specific quality assets of the products (namely the environmental and socio-ethical performance of value chain partners); and *second* these forms of interaction and cooperation include other types of societal actors: apart from newly created non-profit governance institutions and their (for profit) auditing and control bodies also consumer NGO's, development NGOs and environmental NGOs play diverse roles. On a distance governments play a role, partly in supporting these developments and by taking the existence and assumed effectiveness of these forms sustainable supply chain governance as a point of departure for new forms of sustainability policy.

In the fact that firms and NGO's are the main initiators in this field, and that European governments are increasingly supporting this development, we can derive the observation that all practitioners (market, NGO's and governments) apply the *basic assumption* that business-to-business supply chain cooperation, geared by western consumer and civil society pressures, can be effective in improving environmental and social conditions in developing countries (Figure 1).

This multi-actor characteristic of global sustainable supply chain governance calls for a theoretical approach that acknowledges the plural network nature of such new modes of market based governance. Coe and Hess stress this issue in their work on global production networks, where they emphasize the embeddedness of production networks: namely, by analysing how they constitute and are being reconstituted by the economic, social, and political arrangements of the places they inhabit. This also implies that the influences of a range of non-firm institutions (like supranational organisations, government agencies, trade unions, employer associations, nongovernmental organisations and consumer groups) in practice also shape firm activities in the particular locations (see Coe, Hess et al. 2004, p. 1207; see also Hess and Coe 2006).

For understanding the emergence of specific forms and the impacts of these various practices in global sustainable supply chain governance, we need to focus our analysis on three levels: the level of *individual firms*, the level of the supply chain wide *governance systems* and the level of the *system competition* between supply chain governance systems on the global market.

1 See www.globalgap.org

With the analysis of the role of single firms, we need to explain both the behaviour of firms operating with

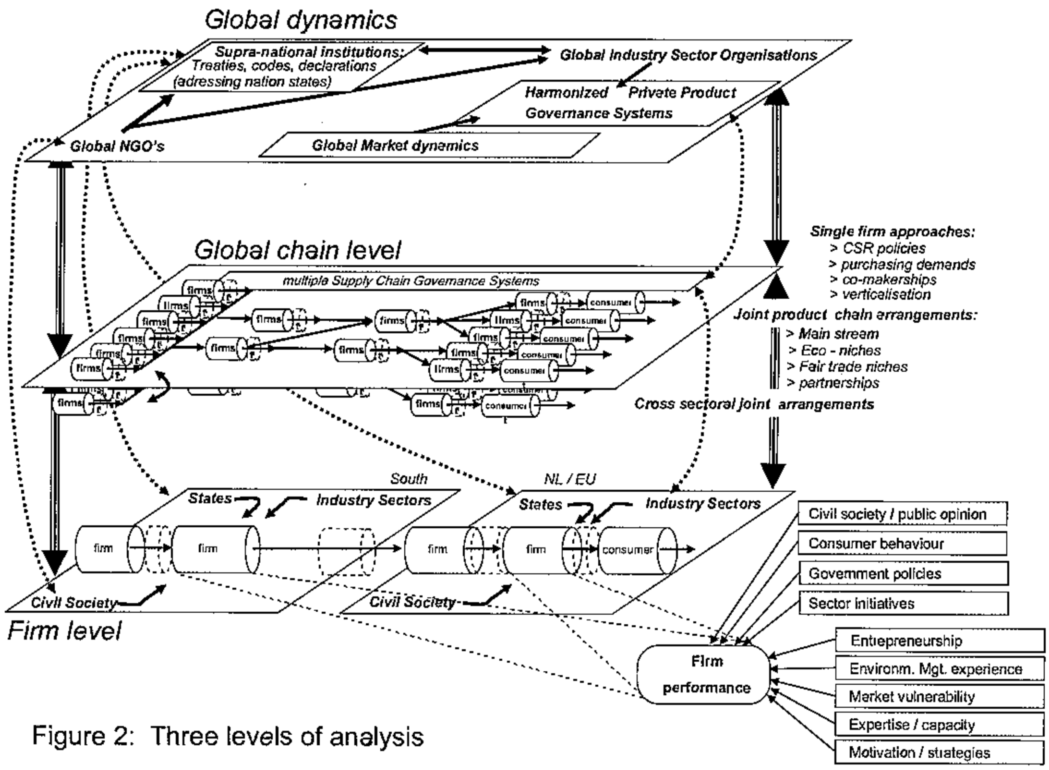

Figure 2: Three levels of analysis

their single firm approach, of firms initiating or actively contributing to collaborative approaches, firms that enter pre-developed systems later on and finally of firms that ignore these developments and continue doing business as usual. A distinction also needs to be made between firms at the demand side (mostly in developing countries) and firms confronted with these business-to-business control systems in developing countries. Figure 2 shows this at the bottom level. In the next section we will focus on each of the required elements of analysis.

4. Addressing the effectiveness

The phenomenon of governance for sustainability in global value chains integrates two general ambitions: that of profitable value creation by all market actors involved and that of improving sustainable development for all stakeholders at all stages of the supply chain. So, analysing the effectiveness of these global multi-actor governance systems implies the use of a multi-dimensional yardstick for assessing effectiveness.

Successful SSCM-systems are about *collective value creation* and *sustainable development*. Both end goals can in principle be measured, but only with serious complications. The distribution of value creation throughout the chain is a core strategic issue for firms involved and data collection will be extremely difficult, because of strategic implications and trust in supplier-buyer relations.

Measuring the contribution to sustainable development implies the use of large sets of social and environmental indicators. Determining the environmental impacts in themselves can only be done with delays and even then one encounters difficulties in attributing them to a specific firm and its activities. Facing this, it is common practice to think in terms of a sequence of impacts: starting with adjusted firm activities –> reported activities –> measurable physical results at firm level -> physical impacts on eco-systems -> impacts on humans. In this sequence, measuring effectiveness ideally would focus on the last two steps, but because of methodological complications often measurements at the first two or three steps are used (Vermeulen 2000). In measuring the effects of new institutions and instruments the focus also often shifts to the appropriateness and functioning of these institutions and instruments themselves.

Here, for the case of global SSCG-systems a combination of deductive and inductive approaches can be applied. As a first deductive step, using the global consensus in general terms on what sustainable development should be about, the overall topics that are considered relevant can be determined. As a second inductive step, the large sum of specific items in these relevant topics, can be identified by means of content analysis of all the existing certification schemes. With this the relevant coverage of each single system can be determined.

The various global assessment reports (Kates and Parris 2003; Millennium Ecosystem Assessment 2005; UNEP 2007) have further clarified the main so-called 'search directions' for the environmental dimension of this global process of change as being directed towards:

- multifunctional use of eco-systems and safeguarding of remaining unaffected eco-systems;
- balancing the provision of growing food needs with sustaining biodiversity and the regenerating capacities of agro-ecosystems;

- converting ongoing urbanisation and urban sprawl into healthy and liveable (mega)cities;
- transforming mobility systems and infrastructures into low impact and space efficient systems.
- efficient use of depleting resources;
- shifting towards economies based on renewable energy sources;
- creation of maximum closed loops of material use in economies.

Global consensus on the social dimension has resulted in the Millennium Declaration of the United Nations General Assembly. In September 2000 the General Assembly has adopted some 60 goals regarding peace; development; environment; human rights; the vulnerable, hungry and poor (United Nations 2005).

These environmental and developmental goals can't be realized without societal transitions and have also been translated into general industry directed reference systems, like ISO 14001, SA 8000 and the GRI Guidelines (Global Reporting Initiative 2002; AccountAbility and WBCSD 2004; International Standard Organisation 2004).

Using such global documents we can integrate the various indicator sets debated in environmental sciences into a *comprehensive reference set*, to be used to determine the level of issue coverage of each specific SSCG-system. Various researchers have made first steps in this direction which can be used as a first draft (Schmidt, Meurer et al. 2004; Kates, Parris et al. 2005; Labuschagne, Brent et al. 2005; Labuschagne, Brent et al. 2005). This allows us to describing the *issue coverage* and *precision* (the level of detail in prescribing actions) of all existing systems.

In addition is it necessary to test the compliance by individual firms' connected to the systems. This can be analysed by measuring the managerial responses with performance measuring in two steps (Coglianese and Lazer 2003): first looking at the availability of in firm management systems, addressing these issues and secondly sample wise testing the factual degree of implementation of specific prescribed actions.

5. Understanding SSCG-systems' performance

For understanding the impacts of supply chain governance ***characteristics of SSCG-systems*** will offer the first set of explanatory variables. In the debate on governance for sustainable development it has been stressed by many authors that some of the key characteristics of the required societal changes are that the involved multi-actor networks are facing long term challenges for substantive changes in resource use, which require entering still unbeaten paths of technological development, which also implies related social and institutional transformations. The directions of change in physical processes have been discussed in section 4 as the *'search directions'* for sustainable development, which include *five common elements* relating to the social dynamics:

- they require influencing the main driving forces of change: population growth, technology development and *production and consumption patterns* as well as spatial developments (land-use and urban, regional and infrastructure development);
- they require the *development of new applied knowledge and technology* and *knowledge transfer* to others (within national societies and between the developed and the developing world);
- they require *balanced decision-making* by various relevant actors in society: governments, businesses, NGOs, citizens, consumers, and experts;
- they require *competing claims and interests to be addressed* in the institutions that govern the various local, regional, national and international societies;
- they require a *link* between *long-term* perspectives and *short term* policies and actions (see also).

For the assessment of supply chain governance systems these common elements also serve as a reference. These systems do address production and consumption patterns. For enhancing sustainable development they need to contribute to applied knowledge development and transfer and to creating more balanced decision making by the various actors engaged (both in individual firms and in the governance institutions). Essential for success is the level of *mutual learning and knowledge transfer* enabled by these forms of multi-actor governance (Bressers and Rosenbaum 2003; Lafferty 2004).

The institutions, being the SSCG-systems then are also expected to have mechanism for addressing competing claims and interests at stake. Using the work on multi-actor governance for sustainable development in *environmental policy sciences*, our assumption is that more *inclusive* and open *network relations* (market and non-market actors) will result in more comprehensive *problem perceptions and objectives* (wider coverage of issues, more precision). A second assumptions is that joint employment of knowledge and power resources enables the application of more effective *instruments* for rule setting and compliance control.

Finally SSCG-systems need to include a mechanism of linking long term requirements via forms of continues improvement to short term step wise approaches.

Comparable conditions are suggested in economic geography, adding one additional key determinant for effective value chain governance: the need for effective provisions for reducing the *complexity of the transactions*, that are the result of difficulties in codifying requirements (Coe 2004; Gereffi, Humphrey et al. 2005; Hess and Coe 2006). This key determinant is especially relevant because of the complexity of the manifold environmental and social-ethical requirements and their debated nature. Can all involved actors make sense of it and communicate is successfully to consumers and civil society at the demand side?

For determining these assets of SSCG-systems and their relevance for effectiveness comparative studies are required, describing the wide variety of systems on these parameters. Little of this work has been done yet. In an article comparing various governance systems in the trade of forest products, Visseren-Hamakers concludes that many of these competing systems emerge ad hoc and ad random, generating relatively little effect in the sense of protecting forests, but have been useful in creating new niche markets for sustainable products and actually do fill a gap where governments are unable or unwilling to implement and enforce policies (Visseren-Hamakers and Glasbergen 2007).

6. Conditions for supply side cooperation

For further explanation of the effectiveness of SSCG-systems we need to analyse the ***supply side firm responses***: under which conditions will they participate and improve the conditions of their production? Based on some first available studies our assumption is that suppliers' responses depend on three key sets of variables: *market dependency, motivation, capacities* (Vermeulen and Ras 2006; Ras, Vermeulen et al. 2007; Zhu, Sarkis et al. 2007).

Market dependency refers to the power balance in supplier-buyer relations: can suppliers choose to deliver to others? This closely correlates with the nature of the SSCG-system involved and the demand side lead firms.

Motivation for compliance to SSCG-system requirements includes considerations of market opportunities, managers' views on corporate social responsibility and responses to external pressures (government, local, NGOs). The allocation of costs and benefits of sustainable supply chain governance will be an important consideration for suppliers.

Capacities refer to supplier's level experience with environmental and social management systems and their ability to quickly adjust their production practices to changing market incentives.

To illustrate these first variables, we first have to look at the position of producers in developing countries that intend to supply to the global market. Their position has undergone major changes in the last decades. In their article on the trade in fresh vegetables between Africa and the UK, Dolan and Humphrey have shown how the supply chain transformed from more or less 'market governance' with many smallholders supplying to via local exporters to the UK market in the 1980's, into far more tightly knit *captive* and *relational* supply chains. In these developments individual supplying farmers become more and more dependent on a small number of export companies that are closely cooperating with a small number of large European retailers. These retailers increasingly developed supply governance systems ensuring supply continuity and controlled quality of the products. Introducing certification schemes for sustainable products is a substantial part of this strategy. In this process, they state: *"the product and process parameters of UK supermarkets changed the roles of exporters and producers, forcing them to acquire a range of new capabilities to retain their UK business. (..) At the same time, the imperatives for rapid and reliable delivery placed pressure on African exporters to gain greater control over logistics by stabilising handling and transport costs, particularly airfreight, which could amount to half of the total cost, insurance, and freight export cost"* (Dolan and Humphrey 2004, p. 501). They continue with showing that production moved away from smallholders to large farms, many of which were owned by the exporters. By 1998 four of the largest exporters in Kenya sourced only 18% of their total produce from smallholders. This stemmed partly from the perception of supermarkets that smallholders could not meet process controls, such as food safety and pesticide regulations, and partly from exporters, who were concerned about the costs entailed in monitoring large numbers of small farmers. Those smallholders that remained in the value chain were organised into grower schemes with a high degree of supervision by the exporters (Dolan and Humphrey 2004, p. 501), illustrating the relational nature of these supply chains.

The GlobalGAP system which we discussed before, developed for food products jointly by the main European supermarket firms, may currently be the most elaborated example of such close knit relational supply chain governance. It poses a long list of detailed sustainable production requirements to all suppliers world wide. Non-compliance by suppliers results in termination of supply contracts and makes it very powerful. Our research in 2007 in the table grape industry in South Africa reveals the impact of this system: 95% of the export oriented fruit producers comply with these GlobalGAP requirements (Ras and Vermeulen 2008).

However, exporting producers in developing countries are in practice exposed to various competing SSCG-systems (see Figure 3). At the one hand they are exposed to general (not sector or product specified) voluntary certification systems (like the UN Compact, ISO 14001, SA 8000 etc.)(see the left side in Figure 1) which can be applied on their own initiative. These systems apply to the firm as a whole, yet businesses are increasing demanding compliance to these to their suppliers. At the other hand the aforementioned sector and product specific certification systems have emerged. Figure 3 illustrates the practice of these systems in the South-African – European supply chain of fresh fruits in 2007, the classes of issues addressed and the sum number of specific activities described in all these systems. Individual suppliers have to monitor all these activities on a regular basis.

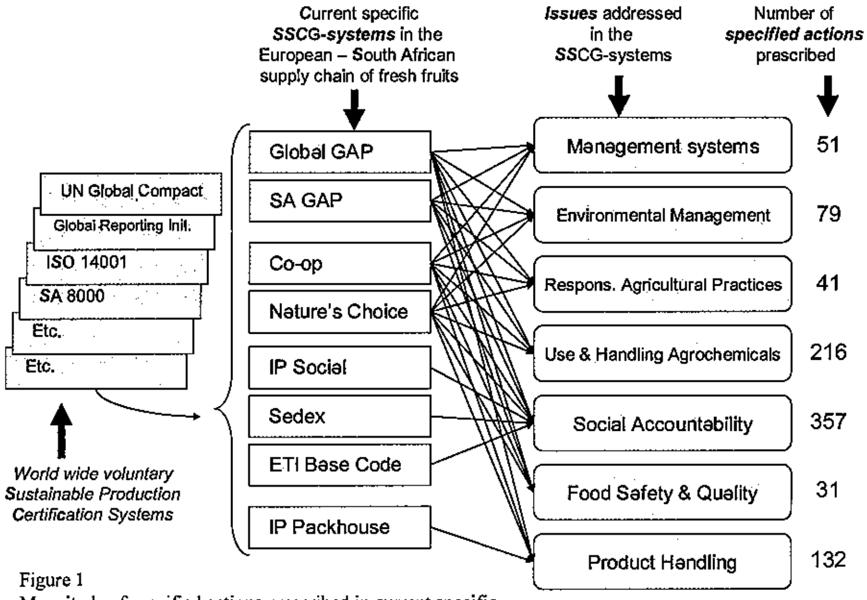

Figure 1
Magnitude of specified actions prescribed in current specific SSCG-systems in the European – South African supply chain of fresh fruits

This illustrates the growing complexity of business to business interaction in global supply chains and posses the question of motivation for supply side firm to enter or continue supplying to European export channels. Little empirical work has been done in this field. However looking at some of the studies addressing suppliers we can show a concise list of advantages and disadvantages of supplying 'sustainable goods', as reported by producers themselves (see Wycherley 1999, p. 124; Ytterhus, Arnestad et al. 1999, p. 124; see Hall 2000, p. 461; Ras and Vermeulen 2008).

Advantages of sustainable product supply	*Disadvantages of sustainable product supply*
• better prices then domestic market • competitiveness through fulfilling standards • continuity and stability of relations • new business opportunities • increasing effectiveness of applied innovations • buyers' assistance / access to best practices knowledge	• Decreased autonomy • Increased information and transaction costs

Some first research in this field, connecting motives, production practices and environmental performance have been done in the global supply chain of automobile industry. Zhu et al. studied the responses of the Chinese automobile industry to demands from upstream western costumers (European automobile producers) on issues of environmental performance (either as specific product requirements or in the form of demanding ISO 14001 certification on plant level). Chinese producers are feeling customers' pressures, but also make their own assessments of the growing demand for sustainable products, both in the domestic and the international market. They tested various explanations for the environmental performance, applying multiple regression models, linking various *drivers for sustainable production* (regulative, market, supplier and internal motives) with both *operational practices* (such as implementing environmental management, green purchasing, customer cooperation and sale of recyclables and eco-design) with good *performance* (environmental, economic and operational). They conclude that from these different explanations only firm-internal motives partly explain specific *operational practices* (investment recovery by sale of recyclables) and that the various *operational environmental practices* (especially internal environmental management, customer cooperation, investment recovery by selling recyclables and application of eco-design) account for positive *environmental and economic performance* (Zhu, Sarkis et al. 2005).

This being one of the few empirical studies going beyond individual case descriptions, makes it clear that more research is needed in identifying the conditions for successful participation in global trade of sustainable products from the perspective of supply side firms. Especially the required capacities and the need for assistance in adopting to the complex demand side requirements needs to be analysed.

7. Demand side dynamics

The third element in explaining the effectiveness is ***demand side firm behaviour***. Here we expect *market opportunities*, *motivation* and *capacities* to be the key variables. We distinguish two routes of firm activity. On the *first route* are the innovating frontrunners, often being small sized entrepreneurs perceiving sustainable business as a competitive advantage. The Natural Resource Based View of the firm suggests that product stewardship offers firms opportunities for achieving sustained competitive advantage, but this requires very dedicated capabilities, skills and experience (Hart 1995, p. 1001). This competitiveness argument has recently be tested and empirically been proven in a study of the relation between various environmental practices and economic performance of 52 leading ISO14001 certified companies in South East Asia. It showed that greening the different phases of the supply chain leads to an integrated green supply chain, which ultimately leads to competitiveness and better economic performance (Rao and Holt 2005).

These front running firms mostly have taken the single firm approach (see section 3), organising their own sustainable supply chain, as we argued with addition transaction costs, but creating their competitive advantage. In many cases their ecolabelled and fair trade products have been supplied to a small consumer market niche (often less then 1% of the sales in their product category). As we stated, creating legitimacy may be a problem for such fully market based governance systems, but in the cases of these frontrunners, the initiators and their costumers acted on the normative/ethical motives of fairness and accountability for environmental impacts. Also mutual trust is easily created in these relations (Ras, Vermeulen et al. 2007, p. 407). This allowed higher prices and allocation of addition transaction costs at the consumer side of the chain. However, these niche markets proof to be very limited. Going beyond this small consumer group, issues of reliability and higher prices tend to become serious obstacles for success, so other businesses will have to develop other solutions for compensating additional costs and gaining trust.

On the *second route* we encounter mainstream (second generation) initiatives, responding to market and society pressures, that motivate them to go beyond regulatory compliance (Gunningham, Kagan et al. 2004). Also on this route the question would be: why do these firms create SSCG-systems and why in their specific forms. There motives are more diverse, as they can be responding to increasing market shares of first movers, to public discourses, to various national policies in different countries, or even to foreign market initiatives or joint sector strategies developed elsewhere. In connection to this, no one-fits-all approach is available. A large deal of the literature about sustainable supply chain management actually is about creating and testing such approaches (Seuring, Müller et al. 2003; Kotzab, Seuring et al. 2005). Cramer has shown in a project with 12 companies in the Netherlands how an adoptive approach is required, enabling firms to respond to the various problems one encounters, when supply chain cooperation in the international supply chain is initiated. As problems she mentions: lack of supplier's willingness to cooperate, the organisation of compliance control, the issue of allocation of audit costs and creating legitimacy. She concludes that 'many companies cannot organise global chain responsibility by themselves' and actually need to join forces (Cramer 2008, p. 399-400).

As we saw, joint approaches are indeed emerging. Here we argue that many of these joint approaches result from a different motivation, connecting issues of sustainability with the competitive need for supplier control. European market requirements, both resulting from regulation (like regulation on the chemical residues on food, REACH regulations etc.) and from consumer and NGO responses (like public scandals about cattle illnesses and child labour in developing countries) have motivated business to enlarge their supply chain control. In these cases, there is no ground for relying on trust in business to business relations and in business to consumer relations and for paying higher prices to suppliers, translating them into higher consumer prices. Their strategy would be of creating a wide range supply control system (including environmental and socio-ethical issues) and of allocating the additional transaction costs at the supply side of the chain. These varying points of departure affect the basic characteristics of their SSCG-systems, determining their objectives, inclusiveness, cost allocation and knowledge transfer.

Still, most businesses will rather be *adopters* than innovators, stepping into provided SSCG-systems. On their motives and experiences little is know yet, as research is not yet available.

In all cases, firms participating in SSCG-systems need to manage the additional complexity of communicating about the wide range of possible sustainability issues across (national and cultural) borders, calling for experience building and knowledge exchange (Koh, Birkin et al. 2007).

8. The third level of the game: global competition

So far we mainly have discussed the creation of sustainable global supply chains as a two level game. The first being: the level of individual firms considering their response being a part of global supply chains, either at the demand or the supply side, and either being frontrunner or late adaptor, and the second level game being the various forms of multi-actor cooperation in specific supply chains. We showed that in specific country to country product channels these chains of producers are actually competing: the specific form of supply chain organisation is an important instrument in competition on the various domestic markets and extended quality claims in the field of environmental and social-ethical issues are instruments in this competition.

Yet, we have to add a third level to this conceptualisation. With the emergence of manifold supply chains governance systems in specific fields of products, the game is actually being moved to the level of global competition. This development has emerged most far-reaching in those product groups, which have the longest history of environmental certification, like forest products and coffee. Mutersbaugh has grippingly described this development in his article 'Fighting standards with standards', where he shows how the original relational standards are being replaced by multilateral institutions creating more general applicable globalized standards, thus transforming the supplier-buyer relations in ways that benefit certain actors (that is, retailers) and imperil the earnings of others. Efforts to establish a single harmonised label (thus reducing the cacophonies of competing labels) need to build broad coalitions in order to be effective, but in doing so must include corporate interests that prefer weaker, contract-based standards (Mutersbaugh 2002; Mutersbaugh 2005).

A comparable development can now be witnessed in the field of international trade of wine, where New Zealand's, South African and Californian front running certification organisations are currently joining forces to establish a global uniform SSCG-systems based upon their experiences (Hughey, Tait et al. 2005; Silverman, Marshall et al. 2005; McEwan and Bek 2006; Bek, McEwan C. et al. 2007). Here it is still to be seen whether is actually will lead to less ambitious systems.

9. Conclusion: challenge for research cooperation

In this article we have discussed the various approaches that are taken by market actors, sometimes in cooperation with non-market actors, in organizing governance systems aiming at the improvement of the social and environmental conditions of the manufacturing and use of products which are produced in global supply chains. While global trade is strongly growing and a wide variety of sustainable supply chain governance systems is emerging, scientific research has just started picking up this issue.

Being a remarkable issue, this double shift in governance (from state to market and from national to global), the understanding of the dynamics of these complex social systems and the conditions for their successful contribution to sustainable development are eminent.

We demonstrated that the existence of market governance systems has attracted attention in various fields of scientific research, but we conclude that a comprehensive approach is still to be developed. Here we tried to set first steps.

It requires combining an understanding of the tree levels discussed: the governance systems at a supply chain wide organisational level; the roles of various classes of individual firms both at the demand and the supply side and dividing them in frontrunners, main stream responders and late adaptors and finally the emerging dynamics on the global level.

Most of the work done is this field addresses just one of these levels and in most cases are based upon descriptive (comparative) case studies or suggesting and legitimizing specific supply chain methodologies for individual firms.

A next challenging step to be taken would be research including all elements shown in Figure 1 and developing a more quantitative approach for testing causal assumption, work that has yet been done by a very limited number of scholars (Rao and Holt 2005; Zhu, Sarkis et al. 2005; Ras and Vermeulen 2008). Applying such theory testing research in various countries and various product groups will result in better understanding of the potentials of market based governance of sustainable production in the global context.

Special attention will be needed for various issues identified in the studies discussed in this article. Some of these issues are the power relations between actors, the transaction cost allocation, the organisation of knowledge transfer and learning in supply chains and the reciprocity in SSCG-systems. The last refers to the participation of developing countries stakeholders in the creation of SSCG-systems and the formulation of their objectives and implementation strategies, which tend to be rather eurocentric.

Such analysis will give an empirical base for drawing conclusion about suitable roles for the national governments, civil society and multilateral organisations in these forms of governance.

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COMPARISON AND REVISION OF TWO INTEGRATED INVENTORY SYSTEM POLICIES

J. Razmi[1], A. Darmani[2]

Abstract

In this poper we consider the single-vendor, single-buyer integroted production problem. We compare ond evoluate two different policies. We ossume, in the first policy, vendor produces continuously to sotisfy the total buyer's demand which is nQ. In this cose the vendor sends orders in porollel shipment size of Q in n separote periods. The second model supposes thot the vendor produces exactly equol to the buyer's demond in each period, which is the total size of Q ond ships them ot the end of eoch cycle to the buyer.

In our comporison, we emphosize on the role of the cost thot we hove to pay for the system to go on functioning, on the totol cost and we regord the lead time os o voriable porometer to conduct more accurate comporison. Finally, we compute the total average cost for both policies to determine the optimol one.

Keywords: Single-vendor single-buyer, Variable lead time, functioning cost, Inventory system

I. Introduction

One topic that attracts numinous attraction recently, is the problem of single-vendor, single-buyer. These investigations tend to find better collaboration between both sides. In each research, they seek to find new policies and substitute them with the old ones to optimize their profit while satisfying all the alternatives. Admittedly, the system could reach to optimum profit and condition with accurate scheduling.

Banerjee (1986) is among the first people who worked on this case. He assumed vendor produces separately with a finite rate and sends the shipments to the buyer in each period, via these assumptions he formulated a lot-for-lot model. Goyal (1988) with proposing a new model which omit the lot-for-lot policy developed a new model with lower cost. Lu (1995) worked on the case that shipments are equal considering that manufacturer could supply the purchaser before the completion of the entire lot. He formulated the optimal solution for that. Goyal (1995) proved different shipment sizes with considering successive shipment size policy could give a better solution and cause lower total cost. Then Hill (1999) admitted this policy as an optimal one; however, he changed the model by adding an increasing factor to the shipment size. He provided a model which was more efficient with these assumptions. Later, Hill (1999) proposed another model in which he assumed this increasing factor increases only at the beginning of the cycle and he considered it constant in the rest.

In the real world lead time is variable and it could be dependant on different factors. In the studies of the lead time, Liao and Shyu (1991) developed a model for the inventory system with assuming lead time as unique variable decision and order quantity as a predetermined parameter. Ben-Daya and Raouf (1994) worked on the same problem with considering lead time and order quantity both as variable parameters. In a recent paper, Ouyang et al. (1996) considered an inventory model with a mixture of backorders and lost sales to generalize Ben-Daya and Raouf's (1994) model, where the backorder rate is fixed. Later, Ouyang and Chuang (2001) revised their model by changing the backorder rate status from a fixed factor to a controllable variable one. Yang et al. (2004) amended this model by considering the time value of money as a representative of opportunity cost.

Ben-Daya and Hagria (2003) studied the model with the stochastic demand and variable lead time. Lead time, however, was proportional to lot sizes transported from vendor to buyer (for further researches refer to Kim and Benton (1995)). They considered that vendor produces continuously and sends shipments with size of Q each period to the buyer. Chelbi et al. proposed the second model with separated producing in each period equal to size of

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shipments for the buyer and compared these two policies to determine the efficient one. They proved as far as the K (setup cost) is lower than threshold value second policy is more economical.

In this paper we revise the two models prior proposed by Ben-Daya and Hagria (2004) and Chelbi et al.. We add one effective parameter titled W which is the costs that vendor spends for the system functioning, such as the workers' salary, payments and electricity bill. We, also, change the function of lead time from a proportional parameter to a variable parameter with normal distribution function. We use from Ouyang et al. (1996) model that previously with considering a variable lead time developed a model for the total cost of inventory system. We acclaim by adding and changing these parameters we conduct a more accurate comparison.

We organized this paper as follow. In continue we defined models and developed formulas, then we provided numerical exampled and compared the two models via them. Finally, we mention our overall conclusion.

2. Proposed models

In this paper we consider collaboration between vendor and buyer. We assume that demand is stochastic and lead time is a variable parameter, with the normal distribution function. In real world, considering the lead time as a parameter dependant on lot size is not accurate and it, commonly, depends on the traffic and roads. Here, on account of this fact, we tried to revise our model by changing the status of this parameter.

As we stated before we added a parameter titled "*W*". This parameter, conspicuously, is spent during the time that system is functioning. In the second model, vendor produces equal to the buyer demand with a specified rate in each period; clearly, this does not mean that vendor produces in the whole period, though means vendor has to pay "W" over the entire period. These leisure times are too short to be dedicated to more useful activities; accordingly, we cannot omit this cost. As an illustration, we cannot fire the workers during these shorts periods in each period. In contrast, in the first model after producing the buyer's total demand, the system can work on other projects with outcomes and profits instead of wasting time like the second model.

The following notations are used in the proposed model. In order to avoid any confusion we use the same notations and numbers as Chelbi et al. did.

D: Demand rate in units per time unit
P: Production rate in unit per time unit
n: Number of lots ordered by the buyer from the vendor/ Number of shipments from the vendor to the buyer
Q: Shipment size from the vendor to the buyer
s: Reorder point
K: Setup cost for the vendor
A: Ordering cost for each order size nQ
F: Transportation cost for each shipment
π : Backorder cost for the buyer per unit short
π_0: Marginal profit per unit
h_b: Holding cost for the buyer
h_v: Holding cost for the vendor
S: Safety stock
L: Lead time
β: The fraction of the demand during the stock-out period that will be backordered $\beta \in (0,1)$

As we stated, in our model to change the status of the lead time from a proportional parameter to the lot sizes to a variable parameter, we use from the Ouyang et al. (1996) model (a mixed inventory model with variable lead time). Therefore, these assumptions are also applicable in our models;

1. In this case the lead time L has n mutually independent components which ith component has a minimum duration a_i and normal duration b_i. Crashing cost per unit time is c_i. In addition, we assume that $c_1 \leq c_2 \leq \cdots \leq c_n$.
2. The components of lead time are crashed one at a time starting with the component of least c_i and so on.
3. . If let $L_0 \equiv \sum_{j-1}^{n} b_j$ and L_i be the length of lead time with components 1,2,...,i crashed to their minimum duration, then L_i can be expressed as $L_i = \sum_{j-1}^{n} b_j - \sum_{j-1}^{i} (b_j - a_j)$ for i=1,2,...,n; and the lead time crashing cost $R(L)$ per cycle for a given $L \in [L_i, L_{i-1}]$ is given by $R(L) = c_i(L_{i-1} - L) + \sum_{j-1}^{i-1} c_j(b_j - a_j)$.

2.1. First policy: Manufacturing continuously

The first model is described as it follows. The buyer requests a lot of size nQ and the vendor manufactures with a finite rate P ($P>D$) and incurs a setup cost K and also W during the time that system is functioning and manufacturing which here is Wn/P. The vendor delivers batches of size Q in each period to the buyer to satisfy the total demand. Buyer incurs ordering cost of A prior to these transportations. In the following we depict this policy in Fig. 1 and in addition, we provided relative formulas and simplifications t used them in our comparison.

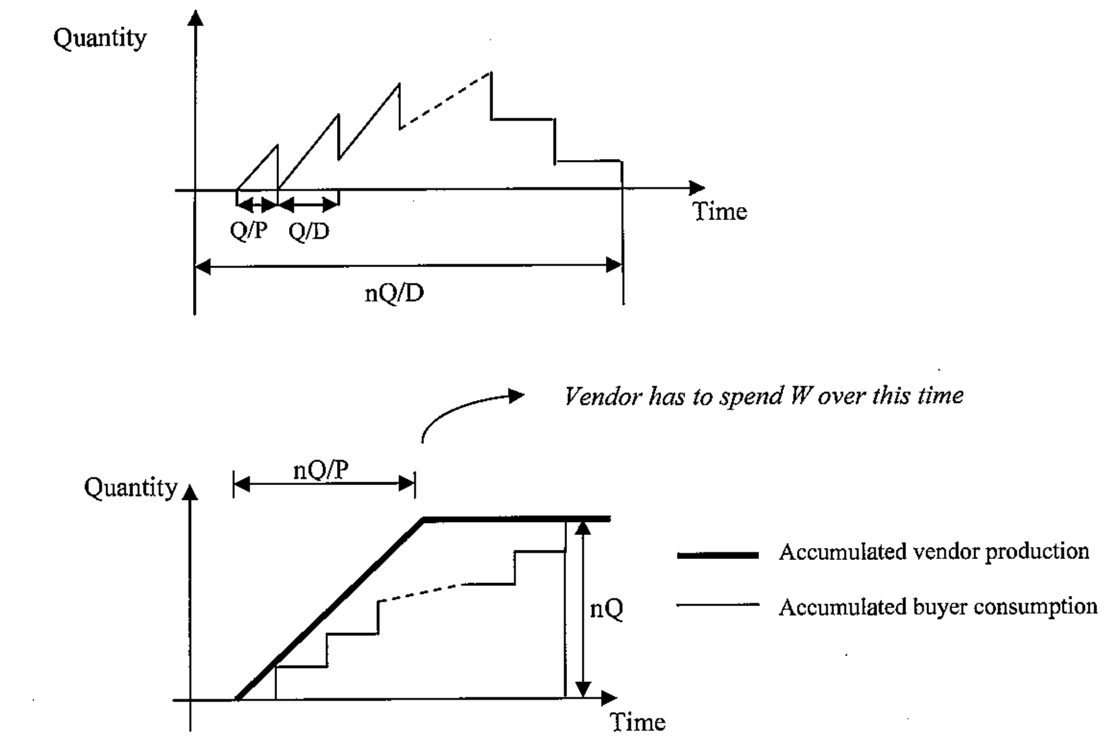

Figure 1. **Inventory system of the first policy**

$$TC_b = (\frac{A}{n} + F)\frac{D}{Q} + h_b(\frac{Q}{2} + S + (1-\beta)(b(s,L)) + \frac{D}{Q}(\pi + \pi_0(1-\beta))b(s,L) + R(L)\frac{D}{Q} \quad [1]$$

$$TC_v = \frac{KD}{nQ} + h_v(\frac{Q}{2})(n(1-\frac{D}{P}) - 1 + 2\frac{D}{P}) + W\frac{nQ}{P} \quad [2]$$

$$ETC_1 = \frac{D}{Q}(\frac{A+K}{n} + F + R(L)) + Q(\frac{Wn}{P} + \frac{h_b}{2} + \frac{h_v}{2}(n(1-\frac{D}{P}) - 1 + 2\frac{D}{P} + h_b S + \frac{D}{Q}(\pi + \pi_0(1-\beta))b(s,L) + h_b(1-\beta)(b(s,L)) \quad [3]$$

Via these simplifications:

$$\pi' = \pi + \pi_0(1-\beta)$$
$$G^1(n) = (\frac{A+K}{n} + F + R(L))$$
$$H^1(n) = (\frac{Wn}{P} + \frac{h_b}{2} + \frac{h_v}{2}(n(1-\frac{D}{P}) - 1 + 2\frac{D}{P})$$

We have:

$$ETC_1 = \frac{D}{Q} G^1(n) + Q * H^1(n) + h_b S + \frac{D}{Q}\pi' b(s,L) + h_b\ (1-\beta) b(s,L) \quad [4]$$

2.2. Second policy: Manufacturing separately

In the second policy, the vendor produces equal to the buyer's demand in each period which, in this case, is total amount of Q and ships the orders at the end of each period to the buyer. This will continue till the end of the cycle as illustrated in Fig. 2. Vendor incurs the setup cost *K* and *W* during the system functioning which in this case is spent over the Wn/D time.

Noticeably, the length of that is different from first one as it is shown in the Fig. 2. Buyer pays ordering cost of *A* before transportations.

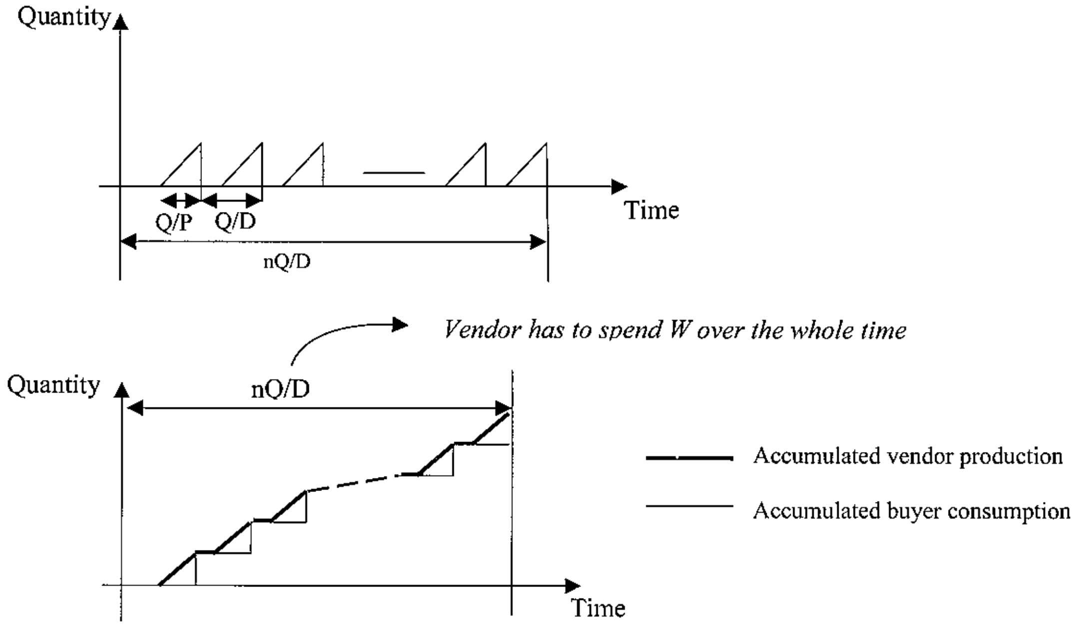

Figure 2. **Inventory system of the second policy**

$$TC_b = (\frac{A}{n} + F)\frac{D}{Q} + h_b(\frac{Q}{2} + S + (1-\beta)(b(s,L)) + \frac{D}{Q}(\pi + \pi_0(1-\beta))b(s,L) + R(L)\frac{D}{Q} \quad [5]$$

$$TC_v = \frac{KD}{Q} + h_v\frac{QD}{2P} + W\frac{nQ}{D} \quad [6]$$

$$ETC_2 = \frac{D}{Q}(\frac{A}{n} + K + F + R(L)) + Q(\frac{Wn}{D} + \frac{h_b}{2} + \frac{h_v D}{2P} + h_b S + \frac{D}{Q}(\pi + \pi_0(1-\beta))b(s,L)$$
$$+ h_b(1-\beta)(b(s,L)) \quad [7]$$

If we assume,

$\pi' = \pi + \pi_0(1-\beta)$

$G^2(n) = (\frac{A}{n} + K + F + R(L))$

$H^2(n) = (\frac{Wn}{D} + \frac{h_b}{2} + \frac{h_v D}{2P})$

We have,

$$ETC_2 = \frac{D}{Q} G^2(n) + Q * H^2(n) + h_b S + \frac{D}{Q} \pi' b(s,L) + h_b \ (1-\beta) b(s,L) \qquad [8]$$

3. Algorithm and numerical procedure

We use the modified procedure proposed by Ben-Daya and Hagria for the first policy and Chelbi et al. for the second one.

A simplified model according to the formulas of [4] and [8], the total cost for the both policies is:

$$ETC_{1,2} = \frac{D}{Q} G^{1,2}(n) + Q * H^{1,2}(n) + h_b S + \frac{D}{Q} \pi' b(s,L) + h_b \ (1-\beta) b(s,L) \qquad [9]$$

Where according to the standard reorder point formula,

$S = k\sigma\sqrt{L}$ [10]

And,

$b(s,L) = \sigma\sqrt{L}\psi(k)$, [11]

Where according to the formula [10] k is,

$k = (s - DL)/\sigma\sqrt{L}$ [12]

And $\psi(k) = \int_k^{\infty}(s-k)\phi(z)dz$, $\phi(z)$ is the standard normal probability density function. [13]

By computing the first derivative of the ETC with respect to Q and then setting it equal to zero we have:

$$\overline{F}(k) = \frac{h_b}{(\pi' D)/Q + h_b(1-\beta)} \qquad [14]$$

Where $\overline{F}(k) = 1 - F(k)$, the complement of the cumulative distribution function.

After rearrangement, Q can be written as follows:

$$Q = \sqrt{\frac{DG(n) + D\pi'\sigma\psi(k)\sqrt{L}}{H(n)}} \qquad [15]$$

The optimal cost for both policies could be calculated from the proposed algorithm by Ben-Daya and Hagria as below.

Algorithm:

Step 0: Set $ETC^* = \infty$ and $n=1$

Step 1: Compute $Q = \sqrt{DG(n)/H(n)}$, where $[x]$ is the nearest integer to x.

Step 2:

- Find k from $\overline{F}(k) = \frac{h_b}{(\pi' D)/(Q + h_b(1-\beta))}$
- Compute $\psi(k)$ using $\psi(k) = \int_k^{\infty}(s-k)\phi(z)dz$

Step 3:

- Compute Q' using $Q = \sqrt{\frac{DG(n) + D\pi'\sigma\psi(k)\sqrt{L}}{H(n)}}$
- Set $Q' = [Q']$

Step 4:

- If $|Q' - Q| = 0$, compute $ETC(Q,n)$; go to Step 5
- If $|Q' - Q| > 0$, set $Q \leftarrow Q'$ and go to Step 2

Step 5:

- If $ETC^* \geqslant ETC(Q,n)$ then $ETC^* \leftarrow ETC(Q,n)$, $Q^* \leftarrow Q$, Set $n \leftarrow n+1$ and go to Step 1

• Otherwise, $n^* \leftarrow n-1$ and stop.

4. Numerical example

We continue our claims with providing an example. We tend to consider lead time as a variable with normal distribution function; accordingly, we have to determine our time unit, which in our provided example is assumed to be one year, and the unit for both μ, σ is a week. Values parameters are shown in table 1 and the lead time value which has a 3 component is shown in Table 2. The total costs for each policy are calculated and compared for different W with K lower than threshold value. We provided number for the first two components of the lead time, numbers and results of the first component are illustrated in Table3 and results of the second component are shown in the Table4. Same results will be calculated for the other amount of L and K with the obtained algorithm.

Table 1. **Values of parameters**

D	1000
P	3200
F	$ 25
A	$ 50
h_b	$ 5
h_v	$ 4
β	0.5
π	100
π_0	150
σ	5

Table 2. **Lead time data**

Lead time component, j	L_j (weeks)	$R(L_j)$	Normal duration, b_j, days	Minimum duration, a_j, (days)	$b_j - a_j$ (weeks)	Unit crashing cost, c_j ($/week)
0	8	0				
1	6	5.6	20	6	2	2.8
2	4	22.4	20	6	2	8.4
3	3	57.4	16	9	1	35

Table3 – K=100 , L=8 , R(L)=0

W	0	500	1000	1500	2000
n	3	3	2	2	2
ETC_1	1564	1622	1645.2	1694.3	1741.8
Q	114	110	141	137	133
n	22	2	1	1	1
ETC_2	1449	1823.3	1958.5	2123.9	2276.2
Q	205	193	208	196	186

Table4 – K=100 , L=6 , R(L)=5.6

W	0	500	1000	1500	2000
n	2	2	2	2	2
ETC_1	1560.9	1615.5	1668	1718.8	1767.9
Q	155	150	145	141	137
n	22	2	1	1	1
ETC_2	1462.1	1827.2	1963.1	2131.4	2286.1
Q	209	196	211	199	189

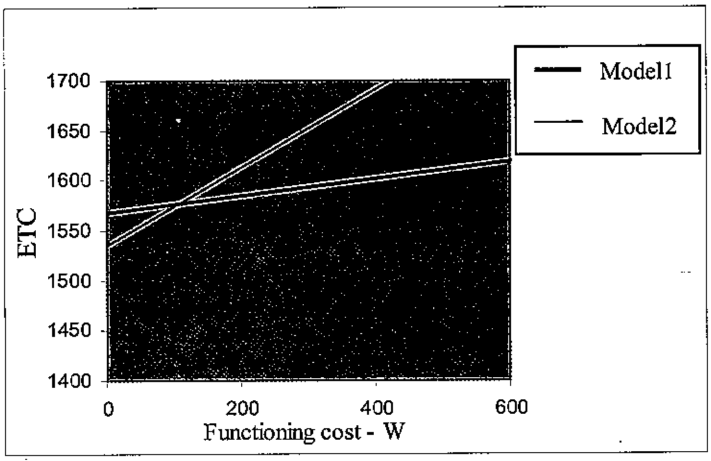

Figure 3: The **optimal expected total cost** as a **function of W (L=8)**

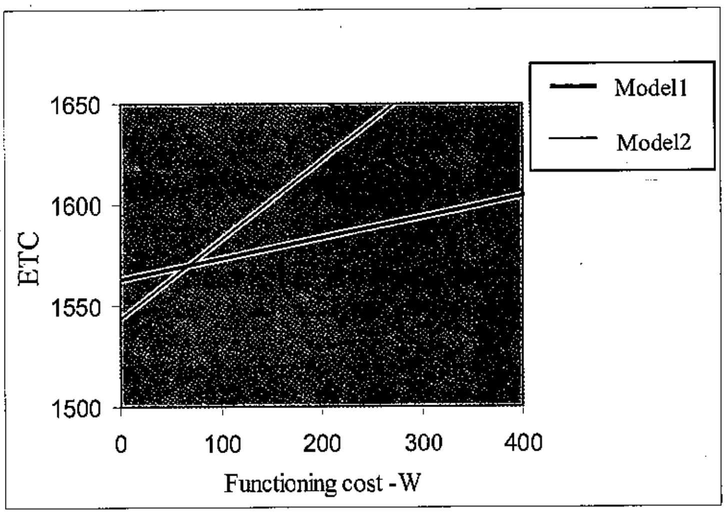

Figure 4: The optimal expected total cost as a function of W (L=6)

According to the results shown in table 3 and curves of Fig 3 and Fig 4, as the value of W increases, whether K is higher or lower than threshold value, the first policy becomes more economical. Whereas the total cost in the second model is less than the first one during the time that K is lower that threshold value when W=0, this functioning cost cannot be eliminated; hence, we claim the first model for all cases is more economical.

5. Conclusion

In this paper two models previously proposed by-Daya and Hagria and Chelbi et al. are amended and compared. We added a parameter titled W to the cost that the vendor incurs during production which is included the costs that vendor has to pay for the system to keep functioning. We, also, changed the lead time status from a proportional parameter to lot sizes to the variable parameter with normal distribution function. We compared these two modified policies to determine the optimal one. Numerical example and figures provided for this comparison that indicated the first policy becomes more economical as the value of W increases for all amount of K.

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INVESTIGATION OF SOURCES OF CREATIVITY IN CATCHPENNY ARTICLES WITH PARTICULAR FOCUS ON TOYS

Dilek Akbulut[1]

Abstract

The aim of the study is to investigate the nature of creative activity in catchpenny articles sold on street peddles with a particular focus on small-scale toy manufacturing industry in Turkey.

In this study, peddling is discussed as marketing medium of informal sector, neglecting some steps of value chain such as tax, store rent, warranty and services etc. Informal sector is known for its ease of entry, reliance on indigenous resources, small scale of operation, labor intensive nature, and its unregulated competitiveness. Considering these facts, the sources of product ideas, product variety (i.e. from craftwork to mass manufactured items) goals and limitations in this sector are introduced.

A case study on small scale toy manufacturing, one of the significant sources supplying products to peddling, is conducted. The creative qualities of the toys on peddles, the sources of creativity in Turkish toy market and the response of Turkish toy manufacturers to the invasion of the market by foreign manufacturers (e.g. Chinese etc.) are identified within the study.

Keywords: Informal Sector, toy manufacturing,

1. Introduction

Despite the fact that bighly competitive formal sector dominates the market, peddling, which is a form of informal marketing share a considerable part in it. Although, the informal sector is named as "informal", it is not totally illegal. Moreover, it offers a solution to the urban unemployment problem which appears as a result of migration. Thus, besides the elements of restriction, government policies contain elements of support and promotion to peddling. Although formal sector is regarded to be the client of professional design practice and technology, informal sector appears as an untouched potential which finds solutions in itself.

Informal sector has paradoxical aspects which are offered by its nature. As the term "informal" suggests, it is on the one hand not well organized, on the other band has peculiar aspects which make it more flexible and creative then the formal sector. In comparison to informal sector, flexibility, which is required for creativity and innovation, is limited in formal sector as a result of its organized nature. Moreover, formal sector is led by a clumsy structure with respect to informal sector since the implementation of the innovation is not immediate.

In informal sector, creativity appears as a result of the poor conditions which are peculiar to it. Either as a way of marketing or production, informal sector lacks the sources such as technology, promotion that are readily available for formal sector.

The products produced within informal sector vary from craftwork to mass produced items. These products are produced with low budget, usually sold on street peddles, and can satisfy needs not met by the formal sector. Nevertheless street peddles serve as the marketing medium of catchpenny articles produced either by formal or informal sectors. These catchpenny items have common ingenious characteristics that make them meet on street peddles. Peddling offer creative catchpennies tbat usually appear in the form of fads that are playful, awaking fun and curiosity are sometimes even obsolete. The aim of the study is to investigate the sources of creativity in catchpennies with particular focus on small scale toy manufacturing industry in Turkey since toys are regarded to be the most common creative catcbpennies.

2. Informal Sector

The term "informal sector", which was initially introduced by Hart in 1971, was first addressed to urban poor as a legitimate and an illegitimate income opportunity varying from street vendor to home industry. It was argued tbat tbe informal sector provided a wide range of low-cost, labor intensive, unregulated, competitive goods and services which are unrecorded.

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Informal sector's appearance is discussed to be a result of modern sector's (particularly industry) inability to absorb a growing surplus of manpower. Consequently, earning opportunities outside the modern system ensuring survival had to be found which is now called as informal sector (Charmes, 1990). The term is defined with several names such as disguised unemployment, illegal economics, marginal economics characterized by low-productivity and low-pay activities.

It was the ILO (International Labor Organization) report on Kenya (1972) which launched and popularized the concept of informal sector. The formal and informal sectors were identified by the mentioned ILO report, cited by Gilbert and Gugler (1984), as shown in Table 1.

Table 1. Characteristics of informal sector in comparison to formal sector (Adapted from ILO report, 1972, cited by Gilbert and Gugler (1984)(p:73))

Informal sector	Formal Sector
Ease of entry	Difficult to entry
Reliance on indigenous resources	Frequent reliance on foreign resources
Family ownership of enterprises	Corporate ownership
Small scale of operation	Large scale of operation
Labor-intensive and adopted technology	Capital intensive and often imported technology
Skills acquired outside the formal school system	Formally acquired skills, often expatriate
Unregulated and competitive markets	Protected markets (through tariffs, quotas, and trade licenses)

As mentioned above, informal sector is mainly characterized by its ease of entry. According to Tekeli, this depends on two facts; as in informal sector the search for capital is very small or none, and there are not any obstacles since there is lack of labor association (1982).

Alternatively Sethuraman (1981) referred by Lubell (1991) proposes a general definition of the informal sector as small-scale units engaged in the production and distribution of goods and services whose primary objective is to generate employment for the participants rather then to maximize profits. In general, informal sector covers all the acts which cannot be identified with the traditional measurement methods of economics and which are partially reflected to the national income statistics. According to Sethuraman (1976) referred by Charmes (1990), the membership of the informal sector depends on employment of no more then ten persons, non-application of legal and administrative regulations, employment of family members, no fixed working hours and days, no institutional loans, production intended for the final consumer, less then six years of schooling for workers, and for certain activities, no use of mechanical and electrical energy, and the semi-permanent character of the activity.

According to OECD definitions, informal economy is subject to four sub groups such as:

1. Underground Production; in which taxes and social security payments are avoided. In this sub-group, the economic legal acts are unrecorded to facilitate tax payment avoidance and tax evasion.
2. Illegal Production; which is examined in two categories. The first category covers the products and services whose production, sales and maintenance is illegal (e.g. dealing of drugs and stolen goods, prostitution) whereas the second category deals with the production of legal goods by the unauthorized (e.g. unlicensed production of legal drugs).
3. Informal Sector Production; which covers the acts avoiding the corporate regulations. In general, informal production is seen in small-scale firms which do not facilitate continuity, and which are unable to produce income that meets the cost of formal sector.
4. Household Production for own final use.

(Ercan, 2006)

The scope of the present study is identified as the third sub group. In this subgroup, production and distribution can totally be performed legally. However, the discontinuous nature of the production act hinders these small-scale units to be recorded as formal sector enterprises.

Formal sector large-scale enterprises ranging from public sector companies to multinational corporations and locally owned firms are closely related to the state and enjoys protection in terms of working conditions, job security and social security. However informal sector which offers a solution to urban unemployment problem gives a chance to the local entrepreneurial talent (Gilbert, Gugler; 1984). Therefore, both production and marketing acts carried out by informal sector can be argued to serve as a balance element in employment.

2.1 Production in Informal Sector:

Informal sector production units differ according to the scale of production they make. Establishments which fall outside the reach of government regulations, with 10 or fewer workers using simple and traditional technology are mentioned to be informal sector production units. These units are differentiated between two types of activity: 'traditional' which operates with very low capitalization, low labor productivity and low incomes, is very small in size (three or fewer workers) and uses static technology organized often within the home; and 'modernizing' which is more capital intensive, is usually larger in size, more dynamic in technology and is linked to urban formal sector.

Modernizing informal sector units also tend to use more skilled labor which is generally acquired through learning and training activities within the sub sector (Ranis, Stewart; 1999). These modernizing units can be regarded as small sized enterprises which are generally in transition between formal and informal sector searching for personal survival with little available capital. Besides providing goods for informal sector market, these serve for formal sector as well. Consciously or unconsciously large scale enterprises prefer to work with these units in subcontracting base in order to avoid high production costs (Ercan, 2006). However, this interaction provides the modernizing unit with technology and skills required.

Informal sector manufacturing act usually depends on limited resources. On the other hand, a certain innovative potential is addressed to these modernizing production units which are regarded as small sized enterprises. An entrepreneur is defined as a figure who carries new combinations of the means of production, and who revolutionizes the pattern of production (Scbumpeter cited by Taymaz, 1997). Thus, small sized establishments are considered as a fertile ground that nurtures entrepreneurship and small sized entrepreneurs are regarded to carry out an innovative production act. Small scale enterprises have certain advantages with respect to large scale firms in innovation. First of all, the ability to quickly react fast changing market conditions and the dynamic management takes advantages of new opportunities in the market. Due to the small scale, the internal communication is usually effective and problem solving ability is fast. However, small scale enterprises lacks qualified technical manpower and financial resources and cannot cope with the patent system (Taymaz, 1997).

The shortage of resources such as capital, technical infrastructure, and qualified technical manpower in informal sector forces the small production units to expand their resources to the maximum. Since capital is limited, the production units are unable to spend huge amounts on R&D and technical know-how. Although technical information is available, it cannot be applied or can be ill adapted. As a result, these small scale production units tend to depend on the technologies readily available, familiar and used by them. Another reason for use of old technologies is the lack of information networks in informal sector. As formal sector holds the networks necessary for information, production, transport and distribution, the flow of information depends rather on personal contacts with technology dealers in informal sector (ILO Advisory Committee, 1985). Since the technology producers nearly neglect the feedback of informal sector production units, these tend to adapt the readily available technologies or to innovate their own technology. In general, informal sector remains humble in reaching the latest techniques and equipment. Thus it depends on older technologies and is forced to modify machinery to process new and recycled materials.

Although informal sector is said to respond the changing market and technological conditions quickly, information for innovation in informal sector is fragmentary and disparate for

- Informal sector enterprises have obsolete techniques and means of production, modest resources, poorly educated and unskilled labor force; but economic progress mainly depends on large enterprises using capital intensive technology.
- There is no regular recording and it is hard to report the history that is important in reconstructing.
- There is lack of institution among them which can support and provide information among these enterprises and can favor a pressure group as in formal sector. (Maldonado, Sethuraman, 1992)

In general, the modified technology results in poor detailed products particular for local markets in informal sector. However, today the catchpenny articles are not limited to these items. The street peddles seem to be dominated by the products sold in global market.

2.2 Peddling as Informal Sector Marketing:

Types and services in the informal sector is divided into two parts as innovative service sector and illegal acts (Gilbert, Gugler, 1984). Peddling stands on the innovative service group tending to bring facilities with small capital or none. It is regarded to be a balance element against formal marketing actions since the catchpenny articles are not only produced by informal sector enterprises. As Fontaine mentions, peddling owed its success to offer luxury goods, goods which are new and often illicit at a better price then sedentary business and sbops (1996). Even stock remainders, produced by formal sector enterprises may shift to peddles and appear as catchpenny articles. In formal sector, the products fails if launcbed too soon or too late to the market, or at a time when the consumer demand is shifting. These shifts are the crack points for the peddlers to be turned into profit. By this way, peddling is also used by the formal sector to harmonize the market.

Peddlers are categorized as follows:

1. Legal peddlers: those permitted by municipalities with a certain toll.
   i. Mobile peddlers
   ii. Stationary peddlers
      - settled in permanent market places
      - acting in half-open shops as florists or green groceries
      - acting as extension of the shop through street
2. Illegal peddlers: those selling whether legal or illegal items without any license or toll.
   i. selling legal goods; county constabulary are in cbarge of their prevention

ii. selling legal goods whose sales are limited to certain places or circumstances, like drugs, tickets; in other words black-market.
iii. selling illegal items like narcotics and smuggled goods. Policemen are in charge of their prevention.

In comparison to formal sector marketing, peddling differs in various aspects. First of all, the manner of expansion is different than formal sector marketing. Peddling does not allow work expansion with wider peddles since this hinders mobility. Henceforth, work expansion is in the form of increase in number of individual peddles rather than widening a single peddle.

The response to the demands is carried out with a creative approach in peddling. The dynamic nature of peddling necessitates the peddler to be attentive, quick and decisive to respond changing conditions. Rather than serving for the planned buying activities in shops, peddler appears as the figure who urges buying intention on streets.

Presentation mainly covers advertising in formal sector marketing. In informal sector marketing, peddle fulfills the functions of display, storage and transportation at the same time. Likewise, the peddler serves both as the advertiser and the seller of the catchpennies. Usually catchpennies do not have any advertisement unless they are formal sector stock remainders. From time to time, peddlers pick certain concepts in advertisements in presentation of related catchpennies. Figure 1, Figure 2, and Figure 3 presents a similar marketing approach where the peddler uses the purple cloth to remind people the purple packages of well-known chocolates.

Figure 1. Chocolate package

Figure 2. Chocolate package

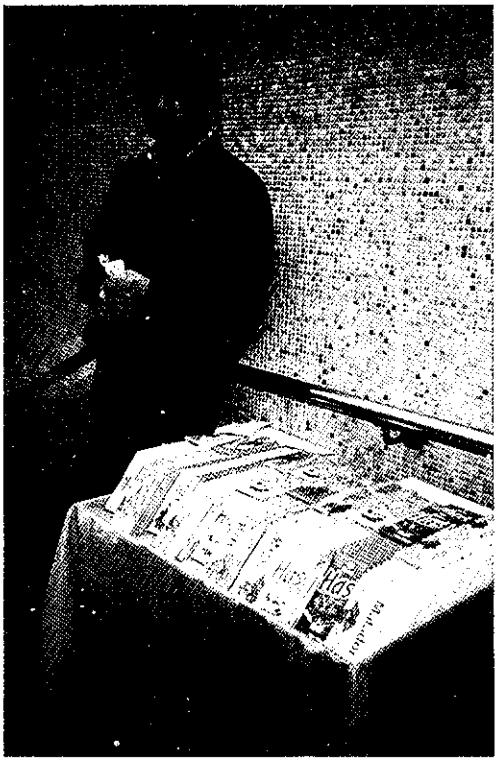

Figure 3. Chocolates sold on street peddle

Normally catchpennies do not ensure any warranty. Moreover the peddler tends not to declare the manufacturing defects of catchpennies. Nevertheless, stationary peddlers provide guarantee or ensure product returns in case of a default.

The range of catchpennies varies from craftwork to formal sector stock remainders. Even the range sold on a single peddle is diversified and do not show any stable character. Usually the shift of the catchpennies is determined by various aspects. Time appears to be one of the determinants of peddling since the shift of the items on peddles differs according to periods of the year, week, or even day. The peddling act is uniform within time since the shift of the catchpennies depends on certain time intervals, as flags are the most common articles in national days, or sunglasses are sold during summers. Location of the peddle is another factor effective on the product range. The peddle on a specific location serves as a quick service for specific urgent needs.

2.3. The Notion of Creativity in Catchpennies:

Creativity is the unknown combination of known ideas (Boden, 1991). Although being unpredictable is a necessity for creativity, it is not sufficient alone. A creative idea must also be useful and as simple as possible.

Catchpennies can be claimed to manifest creativity with their simple and surprising nature. Jackson and Messick identify the qualities of "creative products" in mainly four aspects (1965).

Like Boden, they identify the first creative quality of a product to be 'unusual'. An unusual object evokes surprise, amazes or shocks. Novelty appears as one of the keywords in unusualness. The second quality is 'appropriateness' which is evaluated within the context of satisfaction. To be appropriate, the product must fit its context. The third quality is mentioned as 'transformation' which can be associated with 'breakthrough'. A transformed object is totally a new answer to a problem which cannot be compared with any example in the same category. Transformations are not improvements of pre-existing forms, rather are new forms. Tbe forth characteristic is 'condensation of meaning' which refers to the longlivity of product. Apart from the last item, catchpennies manifest the mentioned qualities of creative products. Since they appear in the form of fads and are respect to quick changing conditions, tbey are hardly regarded as long lasting.

The sources of design in informal sector is identified in three groups as straightforward copies of existing products, adaptations that suit existing technology or local conditions, and new creations (Guimaraes, 1998). However these sources vary with respect to the country depending on the level of industrialization and isolation of the market. The design qualities of catchpenny articles are identified as simplicity, safety, affordability by low income customers, durability, ease in operation, repair and maintenance (Guimaraes, 1998). However these objects generally lack human factors. On the other hand, ILO regards design as a secondary important element in catchpennies for improving the quality of life since the main objective in catchpennies is to provide quick income opportunities for the peddlers (1985).

The creative catchpennies are sold in the form of street fairs. Besides craftwork, products manufactured both by formal and modernizing informal sector units are included by the mentioned group. These manifest creativity with their popular, demonstrative, playful and unusual qualities. The limitations of the materials and machinery used in manufacturing, or the potential of any material used can also facilitate creativity in these items. The most common item among these creative catchpennies appears as toys.

3. Case Study

Through the study, the universe of catchpennies were observed to be consisting of many groups such as food, export remainders, spare parts, imitations and copies, and craftwork. However the borders between these groups are not sharp since any item may lead the characteristic of more than one group. Whether produced by informal sector production units or not, ingenuity can be associated with innovativeness and creativity, appears as the common characteristic peculiar to catchpennies. The study focused on toys which are observed to be the most abundantly found ingenious catchpenny items.

The case study aimed to explore the condition of Turkish toy industry and the sources of creativity in design of the toys produced in this sector. Within the framework of the study, small-scale toy manufacturers in Turkey, whose products are sold both in formal and informal sector, were tried to be reached. Generally these small-scale producers are regarded to be in state of a transition from the informal sector to the formal sector.

3.1 Overview of Turkish Toy Market

Anatolian toy tradition was mainly based on the items that were transferred from ancient cultures. Among these traditional toys, yoyos, kites, hacıyatmaz, fırıldak, teetotums can be mentioned. The tradition of craft puppet production of the Middle Asian Turks disappeared with the adoption of Islam (Önder, 1986). However this tradition can said to be revived in 19th century with shadow theater and the production of puppets (Yalçınkaya, 1996). Eyüp in İstanbul is known for Turkish traditional craft toy manufacturing, since in 18th century Evliya Çelebi mentions about 105 masters resident in Eyüp involved with toy manufacturing. 18th century is also known for the corruption of local toy craftsmanship against the imported European mechanical toys (Önder, 1986).

Foundation of the Turkish Republic accelerated industrialization in toy manufacturing. In the early republican era, toy production was carried out first at homes, as if in backyard industries, and than in small workshops. The sector showed up a stagnant mood after 1955 with the invasion of the European toys. The interruption of imports in 1960's resulted in the sector to evolve. Until mid 1970's toy manufacturing mainly consisted of making direct copies of European examples. The second half of the 1970's is known for the dominance of tutorial toys in the market. The stimulating period of 1980's and 1990's is replaced with a stagnant mood today. The invasion of the Chinese toys caused many of the producers to leave the sector. Even the biggest firm which was said to hold the 19.8% of the market share in 1975 went bankrupt in 1990's with changing market conditions (Önder, 1986)

In current Turkish toy market, as shown in Figure 4, the wholesalers located in Tahtakale, İstanbul serve as the mediator between producers and customers. However, most of the wholesalers are also the manufacturers and provide products for individual customers and peddlers.

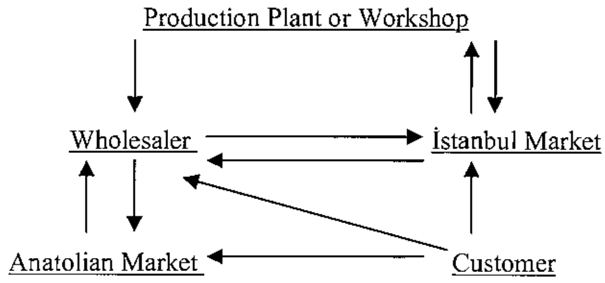

Figure 4. The scheme of Turkish toy market by Önder, 1986

3.2 Methodology

In order to reach the full list of the toy producers in Turkey, the database of the Union of Chambers and Stock Exchange was used. Among the 83 toy producers reported in this database, only 2 companies were found to be involved with toy manufacturing since the invasion of the Chinese toys caused the rest of the producers to leave the sector. Other then the two foundations reported by The Union of Chambers and Stock Exchange, one more company was able to be contacted.

"Lack of reporting" was mentioned to be one of the reasons of technological humbleness in informal sector. However, it appears as one of the problems for Turkish formal small-scale toy industry as well. The database of Turkish Union of Chambers and Stock Exchange did not provide exact information since some of the addresses existent in the list have gone bankrupt while some other manufacturers are missing in the same list.

As a result, three small-scale toy producers were interviewed. Other then the interviewed companies, information was collected by brief conservations made with the salespeople in wholesalers.

Company A located in Tahtakale, İstanbul, was involved with toy gun and truck manufacturing. Company B, which was also located in the same region, and was reached with the help of Company A, had relatively a wider product range varying from lego, trucks to bicycles. Company C was involved with production of legos.

Mainly the questionnaire focused on two aspects as the creation of product ideas and market conditions. The companies were asked;

- Whether they were employing a design team or not,
- How the ideas of new products emerged
- How these companies survived after Chinese toy boom
- Whether the products which shifted to street peddles changed

3.3 Results

All of the interviewed cases were pessimistic about the Turkish toy market and were searching for survival ways against Chinese toy industry. The interviewees, who were the owners of the firms, were aware of the advantages of Chinese industry with low cost and high productivity. It was stated that after the Chinese toy boom, many small-scale producers left the sector which caused peddlers to get in touch with the remaining toy manufacturers larger in scale. Hence, today the catchpenny toys are the same with the toys sold in shops. Under such circumstances, the shop owners in Anatolian market suffered since they had to support a considerable profit for rentals and taxes which are not the subject of peddling.

All of the interviewees stated that the sector was active in the production of low cost toys before the introduction of Chinese items to the market. Before, anyone with a plastic injection workshop was able to produce a single catchpenny item to support a considerable profit. Since these small-scale producers disappeared, today low cost toys hardly show differences between the ones sold on street peddles and in shops.

The companies did not employ a design team consisting of designers, engineers, or educational consultants. The design act usually depended on experience and intention of the company owners and production staff. The sources and methods of design in Turkish small-scale toy manufacturing can be summed up as;

1. Toys produced by foreign manufacturers:

International exhibitions and catalogues of foreign toy manufacturers were observed to be the main sources of design in this sector. In general, direct or modified copies of foreign examples are presented to the market. The products to be copied are chosen intentionally by the entrepreneurs without any particular method. However cultural intentions on the choice and modifications can mentioned to be dominant. For example a jumping spider produced in China can turn into a jumping rabbit, or a toy, as presented in Figure 5, truck can be exaggerated in scale since children in Turkey are said to get on these trucks unlike their precedents abroad. Putting stickers on toys is observed as a method of modification. The relief ornaments and textures on original products can be changed with local figures or stickers put. One of the producers emphasized the necessity of using stickers by mentioning that any toy without stickers is hardly sold in Turkey. On the other hand, the interviewees stated that the use of stickers on toys is forbidden abroad. The design of stickers, like the design of packages, is mentioned to be made by entrepreneurs and printing house staff.

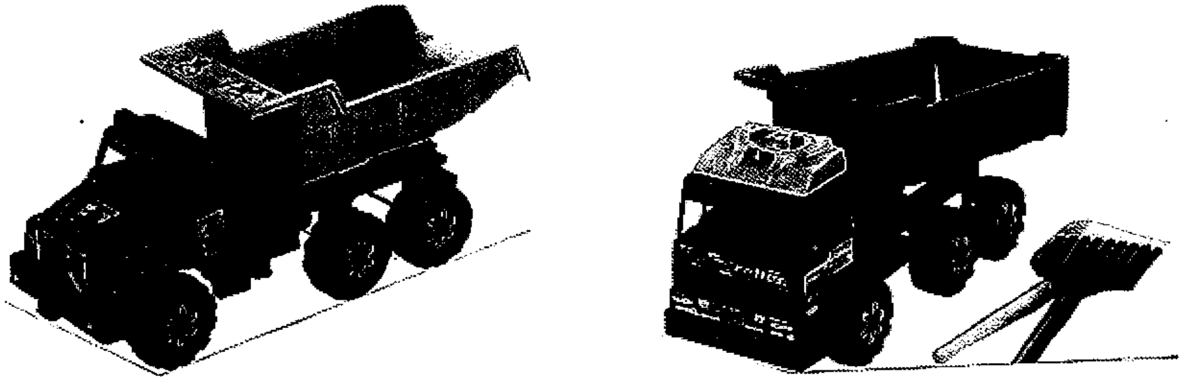

Figure 5. Toy trucks

2. Toys readily available in the market:

Some parts of the toys available in the market can be exaggerated in scale and produced as a separate item itself. For example bell of a certain toy is exaggerated in scale and launched as a new item as in Figure 6.

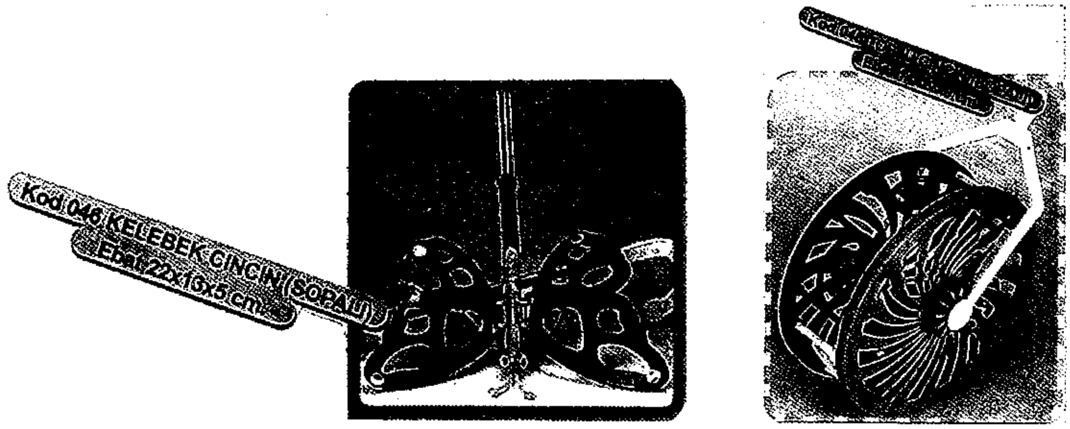

Figure 6. Toy bells

3. Objects used in daily life:

Any item can be decreased in scale and produced in plastics in the form of toy or toy kit which can be installed by the child (e.g. toy baby cart)

4. Local craftworks:

The producers can be inspired from local handmade toys or daily objects. In fact two methods are applied; the original object is decreased in scale and transformed into plastics or handmade toy is turned into a kitsch object produced out of plastics.

The interviewed cases proved that they were searching for ways of survival against the so called Chinese toy industry. The methods used to seize the market are;

1. Shifting the product range to big scale toys; since big scale toys such as bicycles or huge trucks cannot be imported because of high transportation costs, some companies try to fill this gap.
2. Widening the product range; so that any profit loss on one item can be compensated with the profit gained from the other.
3. Limiting the product range to legos and changing the target users to more educated parents and kindergartens.

4. Discussion

Although the domestic producers interviewed were small-scale formal sector enterprises, their products were sold both by formal and informal sector. In fact, the toy producers which are the subject of the study, show the characteristics of "modernizing informal sector units" which is offered by Ranis and Stewart (1999). These modernizing units which are in transition between formal and informal sector provide goods and services for both sectors like the companies interviewed within the study. These production units were leading more a capital intensive nature, were larger in size, and were using more skilled labor with respect to the informal sector production units. On the other hand, these enterprises' small scale of operation, family ownership and serving for unregulated markets converge them to the informal sector units. However their small scale structure, as Taymaz (1997) states, provides them a certain advantage in quickly reacting fast changing market conditions and taking new opportunities in the market. The current situation of the toy market proves that after the Chinese toy boom, while the large scale companies went bankrupt and informal sector units had to leave the sector, only such kind of small scale companies that stand in between informal and formal sector could have survived by according the changing market conditions.

Although these units employed even engineers, they lack a design team. The workshop owners appear as the company directors generating product ideas whereas the masters of the workshops serve as the technical staff responsible for the technical decisions such as material, strength, scale affecting the design of the product.

The sources of design in the so called companies confirmed the categorization of Guimaraes (1998) which consisted of straightforward copies, adaptations and new creations. The product ideas were observed to appear mainly out of sources as;

1. Foreign toy industry. Any toy or daily product produced by foreign manufacturers can be reproduced in original scale or any part of a toy can be exaggerated in scale and introduced as an individual toy. This group shows the characteristics of straightforward copies of existing products.
2. Traditional culture: An item in traditional culture can be directly minimized in scale and produced in plastics. In a way, traditional items are adapted to suit existing technology and local conditions.

On the other hand, traditional component of the informal sector production units are more apt to manufacture handmade toys that can be called as "new creations". Traditional component operating with very low capitalization, generally utilizes adopted technology organized within home, or may totally depend on craftwork. In fact, craft oriented toys manifesting ingenuity participate in considerable amount on street peddles. These may be recent variations of ancient toys like sulu düdük, teetotum, or decreased-in-scale variations of traditional daily objects like cradles, or totally new creations based on craftwork. Totally new creations, as given in Figure 7 and Figure 8, can be inspired from the potentials of easily found materials like paper, plastics, sawdust etc.

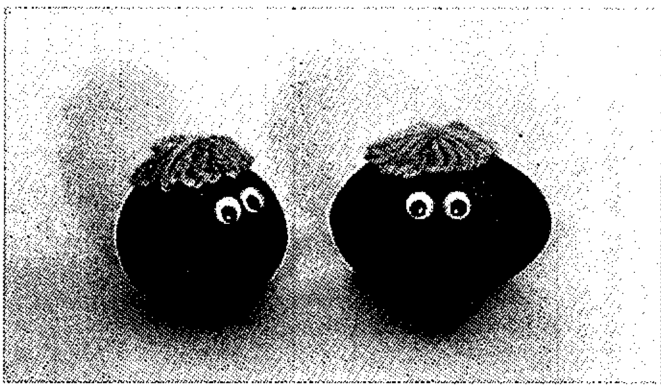

Figure 7. Hand made soft heads made out of balloons stuffed with sawdust

Figure 8. Patchwork puppet

Figure 9. Pumped rabbit

It can be claimed that domestic toy production sector do not produce highly demonstrative goods which attract the attention on streets. Among the catchpenny articles, the demonstrative toys which appear in the form of temporary fads are generally produced by Chinese toy industry. The domestic small-scale producers which disappeared led a similar strategy to manufacture such demonstrative temporary fads in order to ensure sbort-term profit. As the term 'fad' suggests, these items had tendency to become popular for a short time. Such items can claimed to be culturally sensitive since modifications are made due to the locality they are produced. For example, a Chinese pumped spider is interpreted as a rabbit, as presented in Figure 9, in Turkish market.

Although the toys manufactured by domestic producers are sold both in formal and informal markets, they lack the demonstrative quality so are not competitive as catchpenny article. For example packed lego toys produced by domestic formal sector participate on street peddles with mechanical Chinese toys and hardly attracts attention while the other toys are presented in the form of street fairs.

While formal sector domestic producers support fads, they are apt to create their own fads or to copy the foreign fads like the Barbie dolls. In any case, domestic toy manufacturing sector seems to be dependent on foreign sources. The attempts to transform traditional items to industrially produced toys generally results with kitsch items. However traditional culture appears as a crucial element effective in toy production. A further study which deals the dominance of traditional culture on small-scale industry can be suggested.

As a result, Turkish small scale toy manufacturing appears to stand on the border of informal and formal manufacturing sectors. The detailed examination of the production and design processes in such companies can provide information necessary for development of the sector.

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THE KEY ISSUES FOR REMANUFACTURING: REVERSE LOGISTICS AND SUSTAINABLE DESIGN

Ibrahim Gurler[1]

Abstract

Reverse Logistics has become a key competence in modern supply chains. Reverse logistic activities include collection, disassembly and processing of used products in order to ensure a new use or an environmentally recovery. Recovery of used products is receiving much attention recently due to growing environmental concern. Efficient implementation requires appropriate logistics structures to be set up for the arising goods flow from users to producers. The mass of products at end of life becomes a real problem for the environment. The remanufacturing is an end-of-life strategy that reduces the use of raw materials and saves energy while preserving the value added during the design and manufacturing processes. Design for Environment covers any design activity which aims to improve the environmental performance of sustainable product design. The decisions made at the design stage effect all of the life phases of the product - manufacturing, transportation, operation, maintenance and disposal. This article deals with problems related to the integration of remanufacturing activities within sustainable product design and to the coordination of reverse logistics system. In this paper, metrics for assessing the remanufacturability based on sustainable product design features are introduced and addressed the problem of choosing the appropriate reverse logistics channel structure for the collection of used products from customers.

Keywords: Remanufacturing, Reverse Logistics, Sustainable Design, Design For Environment, Product Recovery

1. Introduction

The major cause of continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in industrialized countries. The concept of "Producer Responsibility" requires original equipment manufacturers (OEMs) to "take back" an equivalent used product for each one they sold. The significance of remanufacturing is that it combines profitability and sustainable development benefits by reducing land filling, as well as the level of virgin material, energy and specialized labor used in production. Today, sustainability is often considered to have three dimensions, the economic, the social and the environmental sustainability. The focus of this paper is on the environmental sustainability. Research indicates that up to 85% of the weight of remanufactured products may be obtained from used components, and that such products have comparable quality to equivalent new products but require 50% to 80% less energy to produce (Lund, 1984).

The mass of products at end of life becomes a real problem for the environment. Thus, industrials are turning their attention to strategies for the management of products at the end-of-life. The remanufacturing is an end-of-life strategy that reduces the use of raw materials and saves energy while preserving the value added during the design and manufacturing processes. But, in most of the cases, remanufacturing processes must be adapted to existing products because products have not been designed to be remanufacturable. However, the process adaptations increase costs and this can lead the overall benefits obtained with the remanufacturing process to be reconsidered. The aim of our research was to propose an approach for the designers to integrate remanufacturing constraints throughout the design process; mainly in the earliest phases. Lopez-Ontiveros et al, (2006) determined; easy to disassemble, to clean, to control, to replace and assemble as a set of principles for the design of remanufacturable products.

Over the last few decades accelerating environmental concern which, in some countries, has already resulted in legislation, and financial interests in the reuse of products, parts or materials, have all contributed to reverse logistics recent popularity. In a broad sense, reverse logistics stands for all operations related to the re-use of products and materials. Reverse logistic activities include collection, disassembly and processing of used products, product parts and/or materials, in order to ensure a new use or an environmentally friendly recovery. From a scientific point of view, reverse logistics brings new elements in collection/distribution management, production planning/remanufacturing, and inventory control (Kokkinaki, Nunen & Pappis 2000:10)

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In this paper we give an overview of articles that describe the relationship between sustainable product design features, reverse logistics channel structure and remanufacturing activities. In this way we get a better insight into critical factors success factors for design for environment and reverse logistics of a remanufacturable product.

The remainder of the paper is organized as follows. First we introduce the topic of remanufacturing. Then we describe the methodology used for sustainable design. After that, we present the case studies and the models of reverse logistics for remanufacturing in the literature. We end with final remarks and research directions.

2. Remanufacturing

The remanufacturing industry is a large and economically important industry that includes many market sectors and provides significant societal and environmental benefits. The aim of remanufacturing is to reprocess used products in such a manner that the quality of the products is as good as or better than new in terms of appearance, reliability and performance (Gurler, 2007).

Remanufacturing is a process of bringing used products to "like-new" functional state with warranty to match. It recovers a substantial proportion of the resource incorporated in a used product in its first manufacture, at low additional cost, thus reducing the price of the resulting product. The key remanufacturing problem is the ambiguity in its definition leading to paucity of knowledge and research in the process.

In the remanufacturing industry, a large number of remanufactured products exist, in many different fields of activity. Some industrial fields such as those of cars and of heavy machinery are that already use remanufacturing successfully. However, the remanufacturing industry has enlarged to include other industrial fields, such as the field of computer materials or the field of more complex products such as copiers. This widening of remanufacturing also addresses some less complex products such as pallets or office furniture.

Remanufacturing does not necessarily mean reproduction of the original product. It affords the opportunity to upgrade its performance, e.g., by installing a faster CPU in a computer, by substituting an electronic for an electro-mechanical coin changer in a vending machine.

The remanufacturing process aims at extending the life of products by diverting products to a new second life instead of being buried. The economic interest comes from the fact that the added value due to the initial production of the product is preserved fully or partly. The environmental interest comes from the lower consumption compared to manufacturing a second new product, and the extended product life. The remanufacturing process is a process in which reasonably high volumes of similar products are collected to a central service place, disassembled and then treated to be reused. Therefore, by keeping the components, material extraction and energy consumption can be reduced. The remanufacturing process is generally composed of several stages: disassembly, testing, repair, cleaning, inspection, updating, component replacement and assembly which at each stage, specific measures guarantee quality control (Lopez-Ontiveros et al, 2006:2).

Table-1: Remanufacturing Process (Adopted from Parkinson and Thompson: 2003:252)

Disassembly	The requirement for remanufacturing disassembly is that it be non-destructive. The remanufacturers showed great ingenuity in developing processes for disassembling crimped and rivet fastenings in a manner that caused the least destruction to components. Disassembly equipment includes electric and pneumatic power tools and general workshop tools, especially hammers, mallets and drifts, wrenches, jigs and holding fixtures, bearing presses and drills
Cleaning	Effective cleaning requires that all contamination be removed and involves degreasing, derusting and the removal of surface coatings such as paint. Many methods are available such as cleaning in petrol, hot water jet or steam cleaning, chemical detergent spraying or chemical purifying baths, ultrasonic cleaning chambers, sand/bead blasting, steel brushing and baking ovens.
Inspection and sorting	As part of the remanufacturing processes, the components making up an assembly have to be sorted into their unique groups for further processing. Inspection is an important stage that seeks to assess the reusability of a part and whether it can be reconditioned. The first thing is to establish objective criteria to determine the condition of a component. Once these criteria are established, an effective means of assessing the criteria must be developed. If it is not possible to achieve this cost effectively, the criteria should be revisited. Visual inspection is widely used, along with non-destructive testing (NDT) techniques such as dye penetrant, magnetic particle, eddy current and ultrasonic methods
Reconditioning	Reconditioning processes include milling, turning, grinding, material deposition, heat treatment, welding, powder coating, chroming and spray painting. An example of this would be the regrinding of crankshafts and the fitment of oversize bearings
Reassembly	Reassembly usually takes place on small batch assembly lines, using the same power tools and fixtures that were employed for the assembly of the newly manufactured product. Because production runs are likely to be lower in remanufacturing, it will be harder to justify the use of automation, as the cost could not be amortized over as many products
Testing	Testing is likely to be similar to that used on newly manufactured products. Remanufacturers typically use 100 per cent inspection testing of finished goods, which may be higher than a new manufacturer who may sample a percentage of the products for testing

3. Sustainable Design

Design for Environment, DFE, also called "Green Design," "Environmentally Friendly Design" covers any design activity which aims at improving the environmental performance of a product. It addresses the problem at the design stage, where the potential for impact is the greatest. Tbe decisions made at the design stage effect all of the life pbases of the product - manufacturing, transportation, operation, maintenance and disposal (Hundal, 2000;1). A wide range of different products have been subject to DFE, and many industries bave developed their own schemes. Throughout the 1990'ies several publicly funded methodology projects had the aim of developing more generally applicable approaches to design for environment. The variety of available methods and tools ranges from general to specific tools, which focus on parts of the life cycle or on certain types of products or services.

An important DFE strategy aimed at minimizing end-of-life impacts is remanufacturing; products need to be designed to be viable for cost effective remanufacture, reuse and to reduce the amount of waste going to landfills. With the right remanufacturing process in place, remanufacturing can be profitable for mass produced products provided that sufficient quantities of mass produced products will be viable for remanufacturing (Franke, Basdere, Ciupek & Seliger, 2006). Obvious choices are automotive (Chen, 2005), wbite goods (Parkinson & Thompson, 2003) and electronics industries (Ferrer, 1997).

The overall picture of a product's life cycle and the materials flow associated with it are sbown in Figure 1. This figure also illustrates the three terms frequently used in DFE literature: reuse, remanufacturing and recycling. In the product's life cycle, the design stage is the most critical as far as many of the impacts on and of the product. The decisions on materials and manufacturing processes are made at this stage (Hundal, 2000,2). These decisions determine the total material flow, thus affecting both the upstream (pre-consumer) and the downstream (postconsumer) impacts.

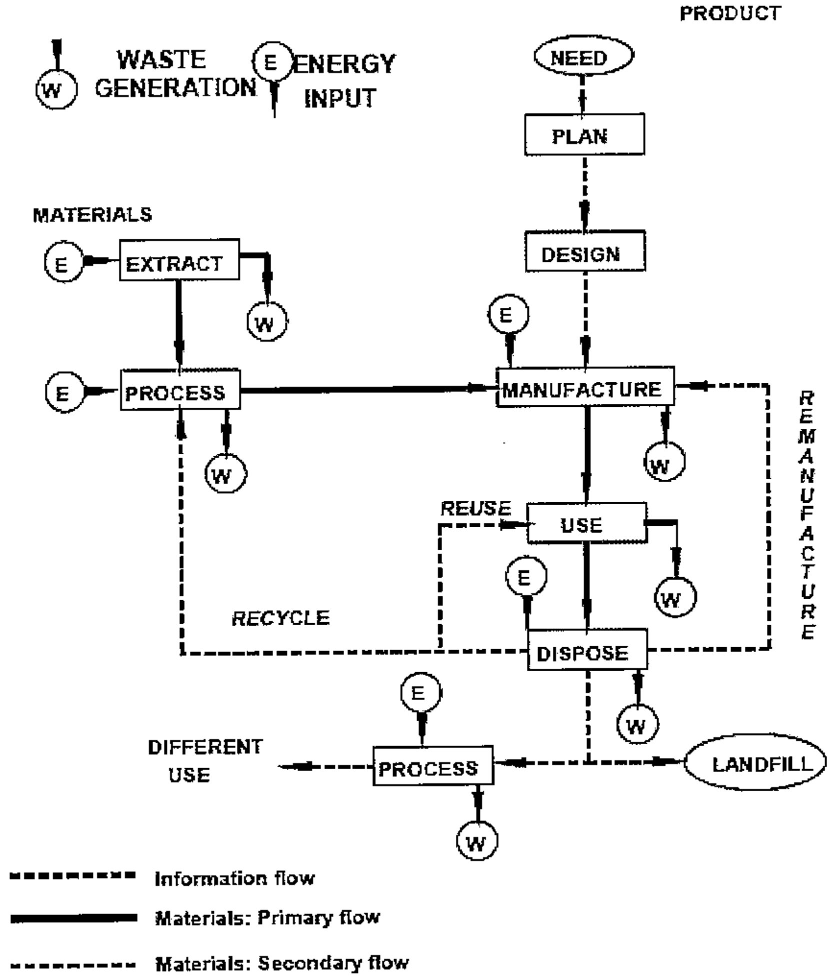

Figure 1. Product Life Cycle and Materials Flow (Hundal, 2000)

Lagerstedt (2003) suggests a set of DFE rules which nicely summarize the guidance given by the various DFE tools and methods which are available:

1. Do not use toxic substances, and use closed loops when possible.
2. Minimize energy and material consumption in production and transportation by striving for efficiencies.
3. Minimize energy and resource consumption in the use stage, especially for products with their most significant environmental aspects in the use stage.
4. Promote maintenance, especially for system dependent products.
5. Promote long life, especially for products with their most significant environmental impacts outside the use stage.
6. Use structural features and high quality materials, to minimize weight; these should not interfere with flexibility, impact strength or functional properties.
7. Use better materials, surface treatments or structural arrangements to protect products from dirt, corrosion and wear.
8. Arrange in advance for upgrading, repair and recycling, through good access, labeling, modules and breakpoints, and provide good manuals.
9. Promote upgrading, repair and recycle by using few, simple, recycled, unblended materials, and do not use alloys.
10. Use the minimum joining elements possible, using screws, adhesives, welding, snap fits, geometric locking, etc. according to Life Cycle guidelines.

We can summarize these recommendations to typical focus points for the development of environmentally benign products as following. They are right for many product developers, especially for mass produced products.

- Focus on the disposal of the products
- Focus on the use of certain materials in the product life cycle
- Focus on longer product life

The steps in remanufacturing are: Disassembly, Cleaning, Sorting, Checking, Reconditioning, and Reassembly. Design for remanufacturing involves rules to help in each of these stages. These rules are classified and summarized by Hundal (2000):

Design rules for disassembly are:

1. Arrange the sub-assemblies for easy disassembly.
2. Use joints which are easy to separate.
3. The joints should have the same life span as the whole product.

Design rules for the cleaning phase are:

1. Design of parts should provide for easily accessible re-entrant corners and cavities or avoid these altogether.
2. It should enable the rational design of the cleaning line.
3. Markings on parts should withstand cleaning.
4. Use of only environmentally friendly cleaning agents should be required.
5. Surfaces to be cleaned should be smooth and wear resistant.
6. All deposits, impurities and other materials should be removable without damage to parts.

Design rules for ease of sorting are:

1. Parts, particularly those similar-looking, should be identified for easy sorting and classification.
2. Parts which fulfill the same function should either be identical or be clearly identifiable as being different

Design rules for Checking

1. Wear and corrosion of parts should be easy to verify.
2. Data such as material properties, load limits, tolerances and adjustments should be available.

Design rules for Reconditioning

1. Shape of the parts should permit the use of jigs and fixtures for reconditioning, e.g., machining, material deposition, insert replacement.
2. Threaded bushings should be easily replaceable.

Design rules for Reassembly

1. The remanufacturing facility should have access to the knowledge of the assembly procedures of the original product.
2. Reassembly should be simple and unambiguous, and permit the use of mass production techniques.

4. Reverse Logistics

Logistics management is a complex task within both the modern manufacturing and construction industries. Effective logistics management implies a mastery of various key processes, including planning, implementing and controlling the efficient, effective flow and storage of goods, services and related information from the point of origin to the point of consumption in order to fulfill customer requirements. A truly effective logistics system involves the integration of information, transportation, inventory, warehousing, materials handling and packaging. Until recently, investment in logistics has focused mainly on the flows from companies to markets. This was simply satisfying demand via a distribution system without appreciating the effort, cost and resources required to operate that system.

Growing concerns for the environment and conserving resources has created new logistical approaches to more effectively manage the distribution function, and make better use of the resources available to an organization. One such approach is the concept of reverse logistics.

Reverse logistics has been defined by Stock (1998) as the role of logistics in product returns, source reduction, reuse of materials, materials substitution, waste disposal, refurbishing, repair and re-manufacturing. The concept is broad and encompasses a number of activities within logistics and other functions carried out within the supply chains. Reverse logistics may be applied to both the materials management part and the physical distribution part of the logistics chain and offers real environmental benefits (Kroon & Vrijens, 1995).

Reverse logistics uses various methods to give scope for a 'back-load' of finished products, components, waste, reusable packing, etc. from consumer to manufacturer. Back-loads "logistics against the flow" allow manufacturers to reduce costs by using the distribution vehicle's return journey to create income or added value. Often this is very simple; a distribution vehicle picks up pallets previously deposited at the warehouse where it makes its deliveries. The return trip adds value to the process by returning those pallets back to usable condition (i.e. back at their point of origin). This basic concept is now being developed to create novel solutions to the problems of reducing pollution, costs and vehicle movements, while maintaining high customer service levels.

The first stage in the reverse logistic process is collection, that is, all those activities that are necessary for reclaiming returned products, surplus or by-products and transporting them to a place, where they will be subjected to further examination and processing. Locating such products, purchasing, transporting them and storing them at a collection point, are all activities related to collection.

A major issue in collection is the encountered high uncertainty regarding the locations from where used products need to be collected, their quantity and timing. Tbese pose severe difficulties in planning and controlling collection processes. Furthermore, these uncertainty factors are detrimental to the integration of forward and reverse distribution networks, which is a very important issue if we consider that the additional transportation induced by return flows is a negative element in the overall ecological assessment of industrial re-use activities (Kokkinaki, Nunen & Pappis, 2000; 12).

Another major issue for products entering the reverse logistic chain is that of their quality. This issue is central at the stage of selection, where a decision must be reached as to whether a product (or parts of it) will be re-used, remanufactured, recycled or disposed. Physical inspection is necessary for determining further processing for most commercial products.

Figure 2 presents a graphical representation of the activities within a product recovery chain together with traditional supply chain activities. The recurrent reverse logistics activities include collection, inspection/separation, re-use, remanufacturing, recycling, redistribution and disposal.

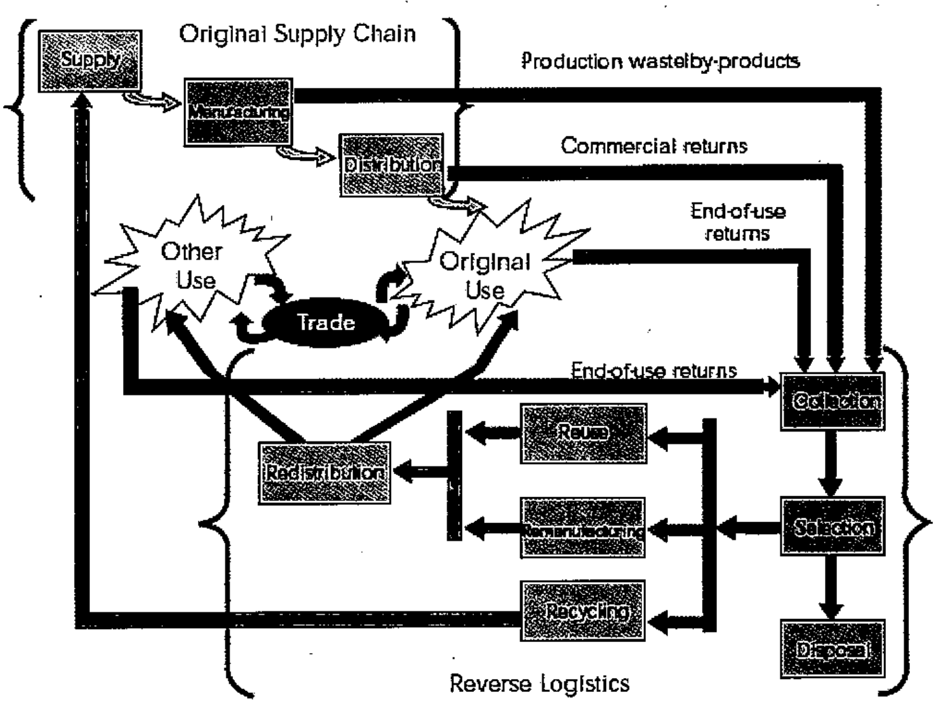

Figure 2: Product Flow in Supply Chain and Reverse Logistics (Kokkinaki, Nunen & Pappis, 2000; 11)

Supply, manufacturing, distribution and their cascading flows represent the traditional supply chain. From the reverse perspective, the flows for production waste and commercial returns are very important, because these two combined with the end-of-use return flow are all input flows in the recovery chain.

Brito and Dekker (2003) specified the return reasons of products in a reverse logistics which are organized according to case studies in literature as below:

1. Manufacturing returns, which embrace raw material surplus, quality-control returns, and production leftovers or by-products;
2. Distribution returns, which include product recalls, returns coming back due to commercial agreements (B2B commercial returns), internal stock adjustments and functional returns;
3. Customer returns, which comprise reimbursement guarantees, warranty returns, service returns, end-of-use and end-of-life returns

Reverse logistics creates value to the logistical process by returning products back to usable condition/position. It is applied in processes connected with recycling; reusing and reducing the amount of materials used. The most efficient reverse logistics solutions merge efficient forward and reverse flows into one process. Equipment, facilities and personnel can share both forward and reverse logistics activities resulting in synergy in terms of reduced costs and improved service levels. Due to shortening of economic life cycles, for products like consumer electronics, the recovery of value from these consumer goods, after use, is becoming a necessity.

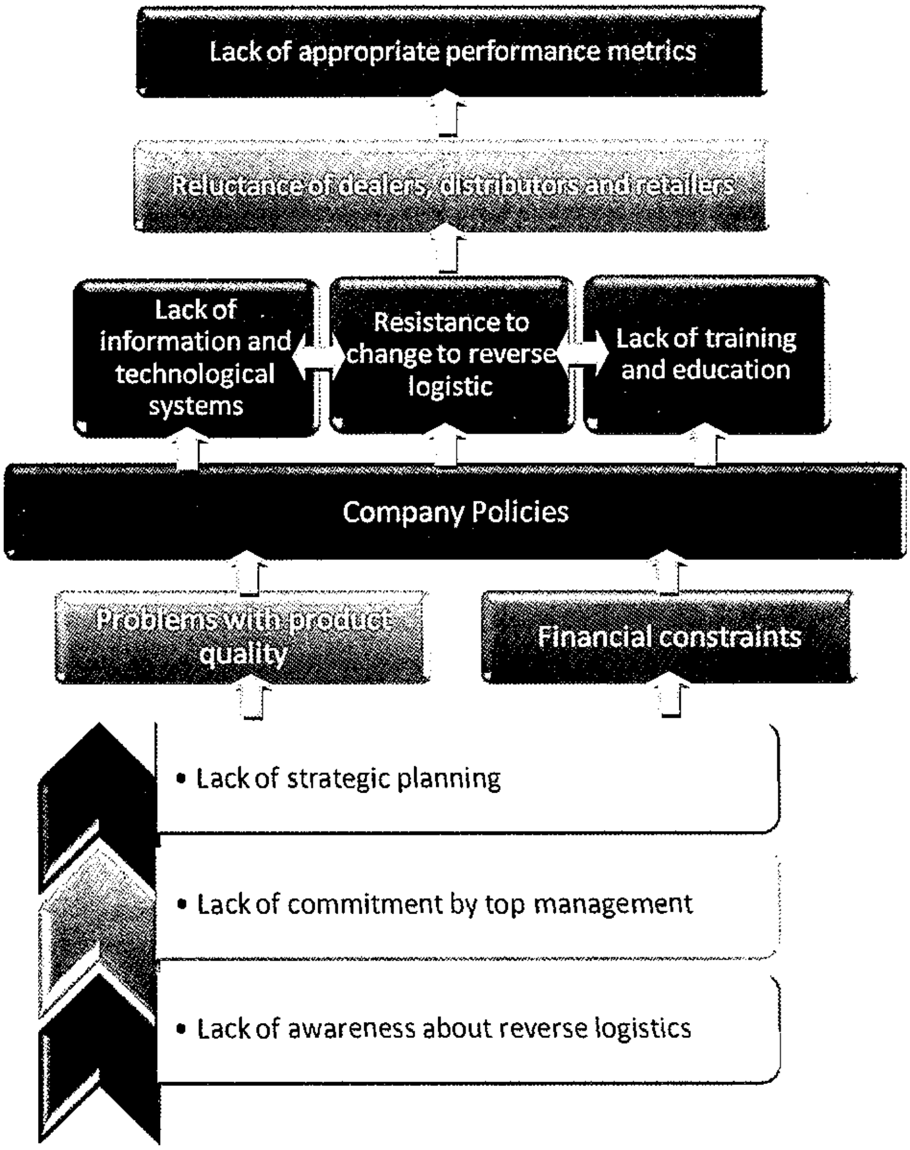

Figure 3: *ISM – Based Model For the Barriers of Reverse Logistics (Shankar & Ravi, 2005:1026)*

The deployment of reverse logistics is not free from barriers. Some of these barriers are lack of systems, management inattention, financial resources, personnel resources, lesser importance of reverse logistics relative to other issues, and company policies. The above-mentioned barriers not only affect the operations of reverse logistics but also influence one another (Shankar & Ravi, 2005:1012). Interpretive structural modeling (ISM) is used for identifying and summarizing relationships among specific variables by Shankar and Ravi (2005). According to this research barriers of reverse logistics defined as below and modeled as Figure 3.

Barriers of Reverse Logistic

- *Lack of infarmation and technological systems*: An efficient information and technological system is very necessary for supporting the reverse logistics during various stages of the product life cycle.
- *Problems with product quality*: The product quality is not uniform in reverse logistics compared to the forward logistics where the product quality is uniform. The returned product quality could be in any range; like that it could be faulty, damaged, or simply unwanted by the customer.
- *Company policies*: Restrictive company policies are an important barrier to the reverse logistics. Companies want to create a brand image to the customers. They do not want to compromise on the end-product quality by using the returned products.
- *Resistance to change to reverse logistics*: The lack of awareness of the benefits of the reverse logistics both from economic and environment angles could be a major factor for the resistance to change to reverse logistics. Reverse logistics systems initially involve high economic investment.
- *Lack of appropriate perfarmance metrics:* Successful reverse logistics programs will effectively coordinate all the processes, focus on recapturing value or proper disposal of products, create environmental friendly products, and create performance measurement systems that provide data as to whether the designed reverse logistics is performing up to the expectations.
- *Lack af training and education:* A significant barrier to good reverse logistics is lack of personnel resources. Lack of training and education is a major cballenge to commercial cycling.
- *Financial constraints*: Financial constraints are a key barrier to good reverse logistics programs. Cost considerations are a prime challenge in commercial recycling.
- *Lack of commitment by tap management*: Lack of commitment by top management is a chief barrier for successful reverse logistics. Efficient leadersbip is needed to provide clear vision and value to reverse logistics programs.
- *Lack af awareness abaut reverse lagistics:* A chief barrier of reverse logistics is lack of awareness about the benefits of reverse logistics. Even if companies knew about it, giving relative unimportance to reverse logistics was seen as the largest barrier to reverse logistics.
- *Lack of strategic planning*: For implementation of reverse logistics in any organization, the role of strategic planning is very important to achieve the goals for the survival of the organization in the global market.
- *Reluctance of the support of dealers, distributors, and retailers*: Another important barrier to the reverse logistics is tbe reluctance of the support of the dealers, distributors, and retailers towards the reverse logistics activities. A generous return policy leads to improved risk sharing between sellers and consumers.

Lack of the awareness of reverse logistics practices is a very significant barrier. From the ISM model, it is observed that strategic management issues like lack of awareness of reverse logistics and lack of commitment by top management are at the bottom level of the hierarchy implying higher driving power. Therefore, top management should focus on developing strategies to create awareness about the use of reverse logistics so that the benefits of it can be reaped. It is also observed from the ISM model that five barriers, namely, lack of awareness of reverse logistics, lack of commitment by the top management, problems with product quality, lack of strategic planning, and financial constraints have strong driver power and therefore, these are less dependent on the other barriers (Sbankar & Ravi, 2005:1027).

4.1 The Steps of Reverse Logistics

Collection, inspection/separation, reprocessing, disposal and re-distribution are the steps of the reverse logistics. Figure 4 gives a graphical representation of the activities within a product recovery chain together with traditional supply chain activities. We briefly describe each of these steps below (Fleischmann et al, 2000:657).

Collection refers to all activities rendering used products available and physically moving them to some point where further treatment is taken care of. In general, collection may include purchasing, transportation, and storage activities. It should be noted that collection may, to some extent, be imposed by legislation.

Inspection/Separation denotes all operations determining whether a given product is in fact re-usable and in which way. Thus, inspection and separation results in splitting the flow of used products according to distinct re-use (and disposal) options. Inspection and separation may encompass disassembly, shredding, testing, sorting, and storage steps.

Reprocessing means the actual transformation of a used product into a usable product again. This trans-formation may take different forms including recycling, repair, and remanufacturing In addition, activities such as cleaning, replacement, and re-assembly may be involved.

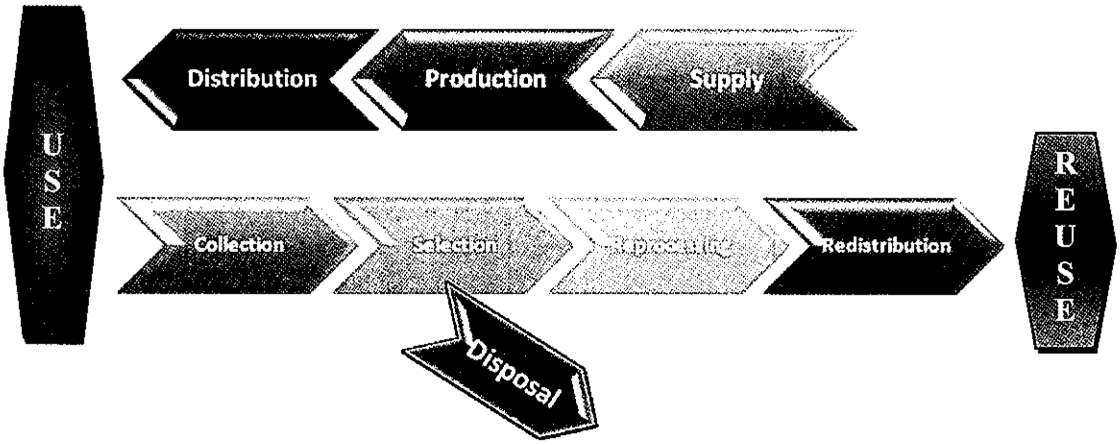

Figure 4: The Recovery Chain

Disposal is required for products that cannot be reused for technical or economical reasons. This applies, e.g. to products rejected at the separation level due to excessive repair requirements but also to products without satisfactory market potential, e.g. due to outdating. Disposal may include transportation, land filling, and incineration steps.

Redistribution refers to directing reusable products to a potential market and to physically moving them to future users. This may encompass sales (leasing, service contracts), transportation, and storage activities.

4.2 Reverse Logistics Design in Practice: A Review

Recently, a considerable number of case studies have been reported which address the design of logistics networks in a product recovery context.

Loosely related with a case study on the recovery of copy machines (Thierry et al, 1995), Thierry (1997) proposes a conceptual model for evaluating combined production/distribution and collection/recovery networks. The model addresses the situation of a manufacturing company collecting used products for recovery in addition to producing and distributing new products. Recovered products are assumed to be sold under the same conditions as new ones to satisfy a given market demand. The production/distribution network encompasses three levels, namely plants, warehouses, and markets. Products may be transported from plants to markets either directly or via a warehouse, yielding different transportation costs. Moreover, from each market a certain amount of used products needs to be collected. Subsequently, collected products are to be disassembled and tested on reusability, after which accepted products need to be repaired while rejected products are disposed of. These activities are carried out in the facilities of the 'forward' production/distribution network.

Jayaraman et al. (1999), analyse the logistics network of an electronic equipment remanufacturing company in the USA. The company's activities encompass collection of used products (cores) from customers, remanufacturing of collected cores, and distribution of remanufactured products. Customers delivering cores and demanding remanufactured products do not necessarily coincide. Moreover, core supply is limited. In this network the optimal number and locations of remanufacturing facilities and the number of cores collected are to be determined considering investment, transportation, processing, and storage costs.

Krikke et al. (1999) discuss the remanufacturing of photocopiers. The authors consider two options for the remanufacturing facility, one coinciding with the manufacturing facility and one in a cheap labor country. They evaluate the costs of both options, including the transportation effects.

5. Conclusion

The remanufacturing is an end-of-life strategy that reduces the use of raw materials and saves energy while preserving the value added during the design and manufacturing processes. It combines profitability and sustainable development benefits by reducing land filling, as well as the level of virgin material, energy and specialized labor used in production. The significance problem in remanufacturing is; remanufacturing processes generally adapted to existing products but these products have not been designed to be remanufacturable. However, the process adaptations increase costs and this can lead the overall benefits obtained with the remanufacturing process to be reconsidered.

The environmental interest comes from the lower consumption compared to manufacturing a second new product, and the extended product life. Environmental protection is a complex and controversial subject. The goal of engineering design has been and is still to design and produce products and systems to fulfill the needs of society. Engineers and designers need information to operate successfully.

An important DFE strategy aimed at minimizing end-of-life impacts is remanufacturing; products need to be designed to be viable for cost effective remanufacture, reuse and to reduce the amount of waste going to landfills. With the right remanufacturing process in place, remanufacturing can be profitable for mass produced products provided that sufficient quantities of mass produced products will be viable for remanufacturing. DFE by itself does not make products cheaper, nor more expensive. On the other hand the overall costs, when one considers the environmental impacts, can be lowered. Environmental attributes must be considered at all stages of the design, as are other attributes, e.g., cost, manufacturability, quality, etc. The application of DFE requires knowledge more than any other resource. Products designed for recyclability are more easily serviceable. Remanufactured products can be of as high quality as new products - and cheaper.

The interface between logistics and the environment is imbedded in the value adding functions a firm performs. Integrative environmental management means that every element in the corporate value chain is involved in minimization of the firm's total environmental impact from start to finish of the supply chain and from beginning to end of the product life cycle. Reverse logistics uses various methods to give scope for a 'back-load' of finished products, components, waste, reusable packing, etc. from consumer to manufacturer. Back-loads "logistics against the flow" allow manufacturers to reduce costs by using the distribution vehicle's return journey to create income or added value.

Supply uncertainty both in quantity and quality appears to be a major distinction between product recovery networks and traditional production-distribution networks. This may be a reason for a more complex network structure. Considering recovery situations in more detail, including product, supply chain, and resource aspects, we have seen that product recovery networks can be subdivided into a number of classes. Re-usable item networks, remanufacturing networks, and recycling networks appear each to have their own typical characteristics.

A major issue in the first stage of reverse logistic process which is named as collection is the encountered high uncertainty regarding the locations from where used products need to be collected, their quantity and timing. Another major issue for products entering the reverse logistic chain is that of their quality. This issue is central at the stage of selection, where a decision must be reached as to whether a product (or parts of it) will be re-used, remanufactured, recycled or disposed.

Remanufacturing with a suitable reverse logistics channel and sustainable design creates value to the firms by returning products back to usable condition/position. The integration of remanufacturing activities within sustainable product design and to the coordination of reverse logistics system will make production firms more profitable with new markets and low production costs while providing significant societal and environmental benefits.

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IKEA AND THE FLAT-PACK CONCEPT ON SCANDINAVIAN DESIGN TRACES

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Abstract

A design's packaging system and ease of transportation effect on price, best practice is demonstrated by a global brand-IKEA. Ikea's manner of transport and manner of design reveals the flat-pack system. Ikea and the 'flat – pack' concept is based on transportation of large amount of products with a minimum volume to ensure the yield of cost reduction. As we consider the logistics involves the integration of information, transportation, inventory, warehousing, material handling, and packaging, the logistics effect on design factors can not be disregarded. The logistics importance on design will be introduced with the case of Ikea and will focus on the flat-pack concept with the possibilities and the frontiers. The aim of the paper is to demonstrate and to discuss the revolutionary example of integration of design, logistics, branding and retail with the flat-pack concept of Ikea.

Keywords: Flat-pack, Ikea, logistics, design, Scandinavian design.

1. Introduction

In the development process of a product, the packaging and the manner of delivery is no longer disregarded from the form and the function of the product. The way of assembly, packaging, storage and transportation are some of the factors that affect the form of the product itself and the whole design process. These factors all together constitute the chain structure beginning from determination on the price of the product. The purpose of the paper is to emphasize the importance of packaging and logistics in design process through corporate values. A product's design influences production, packaging, storage and distribution and this result may reduce costs, increase profits and improve the business volume. Price/cost oriented design brief and design criteria are a radical but effective approach to maintain a concept as Ikea's. The case study of Ikea is chosen in this paper to demonstrate the design manner, the packaging system and retail structure with the logistics performance as the pioneer of a concept that also is a part of grand design geography: Scandinavia.

2. IKEA Overview

2.1. History

Ingvard Kamprad is the founder of IKEA. The commercial career and the success story of entrepreneur Kamprad starts witb selling catalog products such as; fish to seeds, then products range from pens to furniture. The name is simply derived by bimself from the initials of his name and surname; Ingvard Kamprad, and the name of the farm he grew up and his home town; Elmtaryd and Agunnaryd in South Sweden.[3] During the late 1940s, the cost of furniture had risen at higher rate than the other prices of other household items, despite no apparent shortage of labor or raw materials, largely due to a tightly controlled industry by manufacturers and retailers. These high prices prevent a majority of the population from purchasing quality furniture. In this, Kampard recognized a business opportunity that would also benefit a large segment of society. So he modeled Ikea on the concept of offering a wide range of well-designed, functional home furnishing products at prices that most households can afford (Aridi, Craypo, Konzelmann, and others, 2005). In 1958 opens the biggest furniture retail store in Sweden. The first store out of Sweden opens in 1963 and first out of Scandinavia opens in Switzerland in 1973.

Today Ikea has left 65 years after its foundation as the world's widespread and largest company of designing, producing and selling furniture, bathrooms, kitchens and household accessories. Ikea's objective is to offer a wide range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them. It's able to do so by following a global strategy of cost leadership, supplier costs are reduced through long product runs and volume production (Arnold, 2002).

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[3] Our History. http://www.ikea-group.ikea.com/?ID=43

2.2. Facts and Figures

After its establishment in 1943, today The IKEA Group is owned by Stichting INGKA Foundation, tax-exempt, non-profit-making legal entity based in the Netherlands. Since 1986 the founder Ingvar Kamprad remains as the Senior Advisor of the INGKA Holding B.V. the parent company for all Ikea Group companies.[1]

The product range comprises 9,500 products that are the same in all Ikea stores. Ikea Group sales for the financial year 2007 totaled 19.8 billion Euros. The group has 231 stores in 24 countries, 45 trading services offices in 31 countries, together with 31 distribution centers and 11 customer distribution centers in 16 countries, 29 of the stores are owned and run by franchisees outside the Ikea Group. Ikea sales by region are Europe 82%, North America 15%, Asia and Australia 3%. Top five sales countries; Germany 16%, USA 10%, France 9%, UK 9% and Sweden 7%.

Ikea works with 1,350 suppliers in 50 countries. By region, purchasing is mainly made from Europe by 64%, then Asia by 33%, North America by 3%. Top five purchasing countries are China 22%, Poland 16%, Italy 8%, Sweden 6% and Germany 6%.

As Kamprad starts the business with catalog sales, still today the Ikea catalog is a crucial media for promotion and consumer loyalty. By 2007, Ikea catalogue is printed in over 191 million copies in 27 languages and 56 editions.

2.3. The Organization

Ikea has a corporate structure which is based on a franchise system. The franchisor is the Inter Ikea which owns the trademark and copyright. Development, purchasing, distribution and selling of Ikea products are done by Ikea group. Ikea has a global sourcing policy of its products; works with 1350 suppliers in 50 countries. Most of the production takes place in lower- cost countries with 22 percent being manufactured in China and 16 percent in Poland. Six percent of Ikea's products are manufactured in Sweden, with Germany and Italy accounting for further 14 percent and the remaining 48 percent of production distributed around the world. Ikea maintains a long-term relationship with its suppliers and stake holders and this obtains effectiveness in productive system and the lower the manufacturing costs.

Ikea's concept core is the store system. In the Ikea stores a large part is set for the furniture showroom where the customers view the products. This part is designed as room settings; living rooms, bedrooms, dining rooms, bathrooms and kitchens. Furniture, smaller items and accessories are displayed in a separate section. Another section of the store is the part where the products are stacked on shelves in flat-packs. In this market hall the customers make their purchases and assemble the products at home.

Ikea stores have been ornamented with a standard system. One of the most important part of the Ikea concept is the standardized store design and the display areas for the communication of the context and

of the products. The object combinations in series are presented as new ideas for alternative way of organizing the home. The concept is specified store architecture more precisely, defining the classic Ikea traffic flow that took customers through the store in a four-leafed clover pattern that maximized their exposure to the product line (Bartlett and Quelch, 1992). The corporate identity is reinforced through services and facilities. As Bartlett and Quelch (1992) quotes one of the headquarters executive: "We want to create a unique ambiance that makes Ikea not just a furniture store but a family outing destination that can compete with the entertainment park and the zoo for the family."

Ikea has three innovative principles in furniture retail category: self-service with appealing and informative catalogues, disassembled furniture that is re-assembled by the customers and a cash-n-carry concept for suburban stores (Arnold, 2002). Ikea's success in advertisements is another key factor of the innovative approach. Ikea catalogue is the platform where Ikea customers first meet the new product series.

The retail space and design incorporates an experience of the concept within the Scandinavian background. The Swedish dimension is carefully evoked in Ikea's stores and offices located outside Sweden, through photographs representing landscapes and towns, also in the restaurants of the group offering traditional Swedish food and a typically Swedish style of management. Therefore, stores become genuine "cultural incubators" (Rixen, 2005).

2.4. The Philosophy and the culture

Ikea is a prosperous sample of Scandinavian design and also representative of their Swedish roots. Aside being a part of the Scandinavian design, Ikea also highlights 'Swedishness' as own country image through most of the product ranges. Scandinavian design and quality states expressly the philosophy of Ikea. Ikea propounds a simple philosophy: 'We do our bit, you do your bit, and together we save money.' They define their 'bit' as design for low-cost production, bulk-buying and flat-packing, all of which provides 'beautiful, functional products at a very affordable price'. The customers 'bit' is self-service, home transport and self-assembly, which saves Ikea considerable costs and allows the company to charge prices significantly lower than its competitors (Kippenberger, 1997).

Ikea's growth and expansion over 65 years through a series of values, presents a sustainable system with a unique philosophy, organization and management. This phenomenon has been a case-study ever since the expansion

[1] About the IKEA Group. http://www.ikea-group.ikea.com/index.php?ID=25

seemed continuous. The values of the overall concept show interdependent characteristic. Rixen (2005) cites tbe nine key messages distributed by Ikea to build relations with its customers. These nine key messages can also be accepted as the concept values overall:

"Ikea Concept"
Based on the expression "we do our job" used in the marketing positioning, this messages relates to Ikea's commitment to produce value for its consumers through design activities and intelligent solutions; also by minimizing costs at the different levels of the value chain, the purpose being to offer low prices.
"Ikea Mix"
It must be sufficiently wide and diversified to include attractive products for everyone and cover all the functions expected from interior furniture.
"Furniture Expert"
Ikea's products are functional and attractive and enable the majority to improve their domestic life through the offering of practical solutions to daily problems.
"Low Prices"
Central message: a low price is not attractive of it does no reflect a fair quality/cost ratio. Here, Ikea claims to make the difference through transport costs reduction and long term relations established with its suppliers in order to simultaneously reach its objectives of quality and low costs.
"The Function"
Ikea's products are based on a functional approach to design. This vision is reflected by attractive, practical and customer - friendly products. They provide simple, functional and original solutions to satisfy consumer' needs.
"Fair Quality"
The quality of a product is directly related to its possible use. Ikea's products are in accordance with national and international safety standards and undergo quality tests.
"Pleasant shopping"
Ikea stores provide everything under the same roof and in general products are immediately available. Ikea offers services corresponding to its clients' needs; but enables them to decide and act as they wish.
"An excursion for the whole family"
Ikea seeks to talk care of its customers by planning their needs. Ikea encourages its clients to touch, feel and use the products it offers. New products are incoming all the time; special themes and seasonal events are organized.
Ikea systematically uses playgrounds for children and provides family restaurants.
"Ikea and Sweden"
Ikea's key messages find their origin in Sweden. Swedisb furniture articles are ligbt, refreshing and simple. Tbe Swedish style – particularly friendly and welcoming – has become a model of simplicity, functionality and conviviality that is known all over the world (Rixen, 2005).

3. Scandinavian Geography and Design

It is very difficult not to consider the bare relationship between geography and design. History and the tradition of Scandinavian design stands right at this conjunction. The nature of the Scandinavian Peninsula located on the very northern point of the European continent shapes the Scandinavian way of living; socially, economically and culturally (Erdem, 2002). The rough climate, long winters and dark skies gives emphasis on 'the home'. The introverted way of living focuses on the home as arcbitecture, space and emphasis the 'objects of the home'. The characteristics of the northern prospect is based on the use of natural materials to build own homes, boats and furniture, where we also find functionality, crafts, beauty and socially idealized identity of the modern era. The Scandinavian view of design has been characterized by generations of farm workers and fisherman who constructed their own buildings, boats and furniture from materials tbat were close at hand (Sommar, 2003). Simple, economic, useful design culture is nurtured by this socio-cultural, socio-economic Nordic heritage.

Scandinavian social and political dynamics dominated design characteristics of the geograpby: democratic values in design. Design for the working class dominated Swedish design philosophy from as early as 1909 when the Swedish Society for Industrial Design drew attention to the problems of urbanization and limited dwelling space. In 1917 the Swedish Society for Industrial Design included twenty-three interior design settings aimed at the average working class family, stressing the importance of integration social and democratic values to create objects not only aesthetically meaningful but available to a non-elite market. Their philosophy of cbeap functionalism or beautiful things for everyday use gave Sweden its own unique proportion for both home and export markets (cit. Howe, 1999:100). Scandinavian design culture becomes prominent as a style mid-twentieth century mainly in architecture, interiors, furniture, and home-ware as glassware, ceramics and textile. Names as Alvar Aalto, Arne Jacobsen, Bruno Mathsson are considered as the modernist design pioneers among the international contemporariers. Basic concept and philosophy "Design for all" captures all social classes as well as the young and the elderly reflected on all mass-produced goods, which forms the characteristics of Scandinavian design today.

"To understand the durable simplicity that has developed in the north-characterized by clean lines, practicality, craftsmanship and democratic ideals- you have to go back many centuries to the peasant societies that originally dominated the region and which made a powerful contribution in shaping the culture of the Nordic countries (Sommar, 2003)."

The bases of the Scandinavian design culture can easily be traced through the Ikea concept and the whole of the product ranges. Not only the principles but several common threads that ran through Scandinavian furniture in the middle of the 20th century, like use of natural materials, particularly pale northern woods and other natural materials, in seating especially (Howe, 1999).

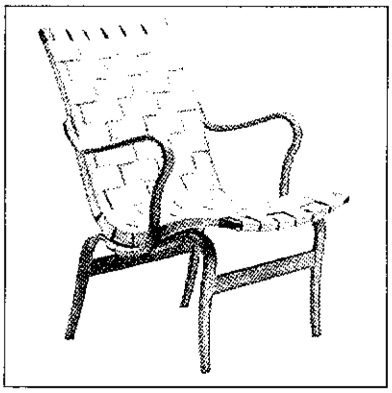


Figure 5. **Eva Chair. Bruno Mathsson, 1933.**

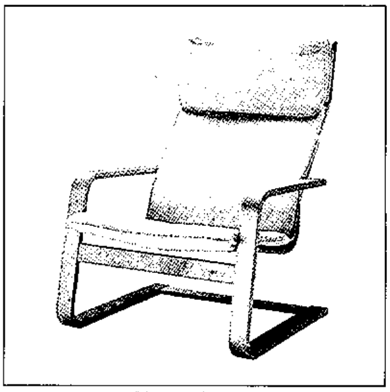


Figure 2. **Poäng. Ikea**

"If Ikea is today a company that may be qualified as a "European organization" due to its complex structure, its deep Swedish roots are nevertheless "a key element of its trade-mark". Everywhere Ikea settles "...it is the Swedish side that is pushed forward. Here we find the exact opposite of what multinational companies (often US firms) are trying to do: to create a brand disconnected from its country of origin. However, Ikea's products are global, which enables to squeeze costs, but they are not presented in an aggressive way" (Rixen, 2005)."

3.1. Democratic Design

"Good design for everyone.", "Design for all.", both mottos refer to the relation of democracy with design. Democratic values in design are portrayed basically through good design and economical accessibility. The issue has three dimensions: form, functionality and low price. Although affordability is the main focus, the issue implies other aspects: aesthetics and function. The Scandinavian iconic values on aesthetics are barely the modernist era's values as stated "less is more". The approach sets various values for the product development stages: the position of the product designer for the company and the role of the designer for production as well as innovative thinking within the constraints to be able to reach majority of the users. These values are strongly presented in all ranges of Ikea products. Kamprad's idea to offer good design at affordable price is a 'democratic idea' that had originated from Ikea's roots in the poor farming communities of the County of Smaland in Sweden (Edvarsson, Enquist, 2006). Ikea is a product of the Swedish variety of capitalism, with its strong tradition, ideology and social democracy, distributional equity and corporate and personal social responsibility (Aridi, Craypo, Konzelmann, and others, 2005). The imposition of the modern Scandinavian aesthetic values upon global values appears to be a phenomenon in the local-global value axis.

"... Good form, good function, and all at affordable prices. Design can be part of everyday life, in every home. At Ikea we call it Democratic Design...Democratic Design is all about making well designed functional furniture that everyone can afford."[1]

4. The Product Development and Design Process at Ikea

The product design and development process of Ikea is done in-house. Ikea's approach for successfully delivering good quality products at low prices for customers, begins at the development stage, where before the product is designed, its price is set at a level that provides high value at an affordable price. Ikea then looks for innovative ways of creating the product, at a cost below the established price (Aridi, Craypo, Konzelmann, and others, 2005). The designers work with the production staff for innovativeness to constitute the form, functionality and low price of the design. Simplicity is one of the key factors in Ikea design which yields ease in manufacturing, distribution and in use. A product's design gains importance at that point; the product's design effect the assembly

[1] IKEA Catalogue 2000, UK.

process, ease in packaging, occupied space of the package, storage and transportation. All together these factors draw a conclusion in the determination of the price. While designs are created around the world, all have to be agreed at Ikea's central product development centre at Almhult to ensure that they meet Swedish design standards (Kippenberger, 1997).

Within the product development stages, usually a product designer is contacted, who gives the product developer a product design suggestion: the design briefing. The designer has to consider whether the product is to be disassembled or stackable. During the product development process it is decided how the product is to be sold in stores (in a multipack in half-pallet or on a pallet on a warehouse storage rack), in what quantities, what material to use and the potential supplying regions (Klevas, 2004). Fig.3 shows the dynamic role of packaging within the product development process's stages. The product development team consists of a product developer, purchasing strategist, packaging technician. The involvement of the packaging issues in the early stages of the whole process can be considered as the characteristics of the Ikea production system.

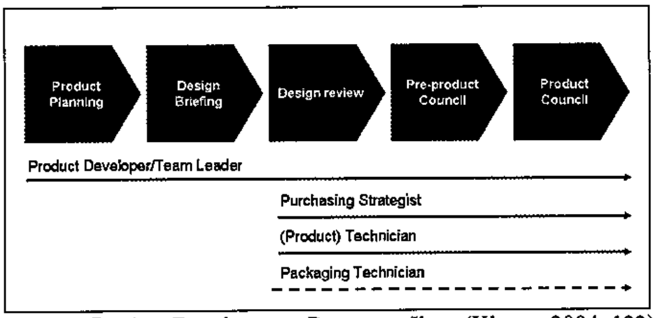


Figure 3. Product Development Process at Ikea. (Klevas, 2004: 122)

The design brief is the first step of a classical product development process where logistics, transportation issues are a part of the distribution stage. For the case Ikea the structure of the process is different. Ikea's product development process integrates the logistics and transportation issues within the concept development and design stage (Figure 4.).

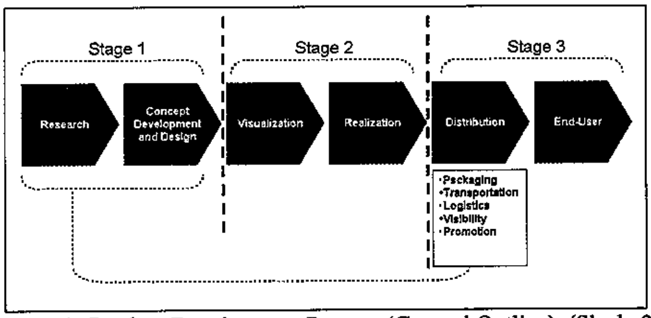


Figure 4. Product Development Process (General Outline), (Slack, 2006)

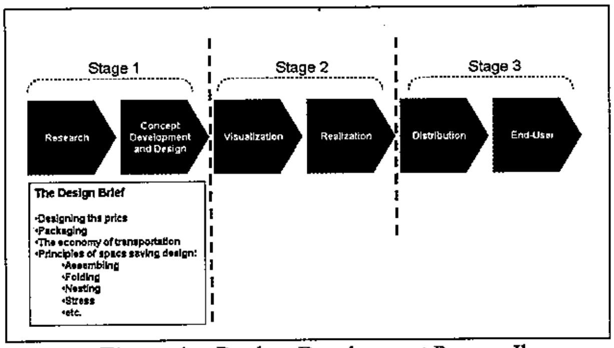


Figure 4a. Product Development Process Ikea

The core concept of reducing transportation cost for affordability portrays a different scheme for the product development process. The focus on cost reduction draws the logistics issues to the early stages of the process as seen in Figure 4a. Design briefing includes issues such as economy of transportation, packaging and numerous principles of space saving design which can be traced easily on the product lines of Ikea.

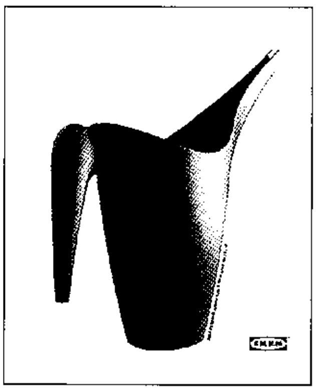
4.1 The Design Brief: Designing the price

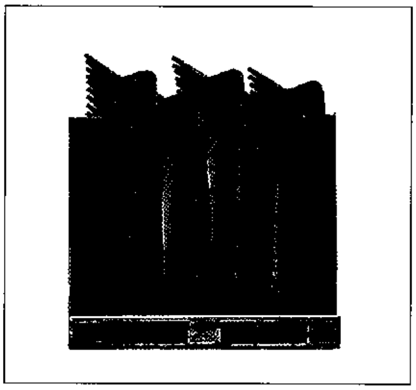
From designer's side concept development is an implementing issue for creativity. Ikea design team designers are never among the contemporary star-designers. But as the design values are driven by the design team to underline the design values, product designers are often referred in communication media. Most of Ikea products are more famous than their designers. Some iconic bestsellers are often related with (the image of) their designer. Despite Ikea's Scandinavian heritage, the design team is global: the 16-member, in-house group hails from eight different countries, while the satellite team of seventy freelancers comes from around the world.[1]

Figure 5. Ikea Catalog 2008, US.
Some iconic bestsellers and their designers shown.

One of the prominent names out of the design team is Monica Mulger. She is the creator of the most iconic product of the PS series: Vållö watering can. The cost oriented design brief doesn't lead always designers to come up with 'do it yourself' genre products, space saving methods and principles may vary as seen in Vållö case. 'Nesting' is the principle referred space saving principle for this item to become stackable, which costs 1,99$ in the US market.[2] The design brief, constraints and the approach to a concept/idea generation/sketch/prototype process is portrayed by the designer herself: [3]

> "...the philosophy behind Ikea, designing within constraints and the cost of transporting air. When it comes to designing new articles it is good to have some borders and frames otherwise you can do anything and it's too big to come to good ideas. These boundaries help me to focus and to be creative, because if you have to do a flower pot with the idea that we are not allowed to transport air :" that is a sort of taboo at Ikea, because transporting air costs money : I have to come up with a concept where I can do something with the inside of the pot.
>
> ...Vållö is an example of an item that I came up with out of my own initiative, because we weren't asked for a watering can.
>
> ...What was important to me was that, yes you can make a can stackable and that is really good for Ikea because it can be made for a low price and it is good for the customer because they can buy it cheap, but then when the customer has the can at home, it's not interesting for them that it is stackable. They shouldn't look at the can and think, 'Oh, it has that ugly shape because it has to be stackable."





[1] How IKEA, MoMA Connect With Design Talent. http://www.metropolismag.com/cda/story.php?artid=1391
[2] http://www.ikea.com/ms/en_US/rooms_ideas/democratic_design/CollectedPage.html
[3] Dialogue with IKEA's Monika Mulder; http://www.polaine.com/playpen/2008/02/04/from-the-archives-dialogue-with-ikeas-monika-mulder/

Figure 6. Vållö watering can. Designed by Monika Mulder.

5. Logistics: Interaction with Product and Packaging

Product design, packaging and logistics activities are generally accepted as apart and independent operations but in fact they are considerably related with each other. A product's design feasibility of assembling, folding, nesting, etc. ways affects the packaging of the product. Minimizing the dimension, the weight of the product and the packaging has a profound affect on the transportation and the logistics activities which helps avoiding shipping air. Flat-pack is a way of analyzing the problem of sbipping air. This packaging system is a method of approach which leads to cost reduction therefore the economy in packaging becomes a key to control logistics cost and ease in transportation.

Logistics has usually been defined in terms such as 'the art of managing the flow of materials from source to user' (Magee, Copacino, Rosenfield, 1985). Tberefore logistics also involve packaging as well as transportation, warehousing and material handling. Ikea has a proprietary logistical system- reputed to be one of the most sophisticated in the world- for managing this flow of components into the warehouses and transport of flat-packs to its stores (Kippenberger, 1997).

Logistics is a part of the 4P in Marketing; Product, Place, Price and Promotion. The 'Place' component ensures the product is at the right place, at the right time, in the rigbt quantity and the right quality. It's the point where the logistics activity meets with the product. The product design has a profound affect on packaging which affects distribution and storage. These chain activities all have a strong link with the logistics. Tbe flat-pack concept of lkea is based on this approach, because nearly all logistics activities are affected by packaging utilities (Bowerbox, 1999) and effective distribution. The logistics approach and the packaging concept of Ikea is based on the democratic design pbilosophy. Keeping down the cost for the formation of low price, form, functionality and good design criteria of Ikea is directly associated with the packaging concept and the transportation method.

Distribution is another key area of system efficiency for Ikea, which plays an important role in the ability to deliver low price. ln this, lkea has strategically established 27 distribution centers in 16 countries to ensure that the route from supplier to customer is as direct, cost–effective and environmentally-friendly as possible (Aridi, Craypo, Konzelmann, and others, 2005).

5.1. Packaging Concept: the flat-pack

Ikea's most of the products come out from the factory with a flat-pack and sold in the store in the same way. Most furniture is sold in flat-pack form so as to avoid transporting and selling air (Warnaby, 1999). The flat-pack provides the transportation of large amounts of products with minimum volume, reduces the damage during the transportation process and this brings out the cost reduction. Packing the disassembled items in boxes that facilitate shipping, storage and handling reduces distribution costs (Arnold, 2002). To implement the flat-pack concept a team of lkea specially designs the furniture and every part of the furniture is produced in specialized factories. Since different parts for a single item may be made in three or four different countries (for instance chair backs from Czech Republic, chair legs from France, screws from Spain), it is at these giant warehouses that the streams of the components are brought together and integrated into individual product packs for self – assembly by the customer (Kippenberger, 1997).

lkea after being founded in 1943, in 1947 a mail order catalogue was introduced, and in 1950 furniture and home furnishings were introduced to the mail order range. (Warnaby, 1999) ln 1951, furniture took place in Ikea catalogue and in that period the lkea we know today was revealed. Gillis Lundgren (born 1929) is barely the inventor of the flat-pack. The technical background of imaginative Gillis brings the revolutionary distribution system. The parcel is flattened simply by pulling off the legs of a table and placing them under the table-top. Gillis meets Kamprad in 1953 and being the founder of the flat-pack becomes the no-name designer of numerous pieces, furniture and other items including best sellers as BILLY and the armchair MILA (Torekull, 1998). After 1956 the concept is systemized and a broad product range also brought different solutions to packaging problems.

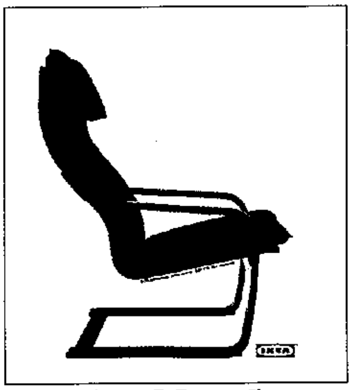


Figure 7. Poäng. Ikea.

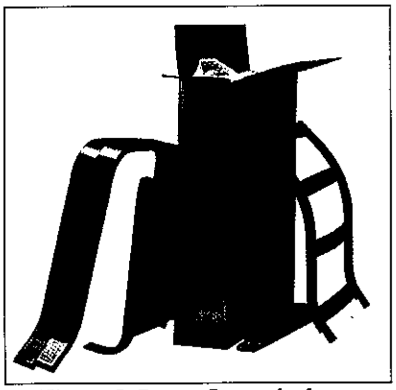


Figure 8. Poäng flat-packed.

As for Klevas, (2004), Ikea had three phases of packaging organization since it was established. The first period of packaging organization is before 1985. As a result of product damage during distribution an attempt was made to standardize packaging. The disassembling of the furniture for obtaining efficient distribution attempt made a way for distribution the products on euro pallets by 1977. This attempt also affected the design; the product development team adapted the products to the size of the pallet. The second period starts from 1980's; as a result of Ikea's expansion, the packaging technicians' closeness to the products during the development process became a necessity. Because of Ikea's growth and the increase in volumes, more efficient manufacturing and packaging solutions were needed (Klevas, 2004). As for today Ikea's current packaging concept was formed in 1999. The packaging concept is the packaging technician's involvement in the product development process with a close connection to Distribution Services. The packaging Concept's main task is to create the overall packaging concept at Ikea (Klevas, 2004).

Conclusion

The success story, the innovative approach of Kamprad as an entrepreneur model, reflects the corporate values that the brand conveys. The entrepreneurship of Kamprad is the core driving force for the creation of the concept with strong bonds to his Scandinavian origins. The whole system of values and operations based on Kamprad's vision keeps Ikea concept alive and developed for over 50 years. The emphasis on the 'home', the beauty of the home yet functional and affordable, gets rooted in the Scandinavian traditions. Ikea values can be categorized in following general aspects: social, economic, environmental. Within the sub categories of the overall values such as: the home, democratic design, designing the price, Scandinavia and Sweden, Ikea as a retail brand results in the international 100 Top Brands ranking.[1] Scandinavian social and political dynamics dominated design characteristics of the geography in general as well as the Ikea design philosophy: democratic values in design. The retail brand value today bears very much the country of origin upon brand identity. At this point Ikea as a pioneer concept and a unique example is the most referred corporate organization. A product's design can influence production, packaging, storing and distribution and all of these factors can provide lower the costs and higher profit margins. The accessibility is constructed through systems of logistics. During the product development process the reflection of the logistics strategy is a part of the Ikea philosophy which makes the concept unique within the product-logistics-packaging framework. The integration of logistics and the packaging concept in the design process creates this uniqueness and demonstrates Ikea as a case. Figure 9. aims to portray the integrated values of Ikea with emphasis on the socio- cultural background of the Scandinavian geography.

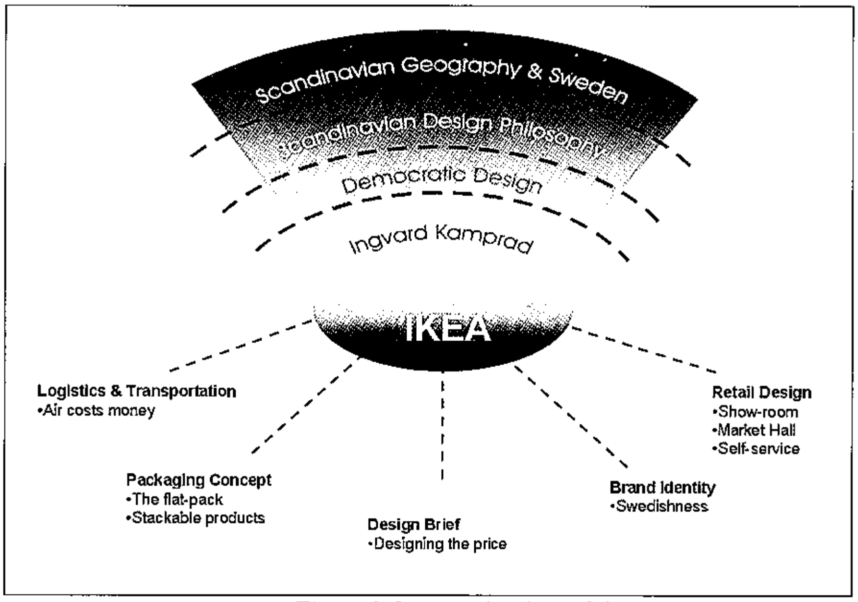


Figure 9. Integrated Values of Ikea

[1] According to the 100 Top Brands ranking research by Interbrand in 2006, Ikea has the 41th position with a brand value of $8,763 million. In 2007 the brand value rises to $10,087 million, the ranking position climbing to 38 th and according to the retail performance of the European Brands Ikea results in the 5th place.

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PLM IN RELATION TO SCM AND CRM, FOR INTEGRATING MANUFACTURING WITH SUSTAINABLE INDUSTRIAL DESIGN

Vasile Merticaru jr.[1], Gavril Musca[2], and Eugen Axinte[3]

Abstract

At the present time, in the frame of Computer Integrated Enterprise (CIE), the Sustainable Industrial Design must be considered in relation with Life Cycle Analysis (LCA) and with the Extended Producer Responsibility. The concepts of Reducing, Reusing, Recycling and Recovery of material resources are also very important in providing Sustainable Industrial Design. At the same time, the analysts, IT specialists and IT solutions vendors outstand a lean strategic vision upon the discrete manufacturing, considering that Product Lifecycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM) and Enterprise Resources Planning (ERP) are the four sustaining pillars for the discrete manufacturing in the user company. However, there still exists considerable confusion among the specialists from enterprises as IT users, concerning the usefulness of the related software applications. These generate significant doubts as to whether or not PLM in particular will be an application able to solve their own problems. The present paper comes to emphasize a vision upon PLM in relation to SCM and CRM, for integrating manufacturing with Sustainable Industrial Design.

Keywords: PLM, SCM, CRM, CIM, CIE, sustainable industrial design, LCA

1. Introduction

As it is well known, the concept of "sustainability" literally means the ability to maintain oneself over time. Just since 1987, The World Commission on Environment and Development proposed a definition of "Sustainable Development" as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Strong, 1992). In the conditions of this definition, a sustainable future development must be established basing on three pillars, as it is shown in Figure 1, respectively: ecological health, economic vitality, and social equity.

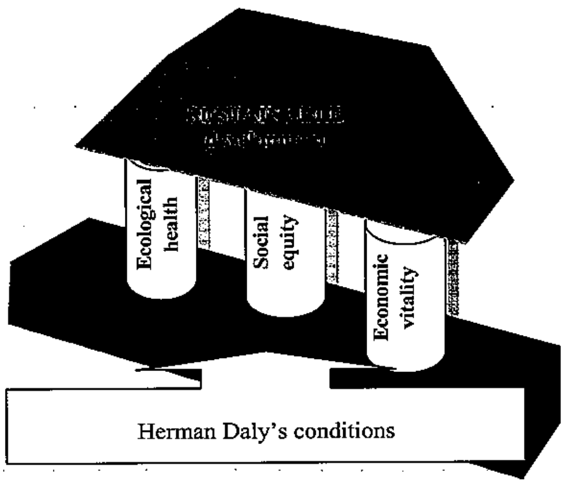

Figure 1. Basement of the sustainable development

Also as it is shown in Figure 1, in the basement of the sustainable development for a society, the Herman Daly's three conditions must be included (Strong, 1992), respectively:

- The rate of pollution emission must not exceed the assimilative capacity of the natural environment;

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- The rates of use of renewable resources must not exceed the rates of their regeneration;
- The rates of use of nonrenewable resources must not exceed the rate at which some sustainable renewable substitutes are developed.

The continue renewing technologies and especially IT have brought radical changes in the global visions and ways of thinking about products, manufacturing systems and processes, business environment and of course about our living environment. Since the Sustainable Development has become more and more a global challenge and goal, from the industrial point of view it is largely accepted that for accomplishing this crucial goal, there must be started with sustainable manufacturing. This determines more and more industrials to adapt their activities to integrated engineering and integrated manufacturing (Usher et al., 2005).

At the present time, a lot of TLAs, defining concepts and IT systems, are acting in the wide frame of the integrated engineering. Under these conditions, there still exists considerable confusion among the specialists from research centers and from enterprises, as IT users, concerning the meaning of the above mentioned terms and concerning the usefulness of the related software applications. Further on, in the present paper, the following notations are used in relation to the corresponding concepts: CAD - Computer Aided Design; CAE - Mechanical Computer Aided Engineering; CAM - Computer Aided Manufacturing; CAPE - Computer Aided Production Engineering; CIE - Computer Integrated Enterprise; CII - Computer Integrated Industry; CIM - Computer Integrated Manufacturing; cPD - Collaborative Product Development; CRM - Customer Relationship Management; CSM - Component Supplier Management; DMU - Digital Mock Up; DRP - Distribution Resources Planning; EDA - Electronic Design Automation; ESML - Embedded System Lifecycle Management; ERP - Enterprise Resources Planning; IT - Information Technology; MPM - Manufacturing Planning; MRO - Maintenance, Repair and Operations; NPD - New Product Development; ORP - Optimization of Resources and Processes; PDM - Product Data Management; PLM - Product Lifecycle Management; PPM - Product and Portfolio Management; SCM - Supply Chain Management; SRM - Supplier Relationship Management; TDM - Technical Document Management; TLA - Three Letters Acronym; TMS - Transport Management Systems; VMU - Virtual Product Mock Up; WMS - Warehouse Management Systems.

The present paper comes to emphasize a vision upon PLM in relation to SCM and CRM, in the frame of integrated engineering, for integrating manufacturing with Sustainable Industrial Design.

2. Main concepts and their IT structure in Integrated Manufacturing

2.1. CIE and CII concepts and their IT structure

A few years ago, analysts, IT specialists and IT solutions vendors outstood a lean strategic vision upon the discrete manufacturing in the frame of CIE. Accordingly to this vision (Evans, 2004), PLM, SCM, CRM and ERP are identified as being the four cornerstones in the frame of an enterprise's IT structure or as being the four sustaining pillars for the discrete manufacturing in the user company, as it is shown in Figure 2.

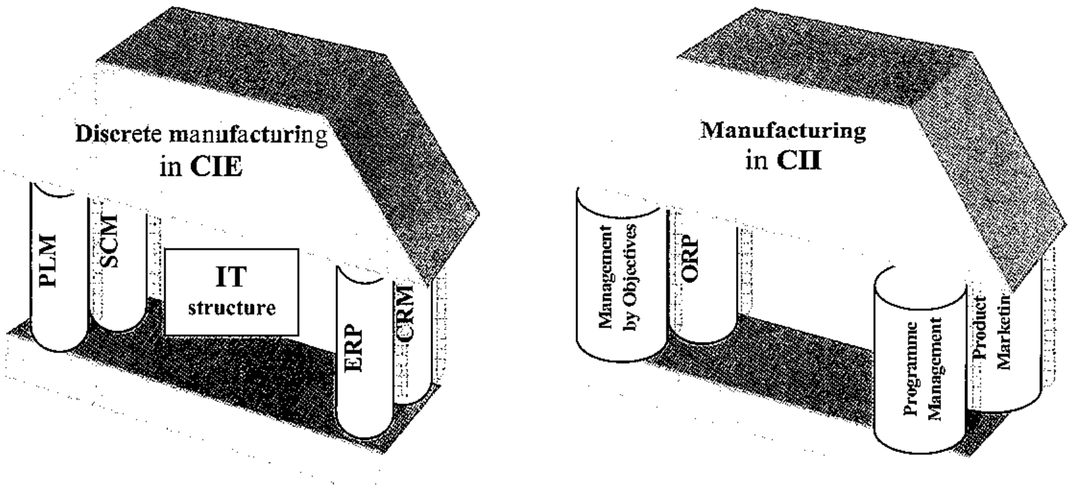

Figure 2. Lean visions on CIE and CII

A new concept occurs nowadays to replace the concept of CIE in the vision for the future of the integrated manufacturing. It is the concept of CII, which puts the accent mainly on the intercommunication between the companies. In the frame of the CII concept, rather than the pillars supporting the enterprise, the emphasis is on pillars supporting synchronization between enterprises, as it is also shown in Figure 2. The four IT systems sustaining CII are: Programme Management, targeting change and synchronizing change efficient implementation in the industry network, by monitoring and controlling the exchange of resources such as stuff, materials, services, capital and plant; Management by Objectives, targeting the synchronization of the activities across the industry network partners to solve issues such as product and process change, external projection of product brand values etc; Optimization of Resources and Processes (ORP); Product Marketing.

2.2. About PLM concept and systems

PLM concept refers to the management of the lifecycle of products, processes and services from the very beginning to the final point or, as it is used to be said by the specialists (Merticaru, Musca & Recio-Perero, 2008), "from cradle to grave", as it is suggestively shown in Figure 3.

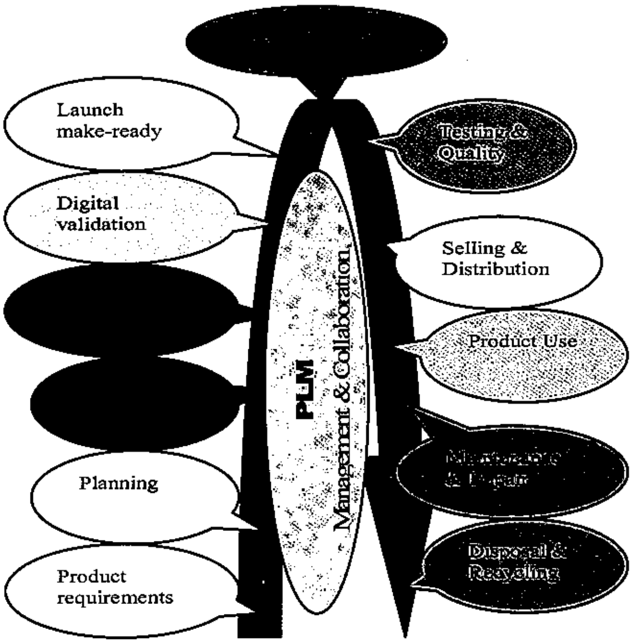

Figure 3. Extended vision on PLM concept

PLM systems co-ordinate, in a collaborative manner, all the information about products and processes throughout the mentioned phases of the new product development, among the various participants, both internal and external to the CIE, who must collaborate to bring the concept alive (Ausura & Deck, 2003). The principle of PLM concept and systems is to maintain an information vault, possibly physically distributed, but having a single logical index towards all the product, project and process information. So, the various factors and processes involved in the new product introduction, production, service and retirement use a single source of product information. The access to the mentioned vault's information is given orderly, PLM applications using for this workflow and authorization rules.

Some specialists consider that within PLM, as a set of application software that help the manufacturing engineering enterprises to develop, describe, manage and communicate information about their products for enabling the NPD business process, there are four primary areas: PPM, CAD, MPM and PDM. An extended vision (Evans, 2002) identifies the following PLM sub-systems, developed at the present time: CAD, CAM, EDA, TDM, DMU, VMU, CAE, MRO, CAPE, Project and Program Management Systems, Release Authorization and Engineering Change Control Systems. Nowadays, the vast majority of PLM expenditure is developed on CAD/CAM systems.

2.3. About SCM concept and systems

SCM concept refers to the management and monitoring of logistic operations, both inward, to acquire materials for making products and outward, to deliver finished goods to final customers. SCM systems come to support the manufacturing managers in making decisions for optimizing the capital tied up in stocks and inventories and to enable the enterprise to deliver products at prices and delivery dates agreed with customers.

The principle of SCM concept and systems is to build a digital model of the supply and demand networks with transport delays and storage locations to serve the known points of supply and demand. By loading the model network with a forecast of the flows of materials determined by the demand plan and using various algorithms an optimum logistic plan is developed. The nowadays developed SCM systems are: Demand Management, DRP, TMS, WMS, SRM and CSM.

2.4. About CRM concept and systems

CRM concept refers to the management of the enterprise's relationships with customers and stakeholders. CRM systems come to support intelligently the activities of finding, marketing to, selling to, and servicing customers. The principle of CRM concept and systems includes the capture, storage and analysis of customer, vendor, partner, and internal process information. The following enterprise's functions are nominated to support this business purpose: Sales, Marketing and Customer Service, Training, Professional Development, Performance Management, Human Resource Development and Compensation.

3. About the relationships between PLM, SCM and CRM

In relation to the above presented considerations regarding the CIE and CII concepts, there result that Integration is developed at two levels: integration inside an organization and integration between enterprises.

Integration inside the organization covers two levels: integration of functional areas and integration between the organization's physical locations. As it is known, integrated enterprises usually have one database for information storage and all the internal users, no matter of their location, are connected to that. Integration between the locations covers the enterprise's different legal entities and its different physical sites such as factories, warehouses and sales offices. Another level of integration inside an enterprise is the integration of functional areas, covering different processes that need information sharing and integration, as it is shown in Figure 4. The benefits of integration are obvious: new design options for the processes, radically changing costs, quality, service and the duration of the processes (Coman, 2008). In Figure 4, there is also suggestively illustrated the area covered by PLM as system of product/process data management, inside an integrated enterprise, and the superposing of PLM, SCM and CRM, in relation to the product data.

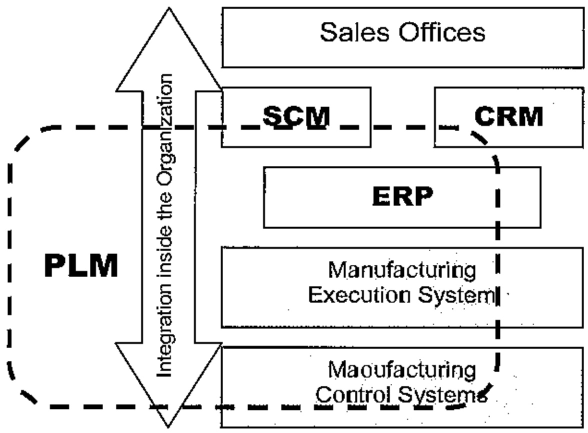

Figure 4. Integration between functional areas inside an enterprise

At international level, nowadays, there still are important debates and there are not yet established well delimitations for the concepts of PLM, SCM and CRM and also for the relationships between them. There are still discussions on whether PLM is just an application software suite like SCM, and CRM or simply an umbrella concept that embraces SCM and CRM applications. Some leading companies in the ERP and CRM branch consider that PLM might simply be a module from ERP or SCM companies (Evans, 2004). At the same time, former CAD applications suppliers strongly sustain PLM as a separate pillar in the IT structure of CIE. Other PLM software developers suggest that SCM will disappear as separate pillar in the IT structure of CIE, being included by PLM and ERP. This idea is sustained with the argument that the product information is indispensable for optimizing the supply chain. Some other specialists see for the future some development of SCM as the core of a new "strategic vision" on the IT structure of CIE.

As it is well known, the purpose of a manufacturing enterprise is to make money by satisfying clients with its products. For accomplishing this purpose, in all its business processes, any manufacturing enterprise has to deal with the following four main factors: resources, suppliers, clients and products. Starting from these considerations, respectively from the main factors involved in the manufacturing enterprise's business processes and from the IT structure in the lean strategic vision upon the discrete manufacturing in the frame of CIE, an extended vision, as it is suggestively illustrated in Figure 5, can be emphasized for explaining the place of the four mentioned TLAs, respectively PLM, ERP, SCM and CRM and for relating PLM with SCM and CRM, as the paper proposes. At a primary look, the image from Figure 5 outstands that PLM covers the area related to the products and processes, ERP covers the area related to the resources, SCM covers the supply area and CRM covers the relations with the clients. For establishing a vision upon the relationships between PLM, SCM and CRM, we can start from Figure 5, which shows that SCM, CRM and PLM are superposing on the area of the product/process models and data.

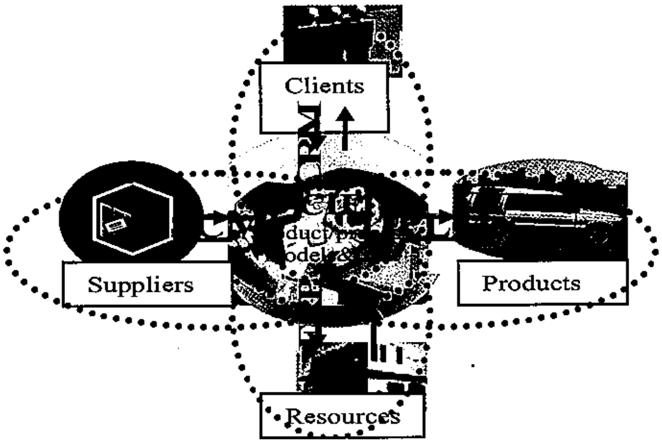

Figure 5. **Extended vision on IT structure of CIE**

PLM, through the solutions of Embedded System Lifecycle Management (ESLM) helps to the construction of an environment for product development, integrated for the product, hardware and the additional software, so that the problems during the product integration are minimized and the product quality increases. The main objective is to support the concurrent product development and to reduce the time to market and the costs. Regarding ESLM, a collaborative view with the identification of the involved applications and with the visualization of the relationship between SCM and PLM, is presented in Figure 6.

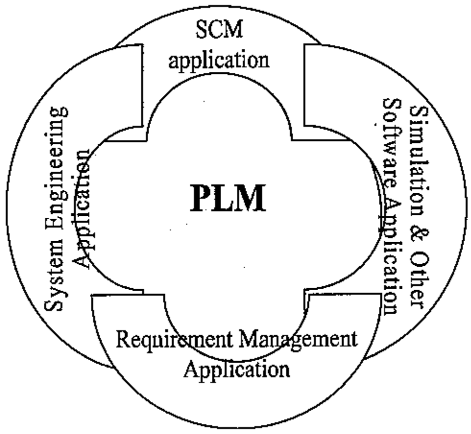

Figure 6. **Collaborative view on relationship** of a **SCM application with PLM**

As PLM is an instrument for implementing the vision of Unique Company (Grieves, 2006), by constructing an infrastructure of product information, with access for all the functional areas such as engineering, manufacturing, design etc, it also can implement common processes and practices. More than that, where this infrastructure is shared with the suppliers' community, these suppliers will be also structured as part of the respective processes and practices and bave access to the product information database. At the same time, the CSM subsystem from SCM, by its main orientation toward the product information, is directly related to PLM.

In PLM, in the case of client orientated product development, the client specifies, more or less, the following aspects: requirements; functionality; specifications; product's characteristics. This situation allow a large range of activities for the product developer, at one end of this range being situated the manufacturer, who gets completely defined the product geometry, specifications and characteristics, sometimes even with the technological process specifications included. At the other end of this range, the client simply transmits the requirements to the product developer, who becomes responsible for transforming them into geometry, specifications and characteristics. Sometimes, the above mentioned situations determine the development of subsystems in which the product developer becomes client of his suppliers. In this informational environment acts the functionality of CRM systems.

Also related to the client relationship management, we mention here that a principle in Collaborative Product Development (cPD) from PLM, considers the use of PLM for developing the marketing collaterals. Especially in tbe entrepreneurial orientated product development, the scope of the marketing is to attract the buyers' attention toward the product. This involves better marketing collaterals. Without PLM, the marketing collaterals will be in trouble when various changes occur. The benefit brought by PLM in this direction has two sources:

- the costs are reduced because marketing area does not need to re-create already existing product information;

- the marketing material is more accurate.

On the other hand, for increasing the efficiency of the value chains, the overall costs of the products must be lowered. Overall costs problem cannot be solved only by CAD/CAM/CAE applications alonc, but requires also integration to other enterprise applications, such as SCM, for example, for understanding if or when a part component is available. In this sense, SCM plays a vital role in product development, and therefore it can be situated under the PLM umbrella concept.

By the same way, as CRM is considered that stands alone as an application suite, it is vital for the product development to be related to it, because it is really difficult for product developers to understand customers' preferences and also customers' satisfaction levels without having a link into CRM. In this sense, also CRM can be considered to be situated under the concept of PLM.

Under these circumstances, PLM can be considered as a concept that covers SCM and CRM applications, as it is suggestively shown in Figure 7. This covering is taking place to the extent of supporting the overall process of conceiving, designing, manufacturing, developing and supporting products. We must say here that under the umbrella of the PLM concept there can be situated more than other company's applications such as SCM and CRM. The area under the PLM concept's covering umbrella may also include the infrastructure that enables the collaborative and distributed product development process into a multiple companies environment, the process of managing product portfolios, the business consultation for best practices in product development and also implementation services. There also must be outstand here that placing SCM and CRM under the PLM concept's umbrella doesn't mean that the application software suite contained within PLM includes SCM and CRM applications as well.

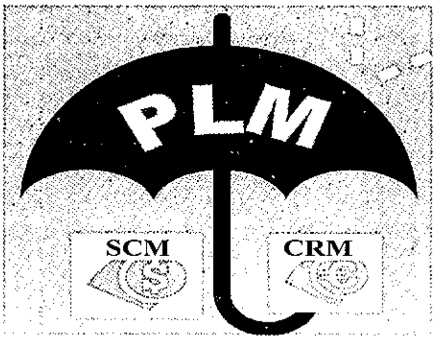

Figure 7. **PLM as a covering concept for SCM and CRM**

In relation to the above presented concept of CII, integration between enterprises is a topic that is very important in the supply chain and networked enterprises. It includes logistic integration of the internal co-ordination of acquisitions, manufacturing support, and physical distribution including also customers and suppliers. There are also the flows for materials and information that penetrate the supply chain. ORP component of CII is targeting all the operations and being the industry network equivalent of integrated ERP and SCM. On the other hand, the Product Marketing component of CII is mapping into aspects of enterprises' CRM systems, developed with PLM elements.

4. PLM, SCM and CRM for Sustainable Design in relation to LCA and EPR

From engineering point of view, it is largely accepted that the crucial goal of sustainable manufacturing has to start with designing activities. In other words, we will go to Sustainable Development via Sustainable Design. Sustainable Design, as the most modern design concept, might be define in various ways. In a few words, Sustainable Design is the art of creating Virtual Products (as the base for Physical Products) or any other similar activity able to assure a harmony between people, planet and profit.

At the present time, in the frame of Computer Integrated Enterprise (CIE), the Sustainablc Industrial Design must be considered in relation with Life Cycle Analysis (LCA) and with the Extended Producer Responsibility (EPR). The concepts of Reducing, Reusing, Recycling and Recovery of material resources are also very important in providing Sustainable Industrial Design. As LCA is a very important tool to guarantee there are no harmful impacts upon the environment, we must mention here that, traditionally, Industrial Design is developed accordingly to the "cradle-to-grave" concept, LCA being in this case a method to evaluate the environmental effects determined by any given industrial activity, starting from the initial extraction of raw materials from the nature, till the point at which all the resulted residuals are returned to the earth. Extended Producer Responsibility (EPR), as a policy measure which outstand the industrial producer's role in reducing the environmental impacts of their products throughout their entire lifecycle, encourages the Design for Environment practices and the reuse of products and packaging.

Considering that the "cradle-to-grave" way in Industrial Design provides environmental protection but will not avoid the depletion of natural resources, there result that the Sustainable Industrial Design can be achieved only by following the "cradle-to-cradle" way. In this case, materials can be reused, no waste gets produced or it can be recycled so that no damaging impacts on the environment are generated within the closed loop of the product lifecycle (El-Haggar, 2007), as is shown in Figure 8.

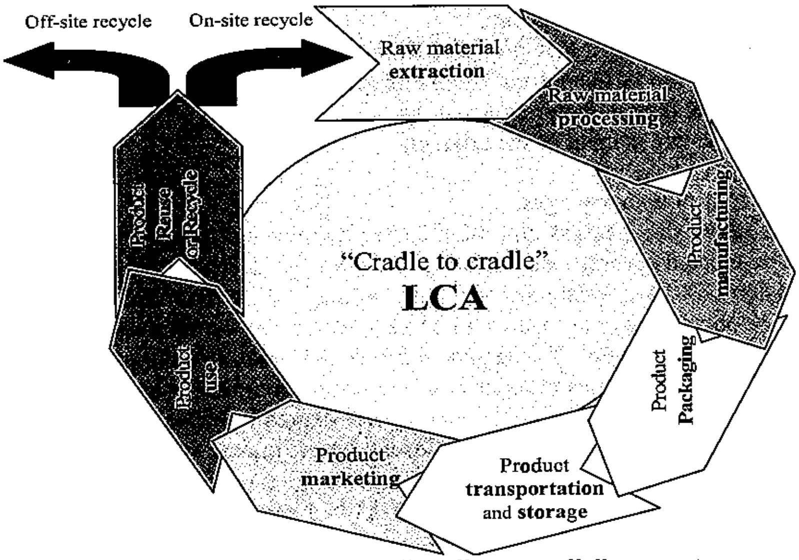

Figure 8. **LCA based on "cradle-to-cradle" concept**

So, for achieving a Sustainable Industrial Design, the Cleaner Production techniques must be also considered into Integrated Engineering (Galis et al., 2008), as it is shown in Figure 9. In Figure 9, there are also presented the superposing areas and the implications of PLM, SCM and CRM upon these techniques.

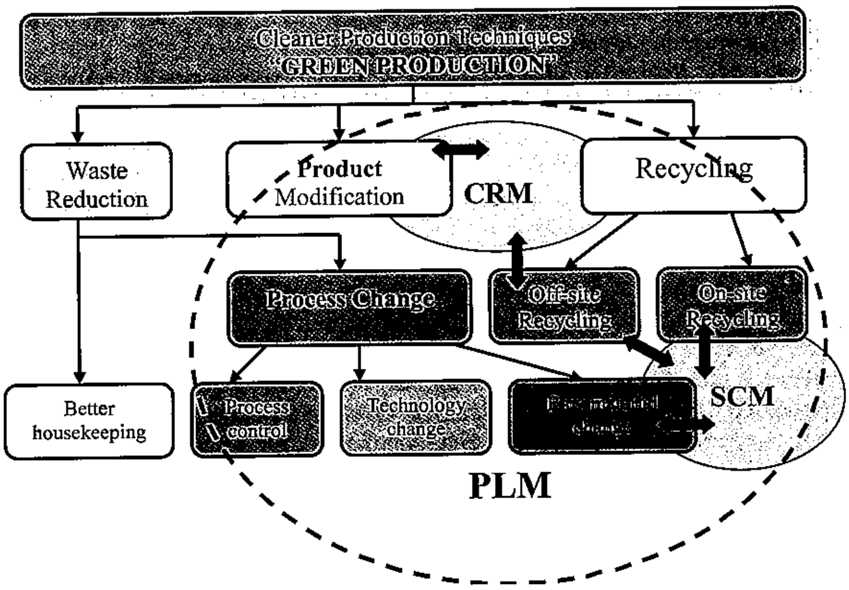

Figure 9. Cleaner Production techniques and their superposing with PLM, SCM and CRM areas

5. Advantages of PLM systems for Sustainable Industrial Design

Industrial enterprises that develop design activities are capable to generate the technical documentation of the products to a great extent, but often these companies do not register some properties of the components as they can be easily found and especially reused. That is why the project engineers have problems in accessing the needed information. Difficulties occur in the ability of the project engineers to efficiently manage the product information. The information systems for the management of the technical information have the capacity to administrate both the properties associated with each product or with the components of a product and the technical documentation of the projects by relating these types of information. The way the PDM/PLM systems cover these requirements is based on stocking the information just once, providing data integrity, monitoring and controlling of the design data changes or updating. Any information from the system can be distributed toward any department based on the priorities of the importance degree established for each user. When a change is made upon any data from the system, this will be automatically registered by the system, keeping the date and author of the change. Since the information generated by a company becomes more and more voluminous, the necessity of establishing a classifying and managing solution is imperative. This capacity for classifying and managing information is the fundamental requirement for a PDM/PLM system. The main characteristics and advantages brought by a system of information management regarding the life-time product are:

- Reduces the time for realizing a new product (Time to market).
- Improves the productivity of the design/calculation process.
- Improves the design and manufacturing accuracy.
- Determines an innovative content of the products.
- Provide data security.
- Provide a better control upon changes.

The PDM systems allow the creation and maintaining of revisions and versions for each document from the database. There can be created several versions or variants of a product without losing anything of the oldest ones. Each version or revision will have a date and signature so that will be information verifiable in the audit process. Lately, the advantages obtained by the use of PLM (Product Lifecycle Management) in managing the products lifecycle led to changing the concepts of computer aided design and manufacturing and improved the innovation, collaboration and reduced waiting times in industrial enterprises, no matter their size. The quality and performances of the realized products are dependent on the innovation degree, which is increased by using the procedures CAD/CAM/CAE. The costs and the delivery times depend on the quality of collaboration between the partners and between the departments of the productive enterprises. A performing collaboration is realized with a management of the project and manufacturing data, realized through PDM/PLM procedures. In this context, the forming of abilities and specialty knowledge acquirement both for technical students and for engineers and researchers are a present aim.

6. Implementation of a PLM solution into a collaborative network for Sustainable Design

As it is well known, the industrial enterprises manifest everyday the strong need for conceiving qualitative, economical and aesthetical products. In these conditions, the research centers from universities can assume time consuming tasks such as: execution of drawings and technical documentation, conception of the products' aesthetics and ergonomics, simulation of the products behavior through FEM, generation and testing of the technologies for CNC machine-tools using the facilities of the CAM systems.

The authors propose the realization of a collaborative engineering network composed by technical universities and productive industrial enterprises. The purpose of this network is the generation of projects and products using the concepts of CAD/CAM/CAE and data management at the network's level using PDM/PLM systems. This paper shows one solution for data management between the partners in the network and also between the departments of conception and manufacturing from the industrial economic agents, administrated by a PDM/PLM system. The development of some type projects consists in the realization by the partners, using computer aided design software, of parts from the product, in information change and assemblies realizing on the network, realization of the changes imposed by the product design (shapes, colors, presentation materials), simulation of the loading conditions using FEM, development of the numerical control programs for the complex parts in the project. For each project the databases specific to the implementation of the PDM/PLM procedures are generated and there is configured the data management system for the identification of the product structure, of the changes and variants of project-product that occur at different requirements of the beneficiaries. Project data management between the partners in the project and also between the departments of conception and manufacturing from the economic agents is realized at the level of a web network, administrated by a PDM/PLM system. The economic agents, through the experience and knowing the competence area, contribute and collaborate to the projects development, providing for themselves a reserve of specialists among the master, doctoral and bachelor degrees students which develop their activity in the universities participating in the project.

Problems in implementing some PLM solutions are well-known all over the world. In the Laboratory of Computer-Aided Design from the Technical University "Gh. Asachi" of Iaşi, there is a sustained concern for developing a PLM solution, applicable in the economic environment specific to the Romanian industry. For implementing such a solution into a network formed by researchers belonging to some universities and specialists from manufacturing enterprises, certain stages are necessary, within them the outstanding ones are the following: the knowledge acquisition and the development of skills for using CAD systems; to know the concept of data management and to establish some procedures for implementation at the level of functional areas into an industrial enterprise; establishment of the soft and hard structure of the system used for data management; the training of the staff involved in the activity of products' conception, design and manufacturing. The authors have passed through the above mentioned stages (Musca et al., 2008), both for their own team and for their industrial partners. After the training of several groups of participants in the PLM programme, groups belonging to the partners, there has been observed that a vital direction for the success of the approach is to form new specialists in the areas of interest, respectively firstly CAD and CAM and secondly in Computer-Aided Engineering (CAE) or data management for the Product Lifecycle. The best results have been obtained with teams formed by researchers from universities and students.

At the level of a PLM network, functional within an environment heterogeneous as education and preoccupations, one of the main requirements is to form a motivated and efficient virtual team. The premises of forming a team efficient in work in the virtual environment are based on: adequate level of knowledge for accomplishing the tasks for the main stages of the product lifecycle, CAD, CAM, relationships with the suppliers and customers; motivation of the team working by co-interesting and counselling in the domain of PDM/PLM. There has been found that partial accomplishment of some premises is not sufficient; so the financial co-interesting of the team members can be inefficient if the motivation of the team does not exist. The accomplishment of this premise is difficult for the teams of the partners from industry, even if the presumed results are known and noteworthy. Even in the research environments or in the universities, some malfunctions can be found, caused, according to the authors' opinion, by: insufficient number of persons with abilities in the CAD/CAM/CAE area; inefficient education of the specialists in this domains and of the students, as the work with a CAD system requires to go through a training stage that must be individually realized; differences between the team members regarding the knowledge level, which lead to difficulties in collaborative activity.

Considering the experience gathered in the CAD area in the laboratory from TU Gh. Asachi of Iasi, the implementation of the PLM solution started with the design of some elements necessary for the partners. For the design stage, there has been used *SolidEdge, v20*. One of the projects realized within this approach by a team formed of professors and students, is a combined stamping tool used for processing sheet metal, as shown in Figure 10.

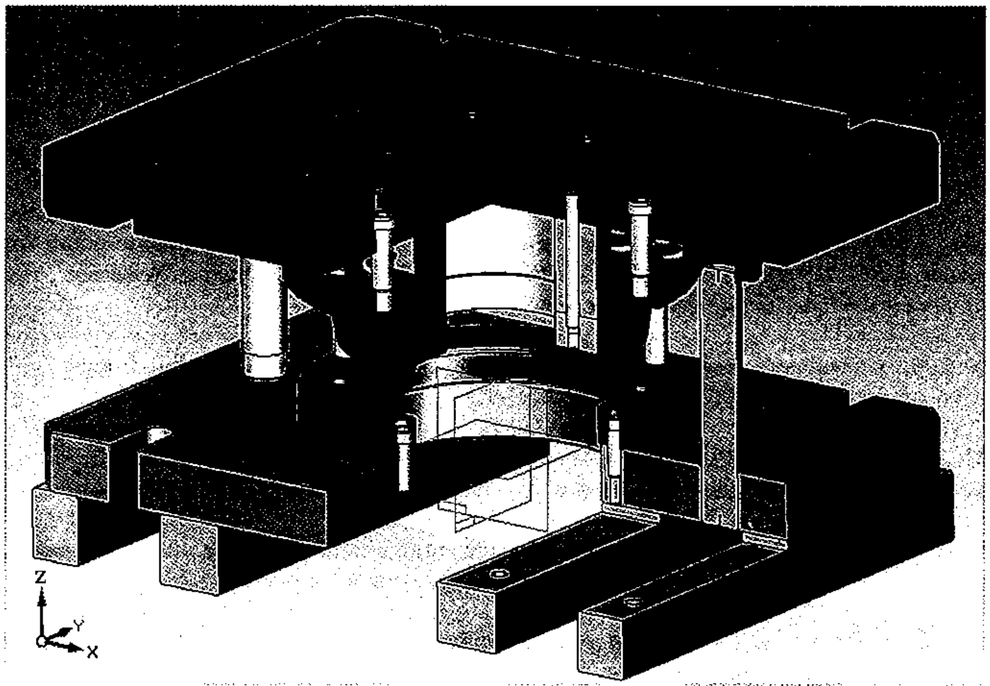

Figure 10. Stamping tool for cutting and dimpling sheet metal parts

The use of this constructive project as support for the implementation of the PLM solution is justified by:

- The necessity of managing the information for this type project; this example is applied for managing the design data for a set of stamping tools, able to realize several types of sheet metal parts, using normalized elements such as plates, columns, bushes, clamping and fixing elements;
- The precise management of the design activity, for realizing some modular stamping tools, by modifying the active elements and keeping the supporting constructive elements (plates, columns, bushes, clamping and fixing elements);
- The extending of the data management process in the area of stamping tools manufacturing, providing the reducing of the necessary of work by reusing some components normalized at the level of the manufacturing department.

Each working team activating in the CAD stage of the product lifecycle, has a manager, an administrator of the computer network, designers, verifiers and drafters. *TeamCenter Express* was adopted as environment for the implementation of the PLM solution. The development of the design procedures was done with a team that realized the design of the components on the Laboratory's network, with the resources managed by the TcX system. For the product structure, taken over from the bill of materials of the final assembly, there are designed procedures for data management, for the management of the design activities and for the work stages for product development.

7. Conclusions

The present paper comes to emphasize a vision upon PLM in relation to SCM and CRM, for integrating manufacturing with Sustainable Industrial Design. For PLM implementation, a realistic evaluation of the organization's present situation is firstly necessary. Secondly, an evaluation of the environment state is requested, including suppliers, clients, competitors and administrative power respectively government.

The revealed concepts and the established vision presented in this paper were useful for the authors and for their research team in the activities for implementing a PLM solution at the interface between the academic research and the economic environment. So, the paper also proposes a collaborative methodology for developing some type projects, specific to the machine manufacturing industry. The realization of the projects for some stamping devices, dies and injection moulds, with the aid of some computer aided design software, uses the experience and the specialty knowledge of some industrial partners and the abilities of the teams from the universities in the field of knowing the latest CAD software at the international level. The development of the design knowledge at the level of the network of the partners is assured by integrating the CAD, CAM and CAE modules into an integrated solution, leading to a greater efficiency of integrating information in the designed products and processes. Including in the partnership a university specialized in design allows a collaborative conceiving activity which leads to the introduction of some aesthetical aspects, favorable to the development of competitive products. These approaches are stipulated in the phase of product conception but also in that of presenting and realizing some visualization elements, product promotion and presentation catalogues.

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APPRECIATION OF ECODESIGN WITHIN TURKISH PRODUCTION INDUSTRIES

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Abstract

In parallel to the considerable steps needed to protect the environment throughout the world, Turkey has also shifted its focus to sustainable development. Ecodesign is a fundamental step to improve sustainable production, consumption and development. This paper presents the results of a study, which analyses the current appreciation of ecodesign in Turkey, in relation to design and manufacturing. It first reports on a comparative analysis of six international case studies with an aim to explore internal and external stimuli for promoting ecodesign, as well as reflections on barriers that were encountered. Then, literature review on ecodesign activities in Turkish industry is presented. Finally, to complement the findings, the results of interviews conducted with three stakeholder groups (i.e. government, universities and industry) are presented. These stakeholders were identified as being especially influential. Although there has been growing awareness of ecodesign and environmental issues in Turkey, implementations of ecodesign in many sectors have been fairly low comparing to European countries. There are lessons to learn from other countries with respect to environmentally-conscious product development.

Keywords: Turkish industry, ecodesign, product development, developing economies.

1. Introduction

It is common sense that reducing the negative environmental impacts of industrial activities is critical. In this respect, new environmental legislations, both in international and national levels, have been introduced to promote such changes in the companies through directives, such as WEEE (Waste Electrical and Electronic Equipments), EuP (Energy using Products) and RoHS (Resistance of Hazardous Substances). Since the early 60s, many innovative companies have tried to achieve the integration of environmental improvements in their daily business activities. The companies initially adopted pollution control and end-of-pipe approaches with the aim of reducing the negative effects (e.g. pollution and waste) of production (Bhamra, 2004). Later, the approach was shifted to cleaner production with a focus on redesign of industrial processes and products to prevent waste generation and pollution.

Over the last two decades, a new understanding 'ecodesign' has emerged. Ecodesign refers to the minimization of environmental impact of products during their total life-cycle, while maintaining the conventional product requirements. It is a systematic way of integrating environmental considerations into the product development (Simon et al., 2000). Ecodesign is a widely accepted and applied approach in developed economies, and its importance is rapidly increasing in developing economies. However, the adoption and integration of ecodesign in developing economies may require different conditions than the ones in developed economies. Parallel to those changes worldwide, it is possible to see the same tendency in Turkey, especially through the Government's five-year development plans, legislations (e.g. 2002795/AT) and international standards (e.g. ISO 14000). Nevertheless, the current efforts in the Turkish industry have stayed rather weak in addressing environmental issues. Therefore, there exists a need for integrating environmental considerations in a more systematic way into the Turkish industry.

Consequently, this paper presents the results of a study jointly conducted at the Middle East University of Technology and the Delft University of Technology, which analyses the current appreciation of ecodesign in Turkey, in relation to design and manufacturing. It consists of three parts: the literature review and exploration of six studies related to integration of ecodesign in different regions of the world; literature review connected to ecodesign activities in Turkish industry; and the results of interviews conducted with three stakeholder groups (i.e. government, universities and industry) to complement these findings.

2. The Ecodesign Concept

The term ecodesign refers to the actions during the product development stage striving towards minimizing environmental impact of products during their whole life-cycle. It is "one of the largest contributor to the sustainable

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development" (Loriot, 2003:15) in the product design phase. At the center of ecodesign is the concept of product life-cycle. The life-cycle of a product starts with use of raw materials and continues with its manufacturing, distribution, use, and concludes with end-of-life operations (Figure 1). Environmental impacts occur in different phases of the product life-cycle and should be considered in an integrated way. By assessing the environmental impact of a product from 'cradle to grave' rather from 'cradle-to-cradle', the enterprise would be able to find an efficient way to prevent pollution (McDonough & Braungart, 1998).

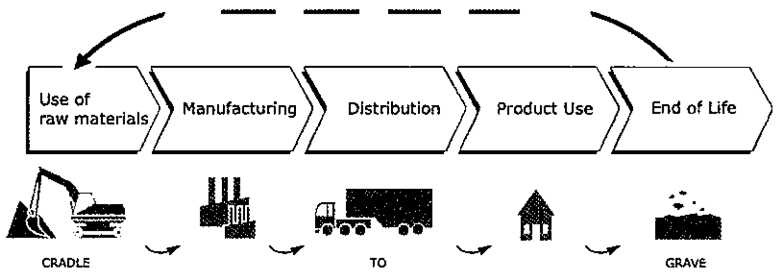

Figure 1. Typical life-cycle of a product.

Environmental improvements can lead to a win-win situation, in which all business, customer and society opportunities can be created through more efficient products in an economical and environmental dimension. Businesses can reduce production costs by using, for example, less material, water, and energy. Moreover, by considering environmental requirements in the product design, enterprises can increase product quality and improve innovational approach. Thus, they can shift consumers' attention to ecodesign products. Consumers can posses more durable and reliable products, and reduce costs (by e.g. reduction of energy consumption, reduction of water usage). The society can keep resources for needs of the future generation by the help of sustainable approach.

Figure 2 illustrates Lambert (2002)'s ecodesign concept consisting of four improvement levels in respect of eco-efficiency improvement factor. These four levels are explained by Hemel (1998) as innovation levels of product development from evolutionary (incremental innovation) to revolutionary stage (innovative or radical innovation). This model requires a significant time period, over 30-50 years, to accomplish type 4 level innovation, whereas improvement and redesign of existing products provide incremental innovation in design phase (between factors 0 to 3). To realize further improvement and to achieve more environmental benefit (e.g. to reach factor 20), functional qualities of a product must be changed, which implies radical innovation approaches in the design phase. A final desired point is a sustainable society that involves remarkable alteration in entire infrastructure and organization. It refers to new product and product-system approaches. Increasing the innovation level of products also requires higher investments and effort for companies as well as (initially) lower demand from the consumer (Lofthouse *et al.,* 1999). From this perspective, it conflicts with the short term benefits of business. Therefore, manufacturing industries try to find new ways and strategies to ensure sustainable innovations while fulfilling marketing requirements (Loriot, 2003).

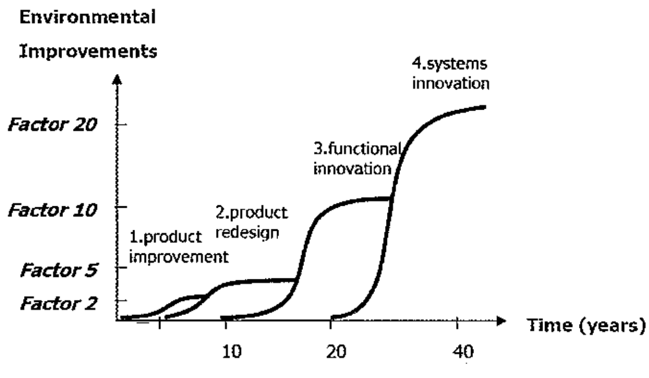

Figure 2. Four Types of ecodesign innovation (Lambert, 2002).

New product developers would obviously need a guide to realize implementation of ecodesign strategies in their practices (Mathieux *et al.,* 2001). Therefore, so far, many tools, guidelines, even software tools have been developed for designers and industry (Ryan, 2004). One of the examples for ecodesign tools is Life Cycle Assessment (LCA), which is one of the commonly used tools in the industry (such as ISO14001). It is "a way of evaluating all processes involved with a certain product or service, 'from the cradle to the grave'" (Robért, 2000:243). It provides considerable data for the product development process as well as production, and can be regarded as a useful tool for designers to see the whole picture of a product's environmental impacts. Moreover, there are tools developed especially for the product designers. For example, Hemel (1998) identifies 33 strategies and structures them under seven groups, called as 'Ecodesign Strategy Wheel' (also called Life Cycle Design Strategies – LiDS wheel). The wheel aims to guide designers in determining whicb ecodesign strategy is more useful to implement in a specific case, and illustrates the progress of ecodesign strategies. Besides these examples, in the literature study carried out by Baumann *et al.* (2002), 650 articles related to ecodesign methods and tools were analyzed and 150 different tools were found. On the basis of these findings, they classified ecodesign tools into six groups: frameworks; analytical tools; checklists and guidelines; software and expert systems, rating and ranking tools and organizing tools. All of these groups serve to assist designers whilst determining critical aspects of a product.

The motivations for companies to adopt and implement ecodesign on the grounds of business economics can be studied under internal and external drivers (Brezet & Hemel, 1997; in Ueda, 2000). Internal drivers are the values originating from dynamics of the company/organization itself, whilst external drivers address the stimuli from the pressures outside the company. From the overview of the examples of integration of ecodesign into the business, it is possible to say that most companies show similar results in terms of external and internal drivers. In general, the most important external drivers are legislative pressures, customer demand, market forces, and (good) position of competitors integrating environmental considerations in their product development processes. Cost reduction/profit increase incentives, better product-market opportunities and environmental (responsibility) policy of company are examples of internal drivers that are the most frequently mentioned factors in the literature. Other essential internal drivers are innovation opportunities, increase of product quality and improvement of corporate image.

According to Tukker *et al.* (2000), the main drivers are related to business-oriented factors rather than environmental concerns. This is because the business cannot give priority to environmental issues as much as other main design requirements that bring big profits for companies. However, when the main obstacles to incorporate environmental issues are reviewed, it can be seen that they are generally related to the internal value chain of the company. Therefore, it can be inferred that internal drivers support long term environmental improvements since they provide optimization in infrastructure of the organization. This supports the idea wby internal stimuli are more influential than external ones for long term achievement in ecodesign.

Increasing attention to the environmental issues has currently become a powerful motivation for the redesign of existing products and for new product development (NPD) (Shrivastava, 1995). This makes an important contribution to the improvement of products from an environmental perspective. Mackenzie (1997) describes the role of the designer as a bridge between manufacturing process and consumer and between technology and marketing. It is a new challenge for designers to incorporate environmental issues in the design pbase by ensuring the fulfillment of market demands and regulations. This requires knowledge and understanding of environmental issues in the product design process besides the technical abilities to design and it would only be possible by means of good cooperation and the information flow between the different NPD departments of a company.

3. The Recent Research Studies on the Adaptation of Ecodesign

This section presents benchmark of six recent research studies on the adaptation and implementation of ecodesign in different regions in the world: France, Central America, the Netherlands, the Baltic States, Brazil and the European Union Countries. This is to understand the current design practice concerned with environmentally-conscious design and the context of other countries that tackle this issue. It is considered as a useful learning before examining Turkish context since the results provide an overview about motivations, drivers and obstacles of companies, in practicing and adapting ecodesign. Tables 1 and 2 sequentially summarize the explanation of these studies, their primary aims, level of implementation; the key drivers; barriers/obstacles, the region in the country (if it is relevant), and the mostly preferred ecodesign strategies.

3.1 Drivers, Barriers and Level of Implementation

The drivers and barriers found in the studies show similar results: 'regulations', 'cost reduction' and 'market demand/competitors' initiatives' are the main drivers for companies to adopt ecodesign. Especially, the external factors are key dynamics of European States. Tukker et al. (2000) highlight the importance of regulations to support ecodesign concept in two directions: creating incentives, and dissemination. This means policy action influences the market demands and shifts public attention to environmentally-conscious products. However, the industry should appreciate that long term acbievement will only be possible by embedding the internal drivers in tbe organization.

From the analysis of the six studies, it is possible to observe three incremental levels in integrating ecodesign into the companies: *legislative pressure*, *commercial benefit*, and *environmental benefit*. This top-down approach appears to be important especially for developing economies in order to show economical benefits to companies by compulsory methods. Developing countries, faced with new environmental targets, must first follow the legislations. Then, they need to appreciate commercial benefits. Companies become conscious of the commercial benefits and perform according to these benefits. Finally, they act upon the awareness of environmental benefits. As Hemel and Cramer (2002) emphasize, ecodesign improvement could only be possible, if it is supported by stimuli other than the expected environmental benefit alone.

In some cases, enterprises are anxious about taking high risks by implementing new concepts into their business strategy. They avoid going beyond conventional values in product development, and therefore, their preferences are closely connected to the ecodesign strategies which match traditional business benefits (Tukker *et al.*, 2000). Another significant reason of this situation is companies' management structure. Corporate leaders generally have a central position to decide many tasks and strategies in company. Henceforth, designers do not develop their own beliefs or make corporate leaders agree with their thoughts (Reyes *et al.*, 2006). Hereby, managerial and structural difficulties in some countries can interrupt innovative thinking in some cases. On the other hand, innovation has seen as a new challenge in competitive market and environmental values can be the point of origin to achieve product innovation (Hemel & Cramer, 2002).

Three different types of barriers can be observed in the studies. First, the obstacles connected to dissemination of ecodesign information such as lack of knowledge, lack of information on market possibilities, lack of information on new technologies, and lack of training related to ecodesign. The second type originates from the internal values in company such as lack of top management commitment, conflict with functional requirements and commercial disadvantage. Lastly, the limitations, especially economical constraints can be given as an example of this group which is an important case for the Baltic States and Brazil.

4. Current Situation in Turkey

This part introduces the literature review on ecodesign activities in Turkish industry from three perspectives: policy framework, existing company activities in the field of ecodesign, and ecodesign related training activities for Turkish companies. However, first, brief overview of economy, industry and product development in Turkey is analyzed to understand country situation to adapt the sustainable development which can be sustained at the strong economies. Finally, the results of inquiry with Turkish stakeholders are presented.

4.1. Brief Overview of Economy and Industrial Sector in Turkey

Turkey's economy is among the world's 20 largest economies with its gross domestic products (GDP) of around US$ 400 billion (The World Bank, 2006). The increasing GDP growth per capita refers to the increasing standard of living in Turkey. Concerning the statistical information, the view of GDP growth rate has some drastic changes year by year related to the economic instability in Turkey (UNECE, 2007). Many plans made for overcoming the high inflation rate, which has led to instability in the economy, inequality of incomes and implicitly decreasing the rates of Human Development Index (HDI) (Sagir & Yuksel, 2002). Nonetheless, there has been a promising growth in Turkish economy in recent years (Figure 3). This positive performance is considered to be sustained and improved for more powerful economic structure.

4.2. Brief Overview of Turkish Industry

The Turkish Industry has many advantages from the perspective of international market, such as the wealth of natural resources, geographical position to export markets, the improvements of infrastructure and telecommunication systems, the existence of young and qualified human resources, and potential big domestic market (IGEME, 2005). According to the most recent information of CIA (Central Intelligence Agency), the contribution of agriculture, industry and services sectors to total GDP is 8.9%, 30.8 % and 59.3 % respectively.

Turkish industry consists of private sector in a great extent. Currently, textile and clothing sector has taken the lead with its largest share in manufacturing industry. Food products, chemicals, machinery, iron and steel, motor vehicles, rubber and plastics, ceramics, cement and glass are other major manufacturing industries in respect of their involvement to GDP (IGEME, 2005). Additionally, industry exports have a big share (82%) in total exports. The main export sectors are textile and clothing, automotive and parts, electrical machinery, iron and steel, food products, chemicals, rubber articles, plastic articles, gold jewellery, ceramics, glass and furniture. The most important market for Turkey is EU countries with over the half of its total exports.

4.3. Product Development in Turkish Industry

With the free market economy after 1980, industrial design has gained considerable importance. The desire of Turkish industry to be an international brand has led them through a way which creates brands through design (Suel, 2006). Thus, as Suel (2006) states, a need was emerged for new product design development structure, bringing a new discourse for both the academic environment and the manufacturing industry. In other words, the industry had a desire to be in competitive market with their products, whilst academia aimed to meet the needs of educating new design professionals. Within this emerging context, the only professional organization in the industrial design field in Turkey, the Industrial Designers Society of Turkey (ETMK) was established in 1988, providing a bridge between designers and the industry. Another critical episode was the beginning of the EU accession phase 1995, which has changed the standards and priorities in Turkish industry. The Decree-Law No.554 was adopted in 1995, which aimed to protect the intellectual property rights of both industrial designers and firms in which industrial design is a part of their business. These show the course of industrial design and prove that industrial design has become more important in Turkish industry. However, there are still many steps to take before Turkish business in general fully understands and comprehends product design activities.

4.4. Stakeholders and Environmental Considerations in Turkish Industry

Turkey has been on the way of establishing sustainable development strategies on national level and adapting environmental considerations into the industry. This is nonetheless a new issue for both business and the government, and Turkey is still at the beginning of the journey. Literature review reveals that many topics related to environmental issues have been categorized under 'sustainability and sustainable development' with no direct focus to ecodesign. This shows the lack of specialization on this concept. For this reason, it is difficult to independently reveal the ecodesign-focused (industrial and commercial) activities in Turkey.

Table 1. Main outcomes of the reviewed ecodesign country or region research studies.

Case	France	Central America	The Netherlands
Description	A survey (Reyes et al., 2006) of approximately 100 foreign experts (e.g. European, North American, Japanese) and 150 French experts (consultants, researchers, and institutional managers).	A PhD thesis (Crul, 2003) that addresses the adaptation of ecodesign concept into a regional approach for Central America.	Hemel and Cramer (2002) executed a study of 77 Dutch SMEs.
Aim of the study	To understand the levels of the ecodesign integration in France. Especially to analyse the initial motivations, action drivers and evaluation factors of environmental performance levels.	To foster environmental aspects of products by describing the process of introduction of ecodesign in SMEs in Central America.	To discover which factors (stimuli and barriers) stimulate or hamper Dutch SMEs towards environmental improvement in their design process.
Main drivers	Management, relations with stakeholders, knowledge management (e.g. educating the team or determining a competent leader), the use of tools and methods, operational application in the product development and market and competition.	Cost reduction, brand image.	The opportunities for innovation, the expected increase of product quality, the potential market opportunities, customer demands, governmental legislation, industrial sector initiatives.
Barriers	Lack of top management commitment, the resistance to change.	Lack of external barriers such as legislation.	Conflict with functional requirements, commercial disadvantage, no clear environmental benefit, not our responsibility, no alternative solutions is available.
The region		Costa Rica, Guatemala and El Salvador.	
Mostly preferred strategies		Materials reduction, optimization of initial lifetime and efficient distribution.	Recycling of materials, High reliability/durability, recycled materials and low energy consumption.

Table 2. Main outcomes of the reviewed ecodesign country or region research studies.

Case	Baltic States	Northeast Brazil	European States
Description	The survey (Belmane et al., 2003) is prepared to inform governments, different international support structures and stakeholders about improvement of industrial environmental performance in the Baltic States.	Costa and Gouvinhas (2002) analyzed SMEs of Northeast Brazil to understand the directions of companies in relation to the integration of environmental issues in product development.	Comparative analysis by Tukker et al. (2000) conducted with 500 transnational companies from 15 EU countries in order to discover the implementation of ecodesign.
Aim of the study	To collect and evaluate present situation of eco-design and product development so as to discover prominent strategies for introducing the ecodesign concept in Baltic States.	To understand the internal and external drivers and also "roadblocks" in the companies.	To explore the methodological approach and the policy implications of the countries related to ecodesign by each country studies
Main drivers	Legislation, market demands, cost reduction, international legislations.	Legislations, competitor's initiatives.	International and national legislations, cost reduction, stakeholder pressure, customer demands, better product/market opportunities.
Barriers	Lack of information on market possibilities, lack of competence and external support, lack of financial support and information on new technologies, lack of education and information and training related to ecodesign.	Little awareness of environmentally-friendly products, the lack of available new technologies, the lack of available educated staff, instability of the Brazilian economy.	Missing understandable tools and strategies (language barriers and cultural barriers), less considerations on environmental benefits in companies.
The region	Lithuania, Latvia, Estonia	The Rio Grande do Norte State, Northeast of Brazil	15 EU countries (including Turkey)

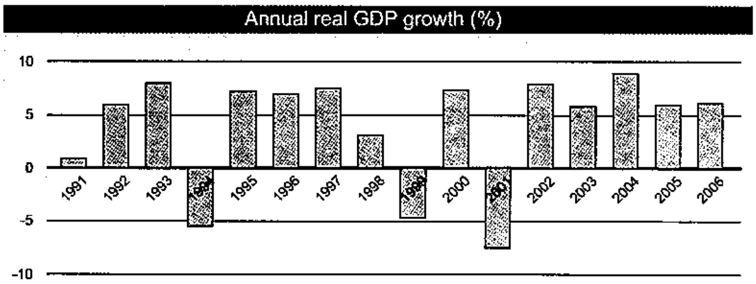

Figure 3. Annual growth of the Turkish GDP during 1991-2006 (The World Bank, 2006).

4.4.1. Policy Framework

The first step in Turkish policy related to environmental issues was the Government's Sixth Five-Year Development Plan (1991-1995) in which the need for undertaking environmental issues and economic growth were stressed (UNIDO, 2002). The principles for the important legislations on waste management and environmental impact assessment were formed in spite of little touch on sustainable development. In 1998, the National Environmental Action Plan (NEAP) was adapted, because there was a need to adapt a different approach to prevent pollution and solve environmental problems after the inadequate incorporation of the Seventh Five-Year Development Plan for 1996-2000 (UNIDO, 2002). The plan did not mention products explicitly, except the introduction of Eco-Management and Audit Scheme to private sector. The guidelines on EU's Eco-Management Audit scheme and ISO14000 were translated into Turkish and distributed to the industry which consists of two aspects, the evaluation of the organization, and the product.

The environmental directives affecting Turkish industry have been mostly discussed at Ministry of Environment and Forestry, and Ministry of Industry and Trade. Directive on Packaging and Packaging Wastes was in forced in 2005 and RoHS directive was in forced in 2008 whilst the studies for the implementation of other directives have being carried on (Table 3). Apart from these, CE Mark (i.e. mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements: Wikipedia, 2008) was enforced in 2002. Parallel to this, Eco-labeling is another remarkable study for environmentally conscious product development in the framework of adaption to the EU directives. As a result of the workshop conducted on eco-labeling by European Commission in Ankara 2007, the Ministry of Environment and Forestry decided to give priority to tourism and textile sectors. On the other hand, improvements in research and development (R&D) and innovation activities were emphasized as important facets for globally competitive Turkey in the vision of the Ninth Development Plan (2006). The statistics showing the investment on R&D and innovation activities are evidence to this support. These positive attempts also provide an appropriate base for new product development.

Table 3. Overview of the directives related to ecodesign.

Directives	Number	Foreseen transposition date	Foreseen Implementation / enforcement date
Directive on the End-of-Life Vehicles	2000/53/EC	2007	2008
Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)	2002/95/EC	2007	2008 in force
Directive on Packaging and Packaging Wastes	94/62/EC	2004	2004 issued 2005 in force
Directive on Waste Electrical and Electronic Equipment (WEEE)	2002/96/EC	2007	2008
Directive of Energy Using Products (EuP)	2005/32/EC	2008	2008

4.4.2. Existing Company Activities in the Field of Ecodesign

The Turkish industry has the seventh biggest share within the countries exporting to the EU (Yilmaz, 2008). This relationship has helped the Turkish entrepreneurs to improve their perspectives on environmental considerations in terms of production and management facilities. There are some high impact areas bounded by the international standards, like textile, electric & electronics, packaging and automotive sectors. The firms in these sectors have to comply with the international standards to export their goods to EU and to other countries. The nontariff barriers are other criteria for competitive international and Turkish markets. In that perspective, the number of Turkish companies having ISO14001 increased from 91 (in 2001) to 493 (in 2005) (Yilmaz, 2008).

According to the study of Korkut & Hasdogan (1998), which was conducted with 24 Turkish firms, environmental factors had little influence on design decisions. Eight years after this study, another study (Suel, 2006) illustrated a similar picture for environmental considerations as being one of the least important factors according to responses from 45 designers and 39 managers. However, there are studies to understand the drivers and barriers of environmentally-conscious design in the Turkish industry. Some inferences from these studies can be drawn related to cleaner production. According to the investigation of Yuksel (2008) with 250 big companies in Turkey, the problems to implement environmental considerations in production generally originate from educational and financial aspects which are the common problems that developing economies are facing with. According to the results of the same study, although Turkisb firms believe in the benefits of environmental technologies in both economical and competitive sense, they prefer end-of-pipe technologies rather than the more preventive and *pro-active* environmental approaches like ecodesign. This demonstrates the *reactive* approach of Turkish industry. Apart from these, the firms mentioned that the attitudes of the government are very important by means of the stricter environmental laws and financial support to industry. In this respect, the cballenge of government should not be only to lay down regulations but also should establish control mechanisms (Yuksel, 2008). As a final point, Yuksel highlights the establishing environmental information network as a main contributor to overcome the difficulties in the implementation of environmental considerations.

Consequently, the Turkish industry bas taken initiatives in view of the accelerating trend on the combination of ecology and production. It has been forced by the legislative pressures and international standards. Tbe financial problems and inadequate awareness on environmental issues make the implementation of ecodesign related activities difficult. Furthermore, product designers, in general, have little impact on the major decisions related to marketing or manufacturing (Suel, 2006), and in particular on the decisions related to the environmental aspects.

4.4.3. Ecodesign related training activities for companies in Turkey

In Turkey, DELTA (Developing Environmental Leadersbip towards Action) was one of the first programmes, which sets the first steps towards an efficient Environmental Management System (EMS). It was initiated in 1995 by Sustainable Business Associates (SBA). The purpose of DELTA is to make industrialists aware of eco-efficiency and to introduce them to new business risks and opportunities related to environmental issues (DELTA, 2004). In that respect, the chamber of Environmental Engineering in Turkey undertook the responsibility of setting up an agency office in order to introduce the DELTA Programme to Turkish companies between 2000 and 2004. In this period, the chamber of Environmental Engineering realized many projects within Turkish firms. Another important promotion activity, 'The Eco-design Awareness Raising Campaign' was carried out in 2005 in 20 countries all over Europe by the Fraunhofer Institute for Reliability and Microintegration (IZM). Turkish SMEs was one of the focus group for this campaign. It was an important ecodesign event for electric and electronics SMEs in some countries such as Bulgaria, Turkey, Romania, and the Czech Republic (IZM, 2005). In Turkey, BEKO and VESTEL provided examples of ecodesign implementations being performed in their companies and also TUBITAK discussed the 'Reliability Considerations in Ecodesign'. In that perspective, it can be said that Turkey has the lowest ecodesign awareness level and the infrastructure compared to EU members. Although this does not set a nice picture for Turkey, the ongoing projects and initiatives on large-size companies presented in the Campaign are setting good examples for other enterprises to reveal the benefits of ecodesign and to lead further implementations in the industry. To disseminate this sort of learning, as the continuation of 2005 the eco-design awareness raising campaign, a conference held by TUBITAK in 2006. This type of ecodesign related events are beneficial ways to enhance the awareness in the industry and introduce them to the key initial actions. They also offer informative and useful guidelines to keep continuous learning and development.

5. Complementary Study on Turkish Stakeholders

On the basis of the findings on the ecodesign integration in different countries, a network circle among the stakeholders in terms of the environmental aspects was noticed, wbich strengthen practices of ecodesign. The relation between stakeholder groups is a strong motivation for the integration of environmental considerations into the industry. Therefore, creating efficient networks between stakeholders is a good starting point to build a strong infrastructure before implementing the concept. To do this, it is essential to understand and to get insight in the current situation of the Turkish stakebolders. Therefore, to complement findings of the literature on environmental considerations in Turkey, a survey was carried out with three stakeholder groups (i.e. government, universities, and industry). The purpose of the questionnaire was to provide an insight into the Turkish stakeholders, opinions of people from key institutions through current and future developments, and to understand the nature of cooperation between the stakeholders. The survey covered five questions. 36 people from 24 different organization and institutions were contacted by e-mail. Of these, 23 people (industrial designers, engineers, researchers and managers) from 15 organizations/institutions responded to questions (see Table 4). Besides the questions delivered to the stakeholder groups, it was considered to be useful to get opinions of some key institutions that have important positions in Turkish platform in terms of product development and environmental improvement, including TTGV (Technology Development Foundation of Turkey), UNDP (United Nations Development Programme) Turkey, and Industrial Designers Society of Turkey (ETMK). The survey aimed to find answers to: i) importance of ecodesign for Turkey; ii) roles of industry about environmentally-conscious design; iii) positions that stakeholders take regarding environmentally conscious design or in a wider perspective sustainable development; iv) responsibilities that stakeholders should have to integrate or develop ecodesign in Turkey; and v) roles that stakeholders should play and activities they should undertake in supporting ecodesign. The answers are analyzed in relation to the perspectives of governmental institutions, educational institutions, business, and other stakeholders the highlights of which are as follows.

Table 4. The interviewed companies/organizations/institutions.

Universities	No. of Participants	Governmental Institutions	No. of Participants
Anadolu University Department of Industrial Design	1	The Scientific and Technological Research Council of Turkey (TUBITAK)	1
Marmara University Department of Industrial Design	2	Prime Ministry of State Planning Organization (SPO)	3
Istanbul Technical University Department of Industrial Product Design	1	Republic of Turkey Ministry of Environment and Forestry	3
Dokuz Eylül University Department of Environmental Engineering	1	Ministry of Industry and Trade	1
Manufacturing Companies	**No. of Participants**	**Others**	**No. of Participants**
Vestel (electric & electronics sector)	1	Technology Development Foundation of Turkey (TTGV)	3
İSTİKBAL (furniture sector)	1	United Nations Development Programme (UNDP)	2
Polinas (packaging sector)	1	Industrial Designers Society of Turkey (ETMK)	1
BEKO (electric & electronics sector)	1		

5.1 Perspective of Governmental Institutions

Two kinds of government perspectives were possible to distinguish. Some of them are optimistic about the developments in structure of the government and Turkish industry (especially electric & electronics, and packaging sectors). Others thought that Turkey is mostly at the beginning of the sustainable development. Main problems indicated were: the lack of implementation in the industry; and the lack of the bottom-up approach because of relatively low awareness level in the society. Suggestions made towards: more training activities related to ecodesign especially for SMEs about how ecodesign can be integrated and why it is beneficial in three dimensions: economy, environment and society. Importance of SMSs were mentioned since they do not have enough time and qualified employees but the implementation period is shorter than big companies due to the less hierarchy. Also, a champion, who is willing to take the responsibility and manage the network, was suggested.

5.2 Perspective of Educational Institutions

Answers to questions from educational institutions pointed out three main points: problems connected to being a developing economy; not optimization of design profession; and EU accession period.

Problems connected to being developing economy. Some of them indicated the conflicts between sustainability and political concerns and especially the permission of Turkey for employment of polluter technologies of foreign companies in Turkey. Likewise, another participant mentioned the cheap labor and poverty as one of the biggest challenges in Turkey. "Therefore, people can take any risk to earn money and regulations do not prevent it." In this respect, cost driver is expressed as a common criterion for the companies. Therefore, it is thought that besides internal dynamics, there have to be conditioned external pressure to push forward to industry like government and legislations.

Not optimization of design profession. In fact, the situation of ecodesign can be strongly associated with the state of product development activities. Among the participants, there was anxiety about the status of the industrial design profession in Turkish industry. It was stated that considering environmental issues or creating a new product regarding environmental quality of product was rarely seen as a role of industrial design in Turkish companies.

EU accession period. The impacts of EU accession period were emphasized before. As it is expected, in the interview almost all participants remarked the influence of the EU on Turkish industry. It is a common sense Turkey has to develop their own plan and framework for environmentally-conscious design and furthermore sustainable development. But Turkey is still trying to catch European standards according to the respondents. However, it was noticed that it is crucial to learn from the efforts and experiences of developed countries in the field of environmental problems in order not to make the same mistakes.

5.3 Perspective of Business

General interest within this section was in which context ecodesign matches or conflicts with the business benefits. They stated explicitly that principles of environmental sensitivity and trade are not parallel with each other since it requires extra cost, effort and time. For all companies, the key concern was to earn more money and profit. From that perspective, according to the answers, the environmental improvements have to overlap with economical benefits rather than to conflict. Another important issue was governmental initiatives. In general, participants associated integration of ecodesign into the companies with governmental encouragement by means of the legislations and financial incentives. Although they mentioned that it is not reasonable to demand everything from the government, they have rarely taken initiatives for stimulating environmental consciousness and disseminating implementation of it. Also valuable ongoing studies that are not known by the public are mentioned.

5.4 Perspective of Other Stakeholders

During the interviews, additional stakebolders appeared as important besides the defined stakeholders for the complementary study, wbich are TTGV, ETMK and UNDP. Tbey, in general, mentioned the reality of Turkish industry, which was mostly indicated before other participants. Then they combined these realities with some suggestions for the Turkey's future:

- The first step should be consciousness of industrial designer's role in the production by the industry. Then, designer can be seen as a big contributor/stakeholder for ecodesign and environmental considerations in the product development and production.
- Turkish industry should convince the benefits of ecodesign and furthermore it is emphasized with the successful implementations in the industry. Additionally, since it is closely related to consumption pattern and lifestyle of the consumer, the successful products should be introduced to consumer.
- Ecodesign becomes a compulsory aspect of production. It will be an inevitable subject in the future. Therefore, Turkisb industry has to match their strategies with the environmental considerations.

6. Conclusions

There has been a rising interest in the world on environmental issues in products, which is promoted mainly by legislative and market pressure. In parallel with the considerable improvements throughout the world, Turkey has also shifted its focus to environmentally conscious product development and production. However, these implementations have been fairly low compared to European countries. To evaluate present situation of Turkish industry, the paper first analyzed the recent studies on the adaptation and implementation of ecodesign in different regions of the world. Then, to complement the findings from literature, it explored four different perspectives of Turkish stakeholders. According to the analysis of the literature and the complementary study following conclusions could be drawn.

- Tbere are few directives put in force and many studies related to environmental policy and sustainable development in the government have been executed by the help of the EU accession period. However, it can be concluded that there is a lack of control mecbanisms and a lack of encouragement for the industry to produce more environmentally-conscious products.
- Training activities related to ecodesign are relatively low in the industry. This kind of information has to be disseminated by means of conferences, workshops. There also is a need for qualified people on this topic.
- For businesses, the most important consideration is cost (reduction). Therefore, while adapting the environmental considerations into organizations, they want to keep traditional methods in production or make minimum changes to cut down extra expenses. It is believed that more successful stories related to implementation of ecodesign will move industry towards more environmentally-conscious activities.
- A network of Turkish stakeholders has tried to be formed in particular projects and situations linked to environmental issues. There are some key intuitions like TUBITAK taking more initiatives to gather industry, academy and government. However, the relationship between stakeholders is not kept in long term because of their other priorities like commercial concerns.

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COLLABORATIVE INNOVATION IN FORMATION OF INNOVATIVE SUPPLY CHAINS

Alberto de la Calle[1], Esther Alvarez[2], and Jalal Ashayeri[3]

Abstract

Supply chain entities in many industries today must simultaneously improve the creativity and productivity of their new product development efforts. Given the fact that limited value is added by each entity, a growing array of sources is responsible to introduce new concepts to market. Innovators across the chain must integrate an increasing number of interdependencies among product development decisions, concurrently addressing customer needs/values, product technical specifications, delivery system capabilities, and environmental requirements. The shorter product/process lifecycles has contributed to the complexity of innovation process. It is clear that supply chain innovative potential is strongly influenced by its organizational / technological capabilities, and by its understanding of external relationship with other entities, ultimate customers, overhead policies, environmental needs, and economic trends. This paper is focused on the analysis of the main features that contribute to create an adequate collaborative environment for fostering innovation processes in the frame of supply chains.

Keywords: Innovation, Collaboration, Supply Chain

I. Introduction

The context in which firms are competing is more and more complex and dynamic: globalization of the markets, rapidly changing technology developments, shorter product life cycles, etc. Firms are forced to change or improve its performance continuously in order to be adapted as fast as possible to the customer requirements. In fact, the search of business strategies to answer the final customer demand or needs is becoming one of the main concerns of many enterprises. It is widely agreed that innovation is crucial for the long-term survival and growth of the firm (Schumpeter, 1939) and it has very important effects on meso and micro economic variables such as productivity growth, competitiveness and employment, although the exact relationships between these variables are not very well known (Edquist et al., 2001).

Innovation has been used to signify either new ideas or practices. Innovation is an idea that could be commercialized. Following the Oslo Manual definition, innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. According to the EU Green Paper on Innovation, innovation is:

- The renewal and enlargement of the range of products and services and the associated markets.
- The establishment of new methods of production, design, supply and distribution.
- The introduction of changes in management, organization design, the working conditions and skills of the workforce.

Following these definitions, innovation could be related to three main areas: product, process and management. Maravelakis et al. (2006) outlined the correlation between product and process innovation and stated that organizational innovation follows these two dimensions. The innovation process is the combination of activities, such as market research, communication, design, process development, organizational restructuring and so on, which are necessary to develop and support an innovative product.

Innovation establishes its basis on what the customers' value is and what they are willing to pay for it. Drucker (1985) suggested that innovation is based on creativity, systematic and order, and also on unexpected events, but in the end, innovation is based on associating a solution to a need. Companies do not usually innovate on

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their own. Some authors explained the interest of collaboration between firms and other organizations for innovation processes (Porter, 1998; Cooke, 2001).

Supply Chain is an interesting framework for understanding how collaboration influences the SC innovation performance. In the SC there are at least established minimum relationships based on buyer-seller links. This paper is focused on the analysis of the main features that contribute to create an adequate collaborative environment for fostering innovation processes in the frame of supply chains (SC).

The paper is structured into five sections. Section 2 presents the innovation and collaboration in the innovation process. Section 3 briefs the necessity of baving a collaborative innovation in forming innovative supply chain. Section 4 discusses a framework to introduce sustainable collaborative innovation process in supply chains. Finally, Section 5 presents brief conclusions.

2. Innovation and Collaboration

Innovation has gone through different stages ever since of industrial revolution, more specifically since the beginning of past century innovation concept has evolved as it is reflected in the different generations of R&D (Miller et al, 1999). These are:

- First Generation (1900s- before the First World War) emphasized the technical innovations carried out by scientists such as Edison.
- Second Generation (extended until the end of the Second World War) was based on in company innovation project management. R&D labs integrated into the companies in order to develop projects that served their needs directly.
- Tbird Generation (1970s-1980s) corresponded to setting up strategic tools in order to plan the R&D strategy, taking into account the financial risks inherent to its development. It was focused on continuous innovation, which refers to the results from improvements made to existing products on existing markets. The core processes of this generation are explicit customer feedback, input from corporate strategy and discoveries in new technologies.
- Fourth Generation (late 1990s – current) meets the difficulties raised by discontinuous innovation dealing with creating new products for new market through mutually dependent learning, which identifies the hidden needs of prospective customers and secure the technical feasibility and marketability simultaneously in the very early stages (Park and Kim 2006).

Tbe literature on innovation strategies is very extensive. Innovation strategies could have short, medium or long-term innovation objectives. Faems et al. (2005) reviewed the firms' innovation portfolio approach, pointing out that firms faced with multiple, often opposing, demands that confront them with the challenge of reconciling conflicting requirements:

- Incremental innovation vs. Radical innovation
- Innovation as continuous improvement through learning by doing vs. Innovation as creative destruction
- Flexibility to keep innovation options open vs. commitment to well-defined innovation pathways
- Divergent vs. Convergent behavior
- Exploitation vs. Exploration
- Path creation vs. Path dependence

When a supply chain is investing in deploying innovative strategy, it is important that the culture of innovation is adjusted accordingly. Any entity should begin its innovation journey with the end in mind; in this case, an effort to sustain innovation must be carefully planned and practiced among all entities to achieve the collaborative culture accelerating the introduction of new products or solutions. Companies which adopt innovation as a strategy would face several stages if they want to see an idea converted into a commercialized output. The proposal of analyzing innovation as a value chain suggests executives to view the process of transforming ideas into commercial outputs as an integrated flow (Hansen, 2007). The innovation value chain offers a comprehensive framework broken down into three phases; idea generation, conversion and diffusion and six critical activities (Figure 1). However this vision differs from the Open Innovation Paradigm (Chesbrough, 2003) due to different analysis focus. Chesbrough (2003) stated the Open Innovation paradigm. Through Open Innovation he declares that firms can and should use both external and internal ideas, as well as internal and external paths to market, as they look to advance their technology. Traditionally, innovation has been seen as a mere internal process through which problems appeared in organizations could be overcome, but so closed mind vision makes lose too many innovation opportunities. In the Open Innovation system enterprises are able to take advantages from other ideas generated or developed by other companies of the same or different sector, even if they are customers or suppliers (Figure 2). Hansen (2007) proposed a picture of innovation process within a company speaking about collaboration in the first stages of the innovation process (idea generation), while Open Innovation is based on the possibility of collaboration through all the innovation process stages.

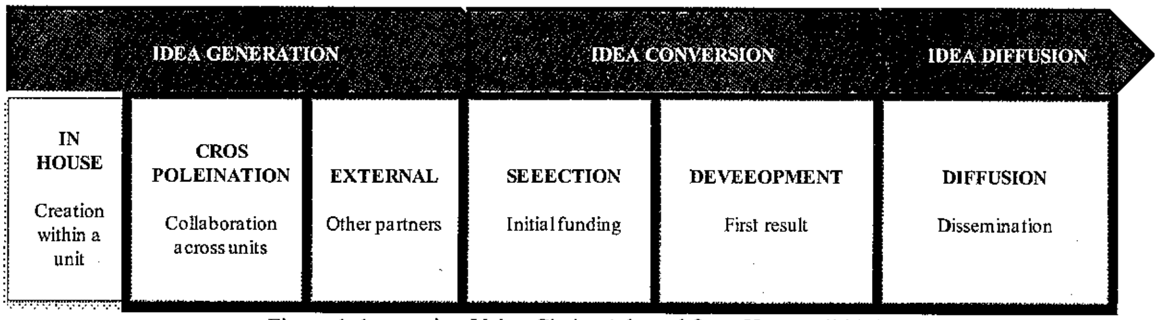

Figure 1. Innovation Value Chain. Adapted from Hansen (2007)

Today, the interest of collaboration is not any more limited to acquire knowledge but to have access to it. Procter & Gamble, for example, developed a model for collaborative innovation crossing the intra-enterprise barriers, changing the concept from Research & Development (R&D) to Connect & Development (C&D), (Huston et al, 2006).

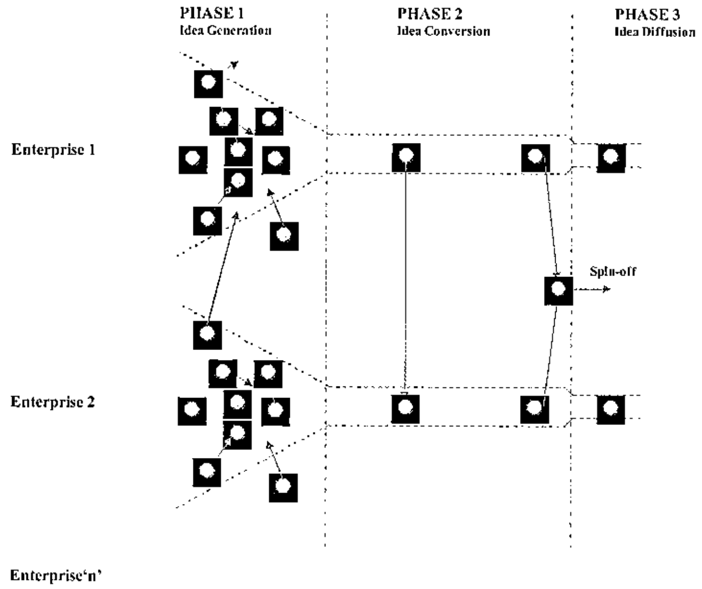

Figure 2.Collaboration between SC members. Adapted from Chesbrough (2003)

The development of Collaborative Innovation (CI) is seen as resulting from processes of interactive learning, i.e. there is often an exchange of knowledge between several organizations involved in innovation processes (Lundvall, 1992). CI enables the supply chain entities to rapidly engage and contribute, so that they readily add value given their own position in the SC. CI accomplishes this by:

a) creating an organizational learning atmosphere; previously Peter Senge (1990) proposed five disciplines for building learning organizations. Learning Organizations are where people continually expand their capacity the results they truly desire, where collective aspiration is set free and where people are continually learning how to learn together. This concept and its five disciplines have great sense on the SC collaboration for innovation context:
   - **Systems thinking** involve a holistic vision. This would allow individual entities to create a total value model..
   - **Personal Mastery** here for each entity is meant to identify where to focus innovation effort to add the most value for stakeholders, while seeing the reality objectively.
   - **Mental Models**: is meant for leaning to unearth the internal pictures of the each organization. This would allow each entity to rigorously scrutinize assumptions and decisions so that others in the chain can consider them and add value by identifying necessary adjustments and/or by embracing them based on clear understanding.
   - **Building shared vision** is the ability to share the picture of the future fostering genuine commitment and enrollment rather than compliance.
   - **Team learning** is the backbone of learning process, allowing collaborative working teams involved in a supply chain to systematically innovate and improve existing processes / products.

b) modeling the functional architecture of a product and its associated processes so that information is accessible to the core entities responsible for product / process innovation and those who support it.

- **Innovation functional requirements**, by analyzing these requirements across supply chain, defining the control logic for the collaborative work, and the required data flow also contained within the functional architecture.
- **Validation & Simulation**, the model can be validated, and completeness verified by simulation. A system dynamic based simulation would fit better the environment, where each function is described as a sub-system and their interactions are highlighted using causal loops.

3. Collaborative, innovative supply chain

A supply chain is traditionally considered as an operational function. Therefore, innovation is not the driver. When a SC is able to deliver the best value to their final customers, it will generate strong demand and builds customer loyalty to its products and services. As mentioned earlier innovation collaborative innovation among SC members becomes an essential approach in order to create sustainable competitive advantages. However, the usual strategies in innovation and approaches adopted and succeeded in the 80s and 90s, are no longer sufficient. Supply chain members must involve in effective experiments and innovation to reinvent the way they create value, since conventional business does not produce the desired results in fast clockspeed chains (Fine 1998).

Von Stamm (2004) considers collaboration with other firms and customers as the innovation's secret weapon. It is agreed that a substantial part of the innovation process occurs between buyers and sellers in the SC (Lundvall, 1988). Firms must look beyond their organisational boundaries and evaluate how the resources and capabilities of suppliers and customers can be used for creating exceptional value (Soosay et al., 2008) and through the optimization or effectively coordination of their links to the outside they would be able to create competitive advantages (Porter, 1985). Lambert and Cooper (2000) shared that vision pointing out that a real source of sustainable competitive advantage would rather be the ability to become involved and create value in innovation and improvement processes involving the whole SC.

The importance of collaboration was proved since Cooper et al (1997) stated that sub-optimization occurs when each organization in the SC attempts to optimize its own results rather than integrate its goals and activities with other organizations to optimize the results of the whole chain. This approach was already considered by Khandawalla (1973), who formulated that the optimization of isolated elements is not enough for having a deep impact on performance, but also the harmony among these elements. The objective of a collaborative strategy within the SC is to secure higher performance than would be achieved by operating individually (Lambert et al. 1999).

Interaction between SC members raises the innovation capabilities of the SC, but the way in which collaboration is canalized could affect final results. Strategic alliances, joint ventures, cooperative arrangements, virtual collaboration, vertical, horizontal or lateral integration, and outsourcing are some of the collaboration types that firms could establish. According to Spekman et al. (1998) relationships evolve from open-market negotiation, through cooperation, coordination, to collaboration, which is characterized by supply chain integration, joint planning and technology sharing among partners.

The discussion above all shows that in a dynamic environment, supply chains are forced to adopt an innovative supply chain management strategy to ensure success and long term survival. For best results, innovation should be engrained part of every process, and supported by the management. In the following section we explain how a sustainable collaborative innovation can be built in order to make the SC stand out.

4. Building sustainable collaborative innovation

Although collaboration is seen as one of the key elements to innovation, the failure rate of strategic alliances is projected to be as high as 70% (Elmuti et al., 2001). There are many difficulties encountered for achieving a true collaboration between SC members i.e. the difficulties for aligning the internal processes, Information Technology infrastructure, Trust, Organization design, Competition, Fear of external pressure, the presence of Powerhouses within the organization and Financial issues (Kampstra et al., 2006).

Considering the SC in the center of the analysis, collaboration for innovation in the SC as stated in the previous paragraph is directly related to some external and internal factors (see Figure 3). From the common understanding of these factors, a solid and sustainable collaborative strategy could be adopted in order to improve the innovation performance of the SC.

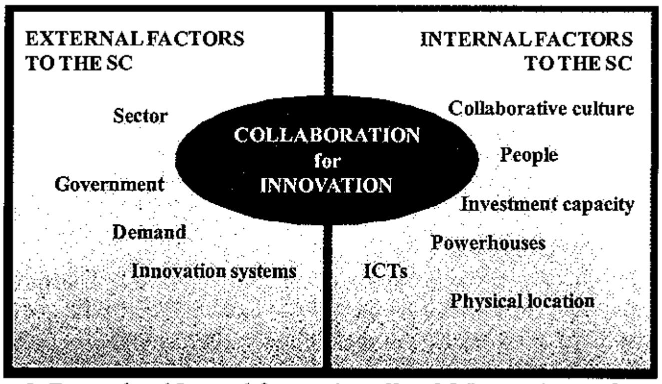

Figure 3. External and Internal factors that affect SC Innovation performance.

External factors to the innovative SC:

- **Sector**: The analysis through the 5 forces analysis proposed by Michael Porter (1979) determinates the ultimate profit potential of a sector. The maturity of the sector should also be taken into account.
- **Government**: Policies, special programmes for strengthening innovation, the creation of innovation spaces in which companies can interact with other innovation agents.
- **Innovation systems at macro-meso and micro level**: "Systems of Innovation" approach is an analytical tool used in several economic levels to understand the relationship between innovation efforts and innovation performance. This approach is already used in other economic perspectives as National (Lundvall, 1992), Regional (Cooke et al., 1998) and Sectoral innovation systems (Carlsson, 1995). The existing relationships through these systems could facilitate or make difficult the establishment of new links between SC players.
- **Demand**: The demand predictability establishes a singular configuration of the SC. The configuration of the SC influences the way a collaborative strategy could be built. With a predictable demand environment the most appropriate SC configuration should be focused on physically efficient processes, whereas with an unpredictable demand a market-responsive-process configuration fits better (Fisher, 1997). Analyzing from the innovation point of view, stable demand emphasizes incremental innovations instead of radical innovations.

Internal factors to the innovative SC:

- **Collaborative culture**: It deals with a collaboration strategy might be designed, developed, implemented and measured. This is a wide concept that includes other main characteristics, i.e. trust, visibility, sharing processes, etc. Currently, enterprises still organise their internal structures following a functional thinking rather than SC approach (Barratt et al., 2001). The desire to maintain the bargaining power of each department arises from this mentality. Externally the fear of small enterprises of being taken over by larger companies of the SC appears. Although collaboration is one of the objectives of enterprises, there is still a lack of collaborative culture.
- **People**: Even though a collaborative culture is adequate for establishing collaborative objectives, the final responsibility falls on the people that work day to day in this field. Social ability, behavior, motivation, their knowledge and experiences, their role and power in the decision making processes are some concepts that should be kept in mind.
- **Powerhouses**: The presence of power centralized in one or two firms in the SC could hinder or smooth the way to reach agreements. This factor could be omitted if the mutuality principle is applied from the beginning. Collaboration has no sense if the collaborative strategy partners do not assume mutual risk sharing and mutual benefit from the relationship.
- **Investment capacity**: Economic resources and investment capacity play an important role in that innovation value chain stages. The role is especially important in the second and third stages (idea conversion and idea diffusion) when the companies really bet for some ideas and rule out the rest.
- **ICTs and information exchange**: Successful collaboration requires a change of mind related to information exchange (Stank et al., 2001). It is not only the lack of connectivity or the lack of a common platform for information exchange but also the idea that free exchange of data, production schedules and financial information is needed to gain the full benefits of collaboration (Quinn, 1999). According to the degree of development of an innovation and its position following the three stages of innovation value chain, different amount of information is needed to be shared. Collaborative Planning, Forecasting and Replenishment (CPFR) is the most recent prolific management initiative that provides supply chain collaboration and visibility. By following CPFR, companies can improve supply chain effectiveness with demand and logistic planning and new product design (Attaran et al., 2007).
- **Physical location**: In spite of the degree of the advanced ICTs used and the volume of information exchanged, the physical location of the firms still have sense in this area of analysis. The proximity to the

customer or supplier, the personal contact and the possibility of arranging a meeting in the short term could increase the level of trust between firms.

Both external and internal factors affect the SC either directly or indirectly.

In the old, linear supply chain, product and information flowed primarily in one direction, and the information itself was limited and not timely. The new internal and external views would provide SC members a true collaborative innovation capability. The efforts involved in introducing such a collaborative process consist of the 8 steps shown in Figure 4.

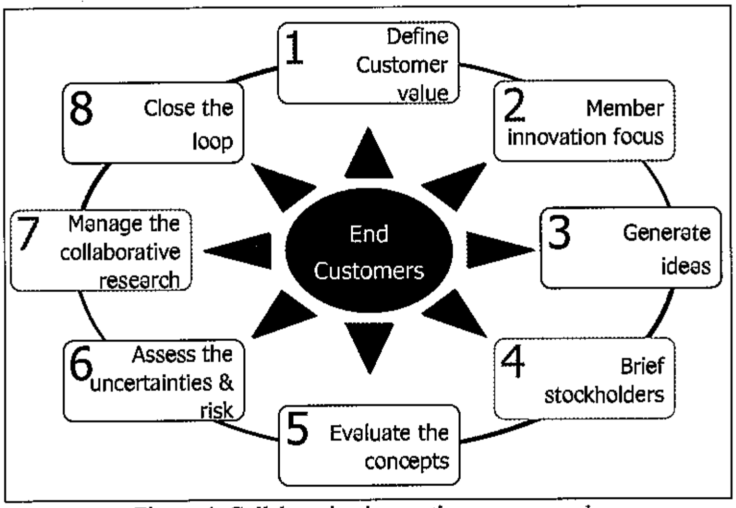

Figure 4: Collaborative innovation process cycle

(1) Define customers' value: this is the holistic system view mentioned earlier. This would be accomplished by individual entities to create a total value model. Based on input from ultimate customers, environmental requirements and laws, overhead policies, the involved parties translate these needs into a value-based measurement system that can be used to evaluate and select concepts that would benefit the entire supply chain.

(2) Members' innovation focus: this is to identify where, what effort is needed to add the most value.

(3) Generate ideas: in order to add value generating a wide variety of concepts is essential by all members, i.e. a platform to facilitate communication is then a necessity.

(4) Brief all stakeholders: funneled ideas can be communicated to all stakeholders for feedback.

(5) Evaluate the concepts: Evaluate concepts, using the value-based measures, and select those that can add the most value for ultimate customers.

(6) Assess uncertainties & risks: the main uncertainties and their associated risks are identified and assessed based on their occurrence likelihood. Then a plan is developed to reduce the risks as quickly as possible, reducing cost and time for rework.

(7) Manage collaborative research: primarily orientated towards coordinating research and development activities in order to stimulate and consolidate the supply chain members' efforts in achieving customers needs.

(8) Close the loop: this is to sustain innovation process and avoid inertia becoming the norm after a success story or disappointment with a failure preventing the process rolling forward again. Here strong leadership is a must.

The above approach should be facilitated by the functional architecture platform explained briefly earlier, and also through development of good practice guidance to help R&D people with different activities required to manage collaborative research projects.

5. Conclusion

In the dynamic environment of most supply chains collaborative innovation is a fundamental strategy for sustainable and profitable growth. Growth through collaborative innovation process is more efficient then setting up an independent innovation. Managing supply chain by cost can lead to a downward spiral and has limited potential for success. Instead, creating an innovative supply chain with a collaborative innovation culture can offer unlimited potential for success. Managing only the supply chain cost limits the freedom to innovate, while leading for collaborative innovation opens minds. This is a positive experience for everyone – however it involves own complexities to manage.

This paper discussed the benefit of collaborative innovation in formation of innovative supply chains and proposed a framework to implement this concept. CI makes the development process more efficient as dependencies are dealt with early in stage. Product or process design rework stemming from incomplete knowledge is reduced.

This will also rednce the costs as existing prodnct and process knowledge is leveraged across snpply chain. The success in the adaptations of Cl mainly depends on the involvement of all parties, the management, creation of learning organization, and availability of a platform to commnnicate bnt more than all proper nnderstanding of cnstomers' needs. The existence of trust cannot be ignored but will increase every time that collaborative innovation process cycle is completed.

Acknowledge

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A VALUE CHAIN FOR PRODUCT DEVELOPMENT IN THE CONTEXT OF CUSTOMER-RETAILER-SUPPLIER CHAIN: AN APPLICATION IN AN ELECTRONIC RETAILER FIRM

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Abstract

Aim of this study is to determine the technical characteristics of a product by listening customer voice and integrate customer voice to product development process of manufacturer. For this purpose, a questionnaire was developed and applied to customers of an electronic retailer firm. This firm is a distributor of laptop computer of XYZ brand. The data obtained from the questionnaire was analysed. 12 customer requirements about the selected product were classified into two groups; brand related requirements (5) and product related requirements (7). Two types of requirements were scaled separately within itself by end customers. Then 14 technical requirements were determined to meet to customer needs. These are three groups; brand characteristics (4), design/ergonomics characteristics (5) and performance characteristic (5). Quality Function Deployment (QFD) method was used to determine degree of relationships between customer requirements and technical characteristics. These results were delivered to manufacturing firm by the retailer firm to be able to recommend the related product characteristics and to integrate customer needs into product development process of the manufacturing firm. Thus, customer voice as well as end-user requirements about the product could be integrated in product development process by means of a value chain including customer, retailer and supplier.

Key Words: Value chain, Product development, Customer voice, QFD

1. Customer Value Chain Analysis and firm's manufacturing flexibility

Understanding customer requirements and values is fundamental to the definition of a product, particularly a new product. It is well known that deficiencies inunderstanding customer needs are the most prevalent failure mode of product development. When products are poorly defined, design teams have been observed to get 'stuck' in redefinition activities, so much so that the project cannot progress to detailed design because too many issues are unresolved (Wilson, 1993). It is now widely accepted that an insufficiently defined product results in less revenue for the design organization because the product is late to market or the market demand have changed from projections (Patterson and Lightman, 1993). It is estimated that 30% of the product development costs are locked in following product definition (Ullman, 1992).

The customer chain is a decision support tool, which is part of the 'Design for X' (DFX) set of methodologies (Herrmann et al. 2004). In today's world of globally distributed corporate partnerships, design teams, engineers and managers require an effective tool to capture and analyze the customer structure, the customers' relationships and each one's stake in the product. Customer Value Chain Analysis (CVCA) is an original 'Design for X' methodological tool used as a first step in the product definition phase to identify pertinent customers, their relationships with each other, and their value propositions. Use of CVCA requires business and organizational models to be established early and confidently in the design process. This ensures that knowledgeable decisions regarding product development can be consistently and systematically made based on customer needs and that weaknesses can be addressed prior to the commitment of significant project funding (Donaldson, Ishii, Sheppard, 2006).

In the era of time-based competition, supply chain must have ability to meet the customers' demands for ever-shorter delivery times and to synchronize supply during the peaks and troughs of the demand. To have this ability, supply chain must be responsive to the needs of the market. Responsiveness requires speed and high level of agility. Agility is business-wide capability that embraces organizational structures, information systems and in particular, minds sets. Agility means using market knowledge and virtual corporation to exploit profitable opportunities in a volatile marketplace. Literature on supply chain agility describes the dependence of agility on the characteristics of some performance variables. A total of 15 variables have been identified for developing a framework for agility improvement of case supply chain. Identified variables are: market sensitiveness, delivery

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speed, data accuracy, new product introduction, centralized and collaborative planning, process integration, use of IT tools, lead time reduction, service level improvement, cost minimization, quality improvement, minimizing uncertainty , trust development , minimizing resistance to change and customer satisfaction (Agarwal, Shankar and Tiwari, 2007).

Supplier involvement plays a major role in the development and performance of a firm's manufacturing flexibility. Not all supplier activities contribute equally to the development of different types of manufacturing flexibility, and manufacturing flexibility should be integrated with supply chain management. In practice, supplier involvement includes a wide range of collaboration activities such as just-in-time delivery, quality improvement, new product design, green purchasing and so on. It is learned from industry that those collaboration activities could improve firms' responsiveness to market demands. Both supplier involvement and manufacturing flexibility are multi-dimensional concepts; managers must understand how various supplier activities correspond to different dimensions of manufacturing flexibility. This knowledge enables firms to align their supply chain efforts with their manufacturing flexibility programs (Chang, Chen, Lin, Tien and Sheu, 2006).

Early supplier involvement is important in the product development process to reduce the time-to-market on new product. It is mentioned that direct communication with suppliers is inevitable to solve problems in the buying company's product development processes (Shin, Collier, Wilson, 2000).

Today customers are from every parts of the world; the supply chain strategy should have focus towards satisfying the customers. Without satisfied customer, the whole exercise of applying the supply chain strategy could be costly and ineffective. For improving performance, supply chain metrics must be linked to customer satisfaction. This measurement is needed to integrate the customer specification in design, to set the dimensions of quality, for cost control, and as a feedback for the control of process (Agarwal, Shankar and Tiwari, 2007).

2. Retailer Driven Colloboration

The objective of mass customization is to deliver goods and services meeting individual customers' needs with near mass production efficiency. Companies can embrace both cost efficiency and a much closer reaction to customers' needs. New flexible manufacturing systems, however, are a necessary but not sufficient condition for successful customer-centric strategies. The companies have to interact with the customers to obtain specific information that defines and translates the customers' needs and desires into a concrete product specification. In other words, the product is the result of a cooperation between all the interrelated parties. This collective design process implies a new form of cooperation. The result is a system of company-customer interaction (social exchange) and adaptation for the purpose of attaining added value. An important task for firms heading towards customer centricity is to develop and operate new kinds of customer interfaces and customer interaction systems. Cooperation needs building an efficient platform. In many cases, however, not only do the manufacturer and the customer have to collaborate, but manufacturers and other related bodies, especially retailers, must collaborate as well. Interaction skills and matching customization possibilities with the needs of a specific customer during the process of co-design are becoming the primary sources of competitive advantage (Berger, Möslein, Piller, and Reichwald, 2005).

In a traditional mass production, retailers are acting as a cushion between customers and manufacturers. In a co-design system, the manufacturer has to get access to information on each single customer in order to fulfill the customer's order, and potentially can match the retailer's advantage. As a result, there is a new demand for collaboration and cooperation between customers, retailers, and manufacturers. Customer co-design provides a very appropriate case to study new modes of cooperation that is relevant well beyond the niche of customized manufacturing. It is believed that co-design and customer-manufacturer interaction is becoming a characteristic of many commercial transactions, and thus understanding co-design and mass customization may lead to widely applicable insights (Berger, Möslein, Piller, and Reichwald, 2005).

Information exchange in the supply chain is considered crucial. The flow of information is the nerve center in any type of relationship, and is the essential flow in a supply chain (Chopra and Meindl, 2001). It determines the magnitude of, and the way the physical flow (involving the product flow from suppliers to end-customers and the reverse flow due to the recycling or the product returns and repairs) and the *cash* flow (involving the payment schedules and credit granting), are carried out. Information flow may range from the exchange of transactional data, through product configuration data, to technology and research and development matters. It must also be considered whether the information exchange takes place on a:

- *Nearest-neighbor* basis, i.e., information sharing is limited to adjacent entities (e.g., supplier-manufacturer, manufacturer-retailer, etc.) only;

- *supply-chain-wide* basis, i.e., information sharing takes place between all entities in the supply chain (e.g., supplier exchanging information with the retailer), not only between entities operating at adjacent stages (Lejeune and Yakova, 2005).

In retail-driven collaboration, the manufacturer is acting as a traditional contract supplier, with the difference that each manufacture requires a direct information flow to deliver co-design information to manufacturing. Only the retailer has full access to all customer information (being able to match configuration data with a customer's name). This model proposes clear advantages in relation to the *acquisition* and *assimilation challenges*. It can be assumed that retailers who are motivated by their own strategic motives to offer co-design are much more willing to invest in adequate customer interaction systems, provide training and incentives to their employees to support customers in the co-design process. Customers see "one face" and major interaction partner in this system, handling complaints and signaling trust. The retailer is usually the one to learn directly from the customers and develops capabilities to understand the broader needs of a customer interaction. However often retailers neither have the capability nor the motivation to transfer this knowledge properly throughout the supply chain, as they lack control over the different supply and manufacturing steps. On their side, manufacturers, often lack the absorptive capacity to take up this information. The major challenge of the retail-based collaboration model can be seen regarding the *exploitation challenge*. From the retailer's point of view (initiating and profiting most form the co-design system), introducing co-design and product customization shifts the sources of strategic advantage to another field. Compared to selling products from stock and competing on the capability to select the right location, bundle appealing assortments, and forecast inventory levels precisely, retailers now have to manage new issues like product design, complex product architectures, co-design toolkits, manufacturability, and individual order tracking. Every sale depends on cooperation with the manufacturer. This long-term extension of the manufacturers' set of competences can become a huge opportunity for retailers to "move upstream" increasing their share of the value chain. On the other hand, in a co-design system they depend more on the manufacturer than before and have to acquire knowledge and competences about the custom manufacturing process to handle the resulting principle-agent situation (Berger, Möslein, Piller, and Reichwald, 2005)

3. Methodology

PC Ltd. has been a firm that sells laptop computer since for seven years. This firm wants to review its sales policy by determining customer expectations and to determine its expectations from suppliers in paralel to technological developments. Therefore, questionnatiore method was used to achieve these aims. To determine customer wants, a questionnaire was developed. Then it was applied to end-user of the laptop computers. Questionnaire was constructed like following; in the fist section, demografics such as age, occupation, income was asked, then customer wants which charactericties should be involved in a laptop computer. It was wanted customers to determine importance level of the each charactericties.

Some characteristics of respondents are summarized in Table 1. Most of the respondents are 26-30 years old (% 65). Most of them are male (% 65). Most of their income change between 1500 YTL and 1999 YTL.

Table 1. some characteristics of respondents

Age	Per cent	Sex	Per-Cent	Income (YTL)	Percent
18-25	23	Male	65	<750	23
26-30	65	Female	35	750-1499	27
31 and above	12			1500-1999	31
				2000-2999	15
				3000<	4

Conmputer usage characteristics are summarized in Table 2. Majority of respondents use computer between 2 and 4 hours in a day with % 38. They use computer for job and entartaintment with % 46.

Table 2. Computer usage characteristics of respondents

Usage duration of computer	Percent	Aim of usage	Percent
Below 1 hour	8	Job	23
1-2 hours	15	Ertertaintment	31
2-4 hours	38	Job and	46

		entartaintment	
4-6 hours	27		
Above 6 hours	12		

Possessed brands of notebook are shown in Table 3. Majority of the respondents has HP brand notebook. This results show effects of recent sales campaignes of notebook firms. Specifically, HP, Packard Bell and DELL launched notebook models which price are below 1000$. 44 % of the respondent explained that they don't satisfy their notebook and prefer another brand as shown Table 3. 50 percent of the unsatisfied repondents prefer Toshiba.

Table 3. Possessed brand and preferred brand.

Possessed Brand	Per cent	Preferred Brand	Per Cent
HP	28	Toshiba	50
Packard Bell	17	HP	25
Dell	17	Dell	12,5
Siemens	11	Sonny	12,5
Toshiba	11		
Asus	6		
Sony	6		
IBM	6		

Retailer detemined significant level of the each criteria as shown Table 4. When weighted scores are investigated, it is seen that most important first five criteria are determined as following; (1) quarantee, (2) Hardware, (3) Quality/brand recognizability, (4) Wide service network, (5) Battery life

Table 4. Evaluation of each criteria by respondent

Which criteria are important for you when purchasing a laptop computer?								
	Criteria/Characteristics	Non-significant 1	Little significant 2	3	Significant 4	Very significant 5	Average Score	Significant level
1	Quarantee	**1**	**1**	**0**	**5**	**19**	**23,6**	**1**
2	Wide service network	**1**	**1**	**4**	**11**	**9**	**20,8**	**4**
3	Quality/ Brand recognizability, reliability	**1**	**1**	**4**	**10**	**10**	**21**	**3**
4	Price	**0**	**0**	**11**	**10**	**5**	**19,6**	**7**
5	Design and ergonomy	**0**	**3**	**9**	**10**	**4**	**18,6**	**8**
6	Battery life	**0**	**2**	**8**	**8**	**8**	**20**	**5**
7	AMD/INTEL selection	**3**	**10**	**8**	**1**	**4**	**14,2**	**10**
8	High second-hand value	**10**	**8**	**5**	**2**	**1**	**10,8**	**11**
9	Screen size and features	**0**	**3**	**8**	**13**	**2**	**18,4**	**6**
10	Hardware alternatives	**0**	**1**	**4**	**11**	**10**	**21,6**	**2**
11	Weight	**0**	**5**	**13**	**5**	**3**	**16,8**	**9**
12	Color	**7**	**10**	**7**	**1**	**1**	**11,4**	**12**

Then retailer and supplier make a collaboration and they prepare a quality house as shown Figure 1. Firstly, customer requirements are prioritized, then engineering requirements are determined as following; (1) Brand related factors: after-sale-service, service and duration, material quality, brand; (2) Design/ergonomy related factors: usage simlicity, multimedia factors, design, carrying simplicity, size; (3) performance related factors: speed, screen image quality, sound, using recent technology, additive hardware options. Secondly, customer requirement and enginering requirements are correlated according to scale of weak (W), fair (F), strong (S).

Thirdly, competitive anaylsis was performed. Firm was benchmarked with a its competitor. Then target value was determined acording to competitive analysis. We determined development factor by following formula

Development Factor = Target Value / Value of the Firm A

This value was calculated each customer requirements. Following this sales point was selected according to scale of 1.5 (strong effect), 1.2 (medium effect) and 1 (low effect). After that Absolute weight was calculated by following formula;

Absolute weight = Importance Degree X Development Factor X Sales Point

Then Customer requirements were sorting according to absolute importance. Most important requirements were determined as respectively design/ergonomy, quarantee, quality/brand recognizability, wide service network, hardware alternatives, battery life.

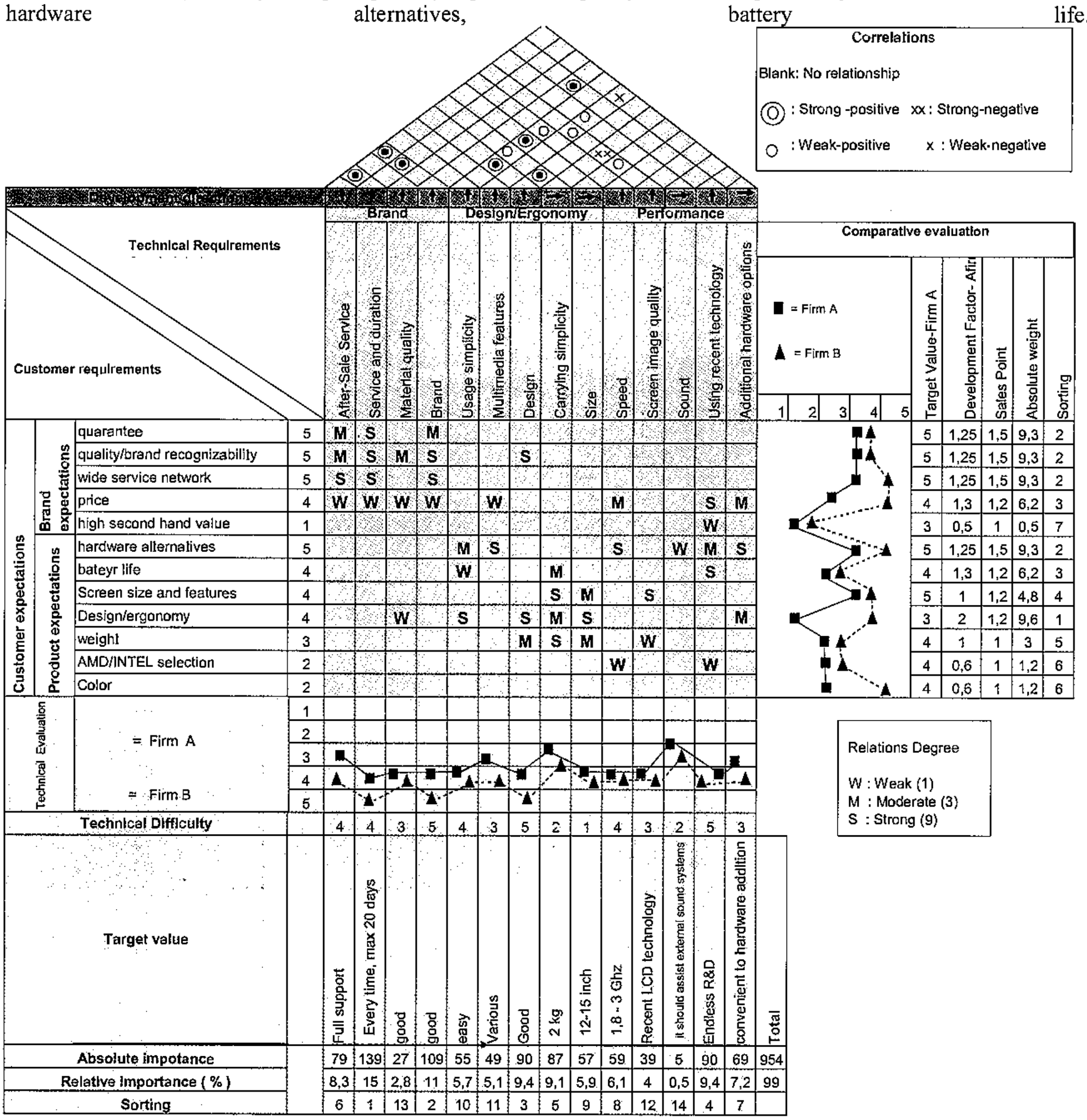

Figure 1. House of Quality for Laptop computer

We developed a technical evaluation of prior generation products and competitive products to access to competitive products to perform product or technical benchmarking. We performed this evaluation based on the defined technical characteristics. Then we developed a technical difficulty rating (1 to 5 point scale, five being very difficult and risky) for each technical characteristic by considering technology maturity, personnel technical qualifications, business risk, manufacturing capability, supplier/subcontractor capability, cost, and schedule. Then we developed preliminary target values for technical characteristics. After that we calculated absolute importance ratings and multiplied the customer importance rating by the weighting factor in each box of the matrix and add the resulting products in each column.

According to these rating results, service and duration, brand, design, using recent technology, carrying simplicity and usage simplicity were determined as most important technical requirements

4.Results

In this study, importance of retailer-supplier collaboration in product development proseswas tried to emphasize. In product development process, specifically, stage of determining customer requirements. Retailer can take over an important role. At the end of collaboration, product development process can be carried out most effectively. Customer requirement can be detemined by theretailer via questionnaires. The retailer can develops come suggestions about customer requirements and reflects these requirements to the manufacturing firm.The retailer firm recommends the related product characteristics and to integrate customer needs into product development process of the manufacturing firm. Thus, customer voice as well as end-user requirements about the product could be integrated in product development process by means of a value chain including customer, retailer and supplier. Then product development process carries out most effectively and efficiently.

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INVESTIGATING THE IMPACT OF VALUE CHAIN PRACTICES ON RETAILER'S PERFORMANCE: A CASUAL APPROACH

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Abstract

This study examines and prioritizes the importance of a number of factors related to retailer's performance with regard to bullwhip effect and total inventory cost from the retailer's value chain perspective. Inventory service levels and forecasting accuracy are selected as design parameters of planning function of value chain of the retailer in the study while seasonality is used to identify the environment where the value chain operates. Lead time is a parameter to represent the logistical practice of the value chain. In order to examine the integrated impact of these parameters on the selected performance metrics of retailer's value chain, first, a simulation model of a two-stage supply chain is developed where demand is assumed to be distributed linearly with seasonal swings. Then, an exponential smoothing forecasting and order-up to policy are used to manage retailer's inventory. Under different lead times and at varying forecasting parameters and service level assumptions, bullwhip effect and the retailer's total inventory cost are measured. Second, a series of univariate tests were undertaken to identify the relationships among the simulations outputs including total inventory cost, bullwhip effect, lead time, forecast inaccuracy and service level. Finally, based on a structural equation model (SEM), a research framework is developed and tested in order to investigate the casual links among the simulation parameters.

Keywords: *Retailer's performance, Bullwhip effect, SEM.*

1. Introduction

For contemporary businesses, the better management of value chain transactions and associated relations among the partners has a significant impact on coping effectively with uncertainties in supply chains. Uncertainty is generally defined as unknown future events that cannot be predicted quantitatively within useful limits, thus, making the occurrence of uncertainty unpredictable (Cox and Blackstone, 1998). The sources of uncertainty lie in the process of matching demand with supply. Delivery lead-times, manufacturing yields, transportation times, machining times and operator performances (Simchi-Levi et al., 2003) are the main source of supply uncertainty that has significant impact on chain performance. On the other hand, the difficulties in predicting customer needs and wants in a given period increase the importance of a good forecast even further. In fact, the ultimate success lies in the ability to manage the demand uncertainty with the existent supply capabilities.

The bullwhip effect, also known as Forrester or whiplash effect is one of the key areas of research in supply chain management (SCM) applications. It represents the phenomenon where orders to supplier tend to have larger variance than sales to the buyer and customer demand information is distorted (Lee et al., 1997a, 1997b). This demand distortion also propagates upstream stages in an amplified form. In return, high inventory levels and poor customer service rates along the supply chain constitute typical symptoms of bullwhip effect. In addition, production and inventory holding costs as well as lead times increase, while profit margins and product availability decrease (Chopra and Meindl, 2001:363). Metters (1997) empirically showed that elimination of bullwhip effect might increase product profitability by 10-30 per cent depending on the specific business environments.

Given the imperatives of intense global competition, the buyers dominate the market and present their personalized and customized requirements. Therefore, forecasting customer demand right is difficult, but extremely important (Ying and Dayong, 2005). Positioning the facilities in the chain and identification of their sizes, establishing the relationships among the chain members as well as the strategies used to run the value systems altogether help to identify the performance of a unit on the chain. It has been emphatically pointed out that understanding and practicing SCM has become an essential prerequisite to be able to manage demand uncertainties and to grow profitably in the global competitive race (Power et al., 2001; Moberg et al., 2002). SCM includes a set of approaches and practices to reduce the uncertainty along the chain through enabling a better integration among suppliers, manufacturers, distributors and customers (Koh et al., 2007).

The main purpose of this study is to examine and prioritize the importance of a number of value chain practices related to retailer's performance with regard to bullwhip effect and total inventory cost from the retailer's value chain perspective. Inventory service levels and forecasting accuracy are selected as design parameters of planning function of value chain of the retailer in the study while seasonality is used to identify the environment where the

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value chain operates. Lead time is a parameter to represent the logistical practice of the value chain. In order to examine the integrated impact of these parameters on the selected performance metrics of retailer's value chain, first, a simulation model of a two-stage value system is developed where demand is assumed to be distributed linearly with seasonal swings. Then, an exponential smoothing forecasting and order-up to policy are used to manage retailer's inventory. Under different lead times and at varying forecasting parameters and service level assumptions, bullwhip effect and the retailer's total inventory cost are measured. Second, a series of univariate tests were undertaken to identify the relationships among the simulations outputs including total inventory cost, bullwhip effect, lead time, forecast inaccuracy and service level. Finally, based on a structural equation model (SEM), a research framework is developed and tested in order to investigate the casual links among the simulation parameters.

The remainder of this study is organized as follows. The next section reviews the previous literature. Section 3 explains the development of a supply chain simulation model used in this study. Section 4 develops and tests structural equation model based on the simulation results. Conclusions are in the final section.

2. Literature survey

Forrester (1961) was one of the first studies identified the bullwhip effect and named it as 'demand amplification'. According to Forrester (1961), the causes of bullwhip effect are related to the internal system itself such as policies, organizational structure and delays in material and information flow, but not to the external forces. Later, Sterman (1989) noted that misperception of feedback loops and irrational reaction of decision makers to a complex and tacit system has created the bullwhip effect. By suggesting the training of operations managers on the bullwhip effect, Sterman (1989) thinks that bullwhip effect can be dampen down, because people have difficulties to realize the impact of their ordering decisions due to complexity of the system and the time lags between ordering and receiving. However, Lee et al. (1997a, 1997b) show that bullwhip effect is present; even if all members of the supply chain behave in optimal manner unless supply chain is redesigned with different strategic interactions. Their analytical study points out that the bullwhip effect stems mainly from four factors: demand forecasting, order batching, price fluctuations, and rationing and shortage gaming. In addition, Geary et al. (2006) include the following causes initially suggested by Jack Forrester and Jack Burbidge: control systems, activity times in the chain, level of information transparency, the number of echelons, synchronization and multiplier effect.

Following Lee et al. (1997a), several other researchers have also concentrated on the causes of bullwhip effect in order to understand their impacts on supply chain. Of these causes, the major emphasis has been placed on demand forecasting. Researchers relying on different methodologies have constructed various models to explore the impact of demand forecast. For example, Chen et al. (2000a, 2000b) used statistical methods; Anderson et al. (2000) adopted system-thinking methodology; while Dejonckheere et al. (2003, 2004), and Disney and Towill (2003a) used control-engineering methodology. All of these studies concentrated predominantly on the parameters of forecasting methods of moving average, simple exponential smoothing and double exponential smoothing to reduce the bullwhip effect.

The impact of lead time on bullwhip effect is another heavily researched area in the literature, e.g., Forrester (1961), Lee et al. (1997a), Anderson et al. (2000), Machuca and Barajas (2004). Under AR(1) demand process using order-up-to inventory policy, Chen et al. (2000a) support the significance of reducing lead times to mitigate bullwhip effect for moving average forecasting model in a two-level supply chain. Zhang (2004) also show that reduction of lead time has the most significant impact on the decline of bullwhip effect under mean-squared forecasting error (MMSE) where MMSE forecast yields the lowest inventory cost under the given conditions. For demand process with a linear trend using double exponential smoothing forecasting, Chen et al. (2000b) emphasized the importance of reducing lead-times to diminish the bullwhip effect.

Information sharing is also suggested in the literature as a remedy for bullwhip effect. While investigating the value of information sharing, Sari (2007, 2008a, 2008b) and Closs et al. (1998) stated significant inventory cost reductions for the entire supply chain and service-level increments under various operational and environmental factors. Relaying on real-life demand data, similar results are also expressed by Waller et al. (1999), Southard (2002), and Smaros et al. (2003). Zhao et al. (2002b) investigated the impact of forecasting models, demand patterns and capacity tightness of the supplier on the performance of the supply chain in terms of total cost and service levels. Their findings have emphasized the impact of the accuracy of forecast models on the value of information sharing. The supplier can improve its total costs and service level through information sharing in all cases, while total costs and service level for retailers may even get worse under information sharing when capacity tightness is low. Through a highly complex simulation model designed to measure the impact of information sharing on inventory levels, service levels and supply chain costs, Lau et al. (2004) claim that information sharing leads to cost reductions for all supply chain members, while decreasing inventory levels lead to high backorders.

Seasonality in the customer demand process is not widely considered in the literature. Bayraktar et al. (2007) simulate a two-level supply chain under linear trend with seasonal swings. Their findings reveal that bullwhip effect is low under high level of seasonality.

In fact, there are many other strategies to deal with bullwhip effect which can be summarized as follows: Sharing POS data with trading partners (Dejonckheere et al., 2004; McCullen and Towill, 2001; McCullen and Towill, 2002; Chen et al., 2000a, 2000b; Mason-Jones and Towill, 2000; Towill, 1997); echelon elimination (e.g. implementing vendor managed inventory) (Disney and Towill, 2003b; Forrester, 1961); training decision makers for more rational decisions (Sterman, 1989); and designing robust systems that minimize human interactions (Disney et al., 2004).

3. The supply chain simulation model specifications

This study concentrates on a simple two-stage supply chain that consists of one supplier and one retailer. The supplier provides a single product for the retailer, while the retailer fulfils the requirements of the customers at marketplace.

At the beginning of each period, t, the retailer receives the delivery of the supplier, which was ordered L periods ago by the retailer (the lead-time is L periods). Meanwhile, actual customer demand emerges at marketplace. The retailer fulfils the customer demand (plus backorders if there is any) by on-hand inventory, and any unfulfilled customer demand is backordered. After actual customer demand is satisfied, the retailer analyzes the historical data to forecast the demand using Winter's method for future periods. Based on this demand forecast, the retailer decides how many units to order from the supplier using its inventory control policy. Here, we assume that the retailer follows a simple "order up to policy" to manage its inventory in which the order up to point, S_t, is estimated from the observed demand as below.

$$S_t = \hat{D}_t^{L+1} + z\hat{\sigma}_t^{L+1} \tag{1}$$

where $\hat{D}_t^{L+1}$ is an estimate of the demand over lead-time and review period of 1, $\hat{\sigma}_t^{L+1}$ is an estimate of the standard deviation of the L+1 period forecast error, and z is a constant chosen to meet a desired service level (Chen et al., 2000b). It should be noted that z is also known as the safety factor. For the purposes of this study, service level is identified by the average percentage of fulfilled demand in a given period (Nahmias, 2005).

We assume that the supplier delivers all orders of the retailer after a fixed lead-time (L) so that it will simplify the retailer's replenishment policy. A similar assumption has also been made in several other studies in the prior literature (Aviv, 2002; Chen et al., 2000a, 2000b). However, when an order of retailer exceeds supplier's capacity, either the order is cut-off, or the lead-time is extended where both will in turn increase the variability of the retailer on order fulfillment (which is the supply capability for the supplier) as well as the bullwhip effect and inventory related costs. This may be incorporated to the model explained above by modifying Eq. (1) for stochastic lead times. In practice, however, supplier needs to adjust its capacity to match the demand in the long run where short term shortages can be negligible.

3.1. Generation of customer demand and retailer's demand forecast

It is assumed that retailer has a seasonal linear demand process. Different demand structures for retailer in the simulation model are generated using the following formula (2); in fact a very similar form for an additive time series is also used by Zhao et al. (2002b):

$$D_t = (base + slope \times \mathrm{t}) \times \left(\frac{[\mathrm{season} + \sin(\frac{2\Pi}{52} \times \mathrm{t})]}{\mathrm{season}} \right) + noise \times \mathrm{snormal()} \tag{2}$$

where Dt is the demand in week t, snormal() is a standard normal value of a random number between 0 and 1. Base, slope and noise are typical linear demand parameters and are assigned the following values of 1000, 3 and 200, respectively. Season represents magnitude of seasonality. In order to evaluate the impact of seasonality on the bullwhip effect, three types of demand structures representing different levels of seasonality are used: low, medium and high. For each level of seasonality in Eq. (2) the respective values of 30, 15 and 5 are assigned accordingly.

Since both linear trend and seasonality exist together in the demand model, Winter's (triple exponential smoothing) method for forecasting is employed in the simulation model. Thus, the retailer uses Winter's method to forecast the demand over lead-time. This forecasting method requires three smoothing parameters to update level, trend and seasonal components of the demand, which are represented by alpha (α), beta (β), and gamma (γ), respectively. More detailed information on this forecasting method is provided in Abraham and Ledolter (1983: 170).

3.2. Verification and validation of simulation model

A two-stage value system is simulated in Microsoft Excel. To verify that the program flows as intended, the conceptual model is divided into three parts: Demand generation, forecasting and calculation of inventory levels. Each part is then debugged individually to confirm whether the findings are in line with sample solution problems. Combined simulation model is also traced and tested with the results computed manually.

In order to validate the simulation output, the random demand variables generated by Excel is plotted on a scatter diagram so that the demand function in Eq. (2) is confirmed. The value system model above was simulated for 520 weeks. The initial parameters of the forecasting model were estimated by the first 156 weeks of simulation run, which was removed later from the output analysis to eliminate the warm-up period effect. Therefore, rest of the data was used for effective simulation output analysis. In addition, 20 replications for each scenario which represents a variety of combinations of the independent variables were conducted to fully explore the nature of the system. A detailed discussion of techniques to reduce the impact of random variations and also output analysis considerations in simulation studies can be found in Banks et al. (1996).

We also performed the sensitivity analysis for demand parameters by changing the values of base, trend and noise to allow increasing and decreasing demand structures. It has been further validated that the variation in the demand parameters does not affect our findings. Therefore, only one combination of these parameters with increasing demand is selected to perform the analysis.

3.3. Experimental design parameters

In order to measure the impact of various contextual factors on the bullwhip effect and the total inventory cost of retailer, a total of four factors which include, lead times, seasonality, service levels along with demand forecast inaccuracy as a function of the three forecasting parameters of α, β and γ, are simulated according to the parameters and their respective values, as shown in Table 1. Winter's forecasting method is used to anticipate the level of customers' demand based on three forecasting parameters referring to level (α), trend (β) and seasonality (γ) components of demand data. Forecast inaccuracy between the actual demand and forecasted value is computed by mean absolute percentage error (MAPE) to generate different levels of forecast accuracy. Then, three different levels for each of the six parameters are identified which will eventually produce a total of 3^6=729 different scenarios. In line with Winston's (1993: 1268) suggestion, the values of alpha *(α)* and beta *(β)* parameters of the forecasting model are selected as 0.01, 0.25 and 0.5. In a similar vein, the levels of gamma *(γ)* are set to produce different forecast inaccuracies (Bayraktar et al., 2008).

Table 1. *Independent factors of the experimental design*

Independent factors	**Levels**		
	1	**2**	**3**
Forecasting parameters:			
Alpha *(α)*	0.01	0.25	0.50
Beta *(β)*	0.01	0.25	0.50
Gamma (γ)	0.01	0.25	0.50
Seasonality	Low	Medium	High
Lead time	1-week	3-week	5-week
Service level	90%	95%	99%

From this experimental setup a total of two performance metrics are computed: Total cost of inventory for the retailer and bullwhip ratio. Total cost of inventory is the sum of the inventory holding costs and backorder cost of the retailer. Initially, unit holding and backorder costs are selected as $0.25 and $10.00 per week, respectively. Bullwhip ratio is the dependent variable of the design of experiment, and indicates the ratio of variance of the orders realized by the supplier to the variance of the demand observed by the retailer, *Bullwhip Ratio= Var(Order)/Var(Demand)*.

4. Results and discussion

The analyses used in this study are conducted in three stages. First stage involved simulation output analysis based on a series of univariate tests. In the second stage, a structural equation model is developed and tested using LISREL in order to test the impact of simulation parameters on the total inventory cost. Finally, a sensitivity analysis is undertaken to consider further the impact of backorder and holding costs on the research model. All these stages are explained in the following subsections.

4.1. Simulation output analysis

Out of 520 weeks of the simulation of the supply chain model delineated above, data from the remaining 364 weeks (from week 157 to week 520) for 20 replications were used for simulation output analysis. The extent of variation in bullwhip ratio with respect to simulation parameters of seasonality, lead time and service levels was examined based on ANOVA tests, while the variation between bullwhip ratio and forecast inaccuracy was identified by means of correlation analysis. Lead time was categorized into three levels including 1, 3 and 5 weeks; service level was measured in three levels, 0.90, 0.95 and 0.99; and seasonality was grouped under three different levels including low, medium and high. ANOVA test results indicate that both lead time (F=1,627.3; $p<0.001$) and seasonality (F=139.4; $p<0.001$) differ significantly in terms of bullwhip ratio. No significant difference, however, has been found for bullwhip ratio (F=0.00; p=1.0) regarding to different service levels. A significant association has also been noted between bullwhip ratio and forecast inaccuracy (r=0.481; $p<0.001$).

Similar analyses were also undertaken to examine the extent of variation in total inventory cost with regard to simulation parameters of seasonality, lead time, forecast inaccuracy and service level. ANOVA test results indicate that both lead time (F=3,329.4; $p<0.001$) and service level (F=695.0; $p<0.001$) differ significantly in terms of total inventory cost. No significant difference, however, has been found for total inventory cost (F=0.36; p>0.10) with respect to seasonality. Based on bivariate correlations, some significant associations have also been noted between total inventory cost and forecast inaccuracy (r=0.470; p<0.001) and between total inventory cost and bullwhip ratio (r=0.673; p<0.001).

4.2. Structural equation model

Since univariate analyses alone are not sufficient to test rigorously the relationships among the variables, a structural equation model (SEM) is developed in order to examine the causal links among contextual parameters, bullwhip effect and retailer's performance as denoted by total inventory cost, as shown in Figure 1. An SEM is a conceptual representation of the relationships between variables. It can be expressed in terms of a structural model that represents the theory with a set of structural equations and is usually depicted with a visual diagram. Advances in SEM techniques have made it possible for operations management researchers to simultaneously examine theory and measures. SEM as a comprehensive statistical approach is considered to be much superior to more traditional statistical techniques such as multiple regression, factor analysis and multidimensional scaling. The most prominent SEM technique is the maximum likelihood (ML) based covariance structure analysis method that is so-called LISREL (Bollen, 1989; Joreskog, 1970; Rigdon, 1998). LISREL analysis was used as a linear structural equation model for latent variables (Joreskog, 1970). The objective of LISREL is to show that the complete set of paths as specified in the model is reasonable and the operationalization of the theory is corroborated and not disconfirmed by the sample data (Fornell and Bookstein, 1982; Hair et al., 2006).

The first step in the analysis was to test the base path model as specified in Figure 1. LISREL first analyzes the data collected on the observed variables for evidence of model specification quality. The model fit criteria commonly used are chi-square (χ^2), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), Tucker-Lewis index and root mean square residual (RMS) (Schumacker and Lomax, 1996). An overall goodness-of-fit (χ^2) test with a *p* value exceeding 0.05 would indicate that the model is correctly specified. Goodness of fit statistics for the base model is shown in Table 2. For the base model, the chi square value of 104.58 (d.f.=7) has a significance level of 0.000 that is above the minimum threshold value of 0.05. The Goodness of Fit Index (GFI) is 0.998, which is close to 1 and accepted as a good indicator of an adequate model fit. The value of adjusted goodness of fit index (AGFI) is 0.993, which is more than the suggested threshold value of 0.80 and thus, it is considered as a good indicator of an adequate model fit (Hair et al., 2005). In this model, the root mean square residual (RMR) value was found to be 0.005 indicating a perfect fit. In terms of goodness of fit indices, there is a need to check further two indices, CFI and TLI. The values of both indices are 0.997 and 0.994, respectively, which are very close to 1. All of the model fit criteria for the path model are highly satisfactory that the base model was accepted to fit the data.

Table 2. Goodness of fit statistics

Model	$\chi 2$	d.f.	*p*	GFI	AGFI	CFI	TLI	RMR
Base model	104.58	7	0.000	0.998	0.993	0.997	0.994	0.005
Sensitivity model 1	84.00	7	0.000	0.998	0.994	0.998	0.996	0.003
Sensitivity model 2	66.14	7	0.000	0.998	0.995	0.999	0.999	0.001

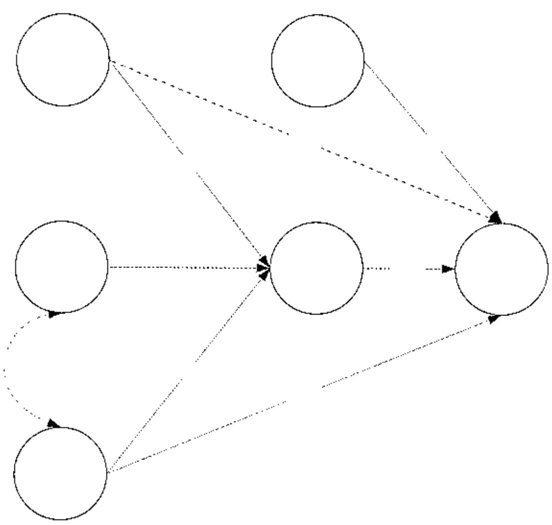

Figure 1. Results of the base LISREL model

The method of maximum likelihood was employed to derive parameter estimates for the structural equation model shown in Figure 1. Based on the SEM results, a strong relationship was found between total inventory cost of retailer and bullwhip effect which tends to confirm the previous research. Lead time was also noted to have a very significant influence on the total inventory cost of retailer. For a retailer who intends to reduce total inventory cost, the high bullwhip ratio and the long lead times appear to be the most important two areas to focus on. Another finding is that increased forecast inaccuracy leads to higher total inventory cost for the retailers. Indeed, the use of right forecasting technique with adequately selected parameters helps to improve forecasting performance as well as total inventory cost. Contrary to our expectations, Figure 1 sbows that the bigher customer service levels were found to be negatively associated with total inventory cost. That is, as the anticipated customer service level increases, total inventory cost will decline. This will be discussed further in the next subsection.

On the other hand, bullwhip ratio has strong positive association with lead time and forecast inaccuracy. The longer lead times and deteriorated forecast accuracies lead to exponential increments on the bullwhip ratio. In contrast to the expectations, the impact of seasonality on the bullwhip effect is somewhat surprising as it was emphasized earlier by Bayraktar et al. (2007). Retailers under bighly seasonal customer demand need to focus less on bullwhip ratio. A retailer, wbo wants to avoid from the bullwhip effect, should place more emphasis on increasing the forecast accuracy and then shortening the lead times without being preoccupied too much with the seasonality of the market demand.

4.3. Sensitivity analysis of SEM

In the base model, the ratio of backorder cost to inventory holding cost is selected as \$10.00/\$0.25 = 40. For a single period inventory problem such as a very well-known "Newsboy model" in the literature, this ratio refers to 97.5% probability of satisfying all demand in a given period. Zhao et al. (2002a) for their simulation model take this cost ratio as 50, which is roughly equivalent to 98% service level for a single period inventory problem. Zbao et al. (2002b) and Sari (2007) assume the ratio of backorder cost to the holding cost as 10 and 20, respectively. As exemplified above, there is no consensus in the literature about the value of the ratio concerning backorder and bolding costs, as it is contingent upon the product and the market conditions.

The research model shown in Figure 1 is further extended using different backorder to holding cost ratios in order to measure the sensitivity of the model in response to varying cost parameters. After experimenting many different value combinations, sensitivity models 1 and 2 are constructed using the value of 8 and 2 for the ratio of backorder cost to holding cost, respectively. Main characteristics of these two models lie in the method of selection of the value of standardized regression weights when measuring the relationship between total cost and service levels, wbicb is almost "0" for sensitivity model 1 and a positive value for sensitivity model 2. The goodness of fit indices shown in Table 2 for these two models reveal the adequacy of model fit. Table 3 shows that standardized regression weights for sensitivity models 1 and 2 are all statistically significant ($p<0.001$).

Table 3. Parameter estimates for LISREL model

Causal links[§]	Standardized regression weights		
	Base model	**Sensitivity model 1**	**Sensitivity model 2**
Total cost – Service level	-0.291*	0.014*	0.274*
Total cost – Forecast inaccuracy	0.252*	0.292*	0.298*
Total cost – Bullwhip	0.441*	0.379*	0.296*
Total cost – Lead time	0.436*	0.577*	0.644*
Bullwhip – Seasonality	-0.161*	-0.161*	-0.161*
Bullwhip – Lead time	0.409*	0.409*	0.409*
Bullwhip – Forecast inaccuracy	0.575*	0.575*	0.575*

*p< 0.001
[§]In() transformation is used for the variables of total cost and bullwhip.

It is clear from Table 3 that there is a negative association between service levels and total inventory cost in the base model. As the cost ratio declines, standardized regression weight of total cost vs. service level first reaches to the level of 0 in sensitivity model I and later takes a positive value in sensitivity model 2. That is, lower service levels lead to severe shortages which are penalized by high backorder costs. Hence, increased service levels contribute to lower total inventory costs. As the cost ratio reduces, so as backorder cost. With an increasing service level, it is expected to have many items inventoried. Therefore, total inventory cost increases commensurate with increased service levels, as shown in sensitivity model 2.

Sensitivity model 1 represents the turning point where the value of standardized regression weight of total cost vs. service level is roughly "0", which indicates that there is no relationship between total inventory cost and service levels. At this point, the value of cost ratio is 8, which refers to the situation backorder cost weighted 8 times more than holding cost. The experiments also show that the relationship between total cost and service levels are even insensitive to the varying cost parameters as long as the cost ratio considered above is maintained.

Reducing the value of cost ratio has some counter effects on the relationships between total inventory cost and other contextual variables. Reduction in the relative importance of backorder cost dramatically affects the relative importance of bullwhip ratio and lead time on the total inventory cost. Assuming low backorder cost, lead time becomes the most important factor influencing total inventory cost. The higher the lead times the higher the total inventory costs. However, under the same conditions, the explanatory power of bullwhip ratio over the changes in the total inventory cost diminishes. It can be inferred that bullwhip ratio becomes less important while lead time gains strength to explain the changes on the total inventory cost under relatively low backorder costs. Under these conditions, forecast inaccuracy becomes relatively more important. For the retailers to whom backordering is a viable strategy, it is not unreasonable to suggest that reducing lead times and increasing forecast accuracy are the key objectives to reduce total inventory costs. In case where backordering is not a favorable alternative, bullwhip ratio warrants more attention.

5. Conclusion

In order to explore the relationship between bullwhip effect and retailer's performance according to forecast accuracy, lead time, seasonality and service levels, a two-level value system with linear demand and seasonal swings was simulated under varying operating situations. Simulation model was verified and validated. For a total of 6 parameters and 3 levels for each parameter, 729 different scenarios were generated with 20 replications for each scenario.

Initial simulation output analysis was performed relying on a series of univariate tests. One notable finding of the analyses was that service level had no significant effect on the bullwhip ratio. In line with the prior literature, bullwhip ratio amplifies with the increased levels of lead time and forecast inaccuracy, while it declines with high seasonality. A similar analysis was also performed for the total inventory cost. While there were significant differences on the levels of lead time and service level for the total inventory cost, seasonality did not produce any significant effect on the total inventory cost. Both forecast inaccuracy and bullwhip ratio have significant associations with total inventory cost.

Since univariate analyses alone were not sufficient to test rigorously the relationships among the variables, a structural equation model was developed in order to examine the causal links among contextual parameters, bullwhip effect and retailer's performance as denoted by total inventory cost. While SEM tends to supports the findings of univariate analyses, it also establishes the relative importance of each factor through the standardized regression weights. For example, a retailer who intends to reduce total inventory cost should focus on the high bullwhip ratio and to reduce the long lead times. On the other hand, the longer lead times and deteriorated forecast accuracies lead to exponential increments on the bullwhip ratio. A retailer, who wants to avoid from the bullwhip effect, should place more emphasis on increasing the forecast accuracy and then shortening the lead times without being preoccupied too much with the seasonality of the market demand.

Finally, a sensitivity analysis was undertaken to consider further the impact of backorder and holding costs on the research model after finding that increased forecast inaccuracy leads to higher total inventory cost for the retailers. This occurs if the value of the cost ratio (backorder cost / holding cost) is higher than the value of 8 roughly as in base model. Sensitivity model 2 assumes a value for cost ratio less than 8, and then the associated relationship turns all the other way around. Under this condition, lead time becomes the most important factor influencing total inventory cost; however, the explanatory power of bullwhip ratio over the changes in the total inventory cost diminishes. For the retailers to whom backordering is a viable strategy, it is not unreasonable to suggest that reducing lead times and increasing forecast accuracy are the key objectives to reduce total inventory costs. In case where backordering is not a favorable alternative, bullwhip ratio warrants more attention.

Other than the assumptions of the model, main limitation of the study lies in the consideration of only the direct effects of inbound logistic activities on the retailers. In fact, in many real world applications retailers may get some indirect benefits through information sharing, collaborative planning and replenishments, which are not considered in the assessment of retailer's total inventory costs.

The paper may be expanded to analyze the individual impact of many parameters used in the study on the overall inventory cost. Different marketing, inventory control policies and service levels may be considered to further evaluate the retailer's performance.

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INNOVATIVE ANALYSIS OF A CRM DATABASE USING ONLINE ANALYTICAL PROCESSING (OLAP) TECHNIQUE IN VALUE CHAIN MANAGEMENT APPROACH

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Abstract

In this paper, we emphasize the main capabilities of a CRM software, which integrates three aspects that provide value chain sustainability: operational (marketing and sales automation), collaborative (the relationships between companies' representatives and customers) and analytical (the opportunity to apply OLAP technique on CRM system variables).

The multidimensional analysis applied to the information gathered on CRM database provides a real support in view to make an efficient decision by the managers that are responsible for the business development, centered on profitable customers. The OLAP technique emphasizes the interdependences between the different variables of CRM system in order to value the information about customers, which represents the "digital gold" in the e-business approach.

Keywords: CRM, online analytical processing, information and communication technologies, branding, logistics

1. Connecting CRM systems to branding strategies

The value brought by the customers to the companies differs according to the specific of the business relations developed with them. In order to quantify the customers' profitability, the performing companies have created and developed information systems of CRM focused on the value of the data warehouses which stock a large amount of information collected as a result of the interaction with the customers during the stages of their life cycle. Due to the flows of information, the software designed for CRM, adaptable to each company's specific, allows the analysis of the information related to customers and the identification of the clients segments according to the profitability they generate; at the same time, it presents communication abilities with the customers in real time, ensuring a high receptivity of the companies' needs and the customers' requirements.

CRM systems record customer preferences and histories but are often isolated in one part of a company. By strategically linking CRM systems to branding strategies, companies can pass valuable sales or service data to the right customer. The brands achieve competitive advantage by reinforcing sustainable emotional bonds with target consumers who are aligned with their distinctive positioning. These bonds are taking on new importance as consumers exert unprecedented control over CRM interaction and as categories become increasingly fragmented.

Based on great amounts of advertising expenses on all types of markets, brands have looked toward alternative methods of targeting customers. CRM is one route that brands use in order to increase consumers' expenses. The CRM managers need not to only analyze customer spend by product, but across the whole product/service range in order to manage revenue effectively. Customer centricity enables businesses to think not only about product profitability but also about customer value, and to develop brand extensions strategies connected to customer value management models that are designed to appeal to their best customers. With the most profitable informing the brand extension strategy, the success chances are greater in the e-business environment.

In our opinion, the branding strategies must be connected to the following CRM activities:

- Identifying key customers targets and their needs in order to realize the best offer positioning;
- Defining the brand architecture and core value propositions to customers;
- Aligning brand assets to the organizational culture in view to reinforce brand promise at every contact point with customers;
- Developing innovation programs that expand brand relevance and impact;

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- Creating effective, target-specific brand communications and personalized marketing programs.

A well implemented branding concept relied on a successfully CRM strategy can focus a product or a service as being the best on its market target by capitalizing its competitive advantage or an absolute innovation in its industry. Putting the branding strategy in the core of a business helps the CRM specialists understand how to extend and manage their brand, how to prioritize their product line and how to structure their organization for delivering satisfaction to all the customers.

The information systems designed for CRM must answer the informational needs of the project managers, so that they can take the most efficient decisions referring to the acquisition of new customers and the development of branding strategies.

The design of the CRM information systems in value chain management approach must be based on the following characteristics:

- **The top–management involvement** – supposes a business philosophy centred on customers and a general manager that should have a strategic vision on the information systems and their role in the increase of the business processes efficiency, especially those which serve directly the customers;
- **The focus only on the real needs of customers** – involves the knowledge of the selection and analysis procedures of the information referring to the customers within the data deposits;
- **The availability of the data sources** – before the implementation of an information system, the CRM project manager must make sure of the existence of some multidimensional data bases, in which there are stocked large amounts of information derived from the potential or actual customers;
- **High flexibility** – while the information needs of the CRM project managers evolve and change in time;
- **Possibilities of continuous up- to- date** – an information system designed for CRM can't be exploited without having some permanent accomplishments to satisfy the changes in the business environment in which the company is involved.

2. The definition of the design specifications and implementation of the CRM information system functions

The CRM software that we created and developed is designed for small and medium companies and has as a purpose the customers and their sales management on a certain period of time. These data represent the basis for generating some cubes that will allow the carrying out of some multidimensional analyses on the sales using the OLAP technology (On Line Analytical Processing). The information resulted from these analyses represents a real support for the marketing managers of the organizations, responsible for the strategies oriented towards the complete satisfaction of customers.

The main characteristic of this information program is its **personalization** capacity, according to the concrete situations at the companies' level; thus, we considered appropriate to offer our users the possibility to configure the products categories, the offers, the information referring to the customers, necessary for the development of the CRM projects.

The CRM application was developed using the Borland Delphi 7 technology and for the data stocking there was used an operational database with Paradox 7 type charts. In order to generate the data cube, a SQL Server 2000 relational database was used, which was previously completed with data from the operational database. This functionality was implemented within the CRM application by means of a transfer function.

In order to generate the enthusiasm and implicitly, the customers loyalty, every organization must efficiently manage a data basis of opt-in type, that ensures the application of the marketing concept based on permission, according to which there is the previous agreement of the potential or effective customers to dispose personal information to the companies, so that they could send them personalized offers according to the preferences expressed by them. The information stocked in the databases (obtained by means of the direct contacts with the sales representatives, as a result of some marketing researches, registrations on the companies' websites, etc) allow a division of the customers' portfolio, the determination of a customer profile and an efficient position of the offers on the market. The CRM information program offers to its users a **way of sending personalized e-mails** to the persons included in the databases in order to facilitate the on-line communication with the customers.

The main **functions** of the CRM information system that makes it original from other systems of the same type by the approach manner are:

- **the processing of the transactions carried out by customers**, the customers' invoices being registered in the system's data basis; this function is found in most of the information programs designed for CRM;
- **the on-line communication with customers**, the CRM managers having the opportunity to send newsletters or any other kind of marketing messages to the customers:

- **the promotion and loyalty programs management**, in function of the number of fidelity points determined for each customer on the basis of the algorithm implemented in the software; we offer to the users of this application the option that allows to allocate special offers for predefined points levels;
- ***the multidimensional analysis of the sales***, based on different segmentation criteria (product type, occupation, sex, revenue level, etc.).

We appreciate that our CRM software offers the capacity **to provide value chain sustainability** as **it integrates brand, design and logistics:** in this way, we applied it to a company which its main activity domain consists of clothes' production and selling; the software allows the introduction of company's brands and the design of each product and the multidimensional analysis of sales provides information for logistics department in order to guarantee the products' availability in the points of sale and customers' satisfaction.

The evaluation of the CRM software functions was performed by gathering in the application a sample of products, customers and sales and their transfer in Microsoft SQL Server in view to realize a multidimensional analysis based on OLAP technique.

3. The application of OLAP technique for the multidimensional analysis in the CRM system and its integration with logistics

One of the multidimensional analysis that can be performed by the means of the information transferred in SQL Server database consists of the sales allocation on personalized products, in function of different segmentation criteria. In this way, marketing managers can identify exactly the products positioning when they develop customer value management strategies.

The data transfer from the operational database integrated in the CRM software to SQL Server offers the possibility to view the tables diagram, accessing Enterprise Manager option (figure no. 1.1)

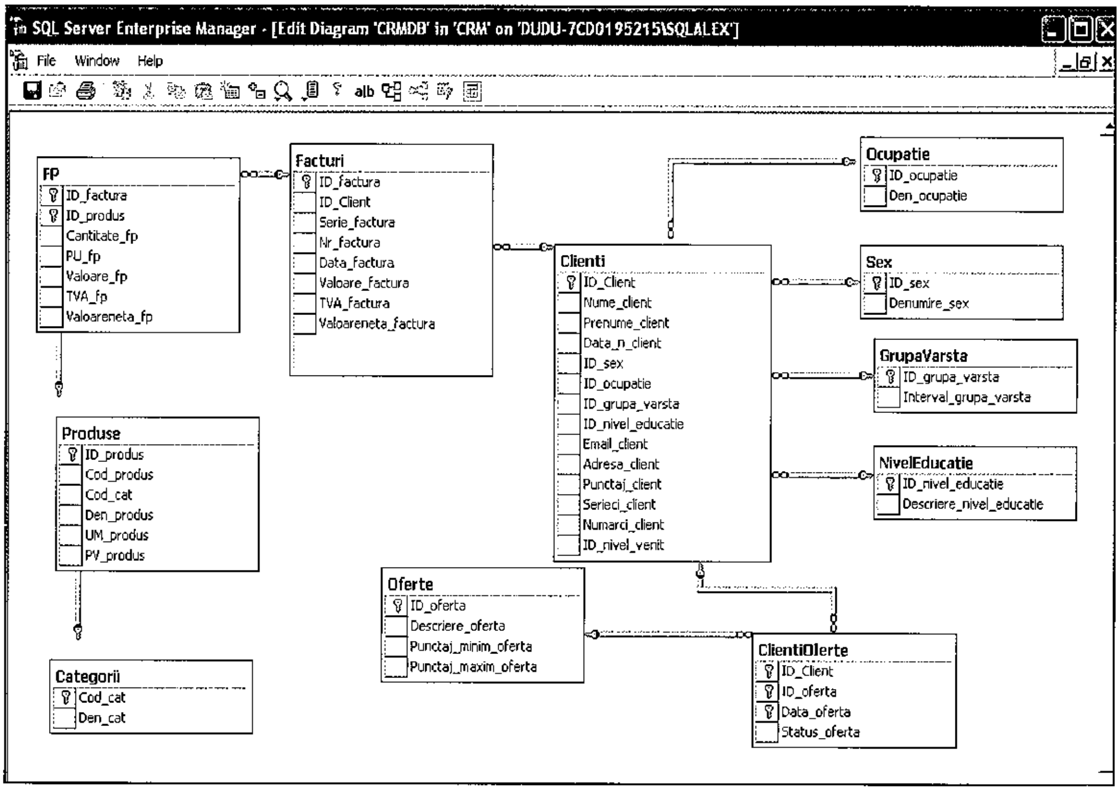

Figure no. 1.1 – The visualization of network diagrams between CRM application tables

The multidimensional analysis can be realized using a Pivot Table from Microsoft EXCEL, in which we import an external data source - the operational database from CRM software. The analysis using OLAP technique is facilitated by the creation of a cube with SQL Server functions.

The sales analysis based on two segmentation criteria (the education level and the intervals of customers' age) is revealed by the OLAP cube generated by Microsoft SQL Query Analyzer using the following script (figure no. 1.2)

The *analysis dimensions* are the products categories, the products names, the intervals of customers' age and their education level, while the *analysis measure* is the sum of all invoices' values inserted in the database. The pivot table opened in Excel sheet allows a lot of analysis for the entire values domain of the dimensions or selecting several values, in function of the user's specifications.

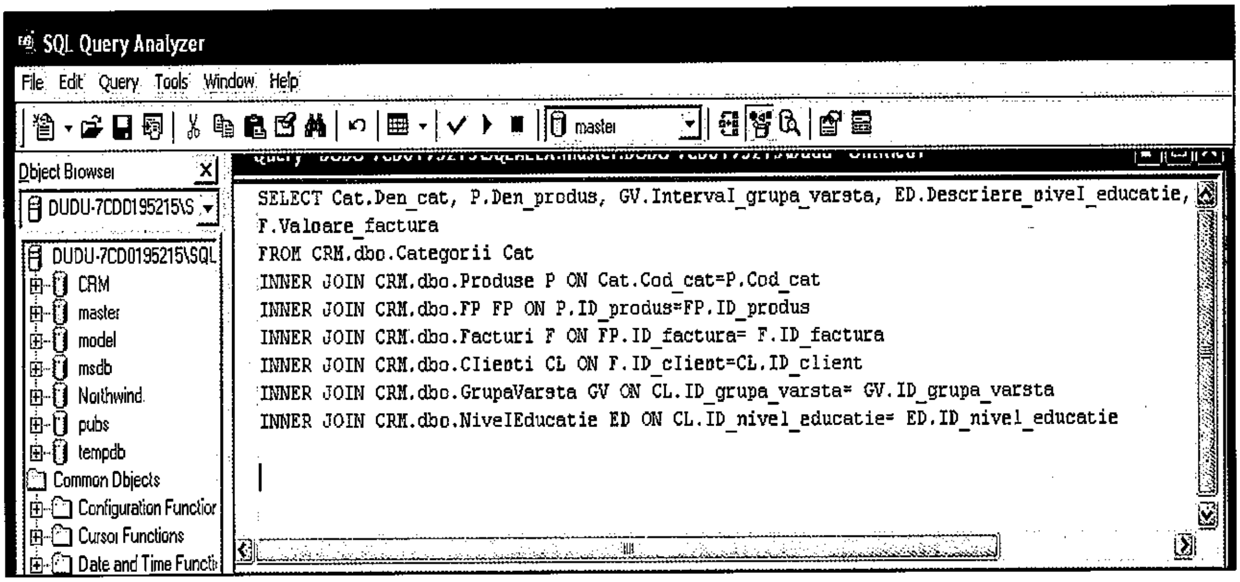

Figure no. 1.2 – The SQL script configuration in view to generate the cube for sales multidimensional analysis in function of specified criteria (the education level and the intervals of customers' age)

After launching in execution the query presented in the figure no. 1.2, the wizard of Microsoft Query allows the option to link the cube dimensions by transferring them in the OLAP analysis module and requires the configuration of the analysis measure - the sum of all invoices' values. (figure no. 1.3 and figure no. 1.4)

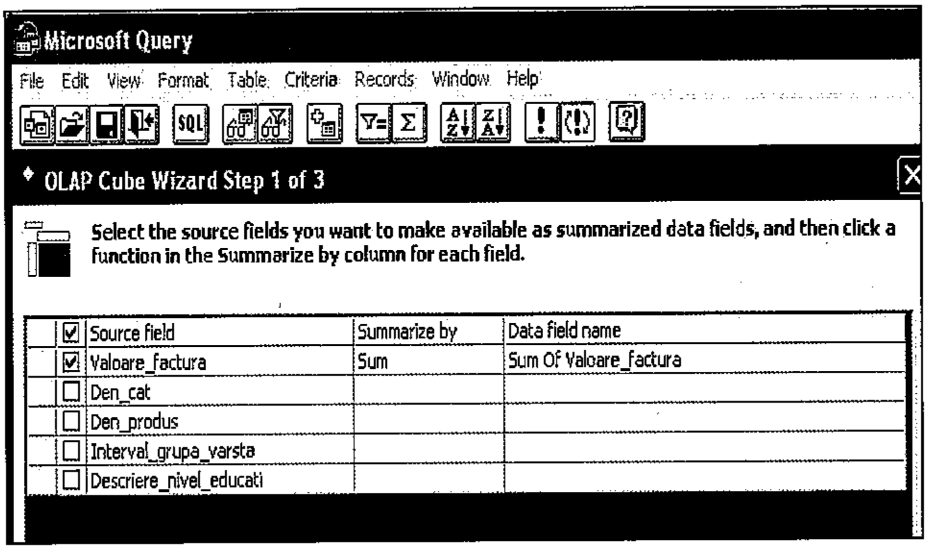

Figure no. 1.3 – The selection of the pivot table from data cube

Returning to the Excel sheet, we can distribute the cube dimensions on rows and columns, taking into account the fact that the pivot field (the sum of all invoices' values) must be distributed into Data Area, determining the dissemination of the sales on four aggregated dimensions (the products' categories, the products' names, the intervals of customers' age and their education level) (figure no. 1.5)

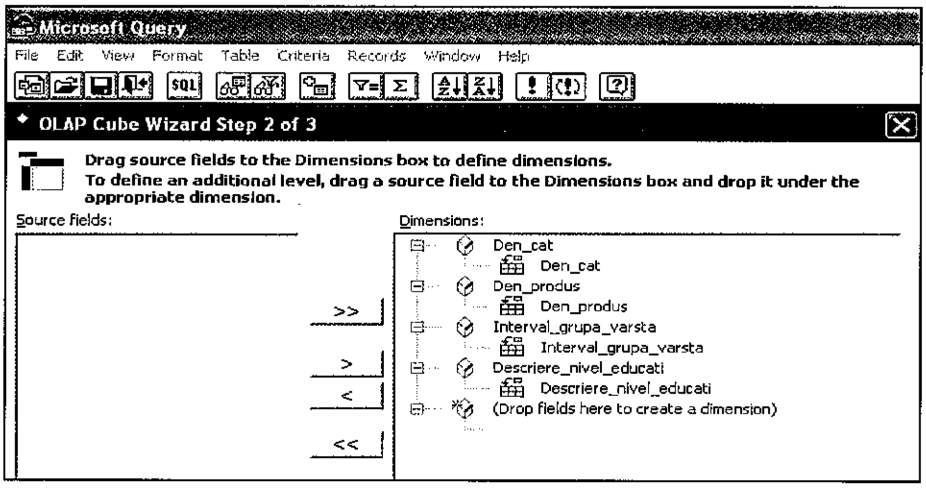

Figure no. 1.4 – The transfer of the aggregated fields in the cube dimensions

The goals and decisions from logistics domain are close related to CRM objectives, both from the aspect of customers' expectations and needs satisfaction and from the perspective of customers' profitability. The accomplishment of the CRM goals imposes the existence of a logistic system that is able to offer time and place utilities wanted by the customers.

Our CRM software provides a unique database that gathers information about products, customers, leads, personalized offers and invoices helping the processes of sales force automation and the quick search of information about sales analysis, the visualization of sales reports on each brand and product, offering a fast response to the requests of **Logistics Department** of a company.

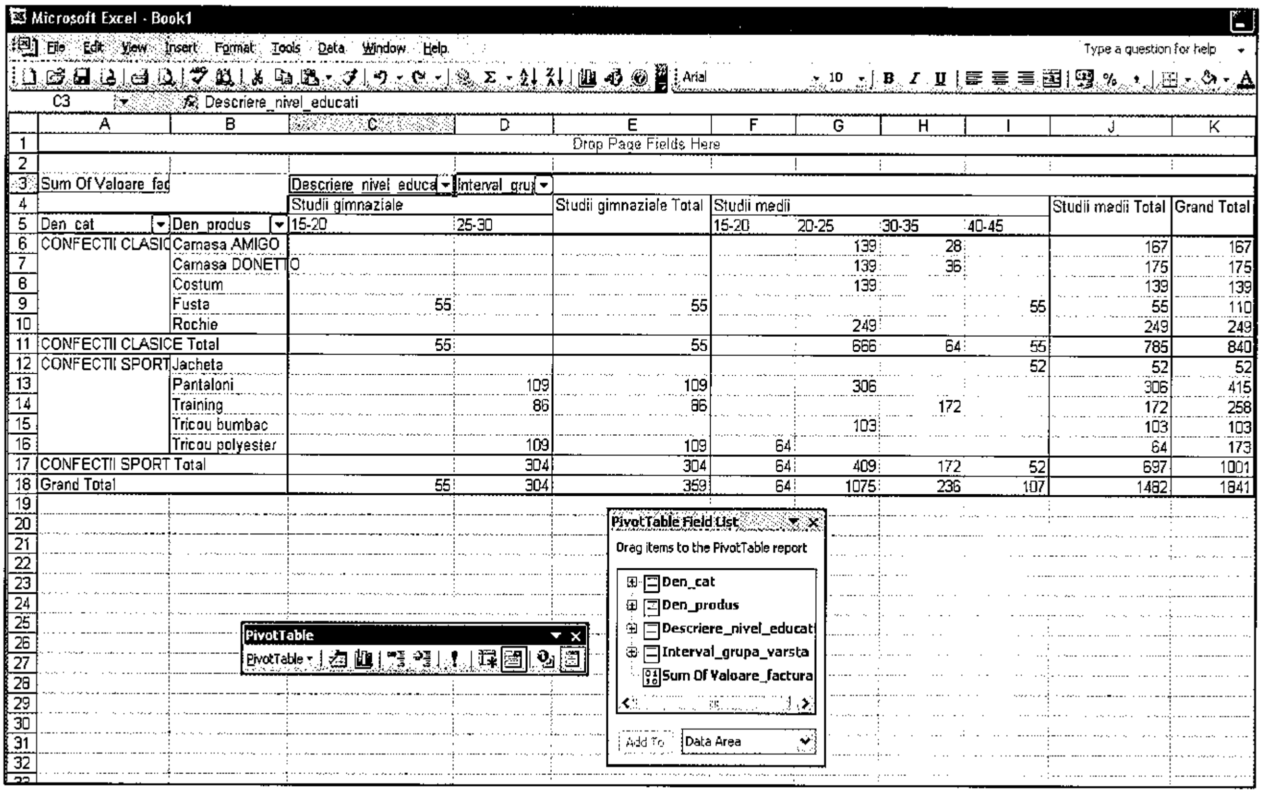

Figure no. 1.5 – Sales multidimensional analysis using OLAP technique – support for Logistics Department activities

We consider that the CRM system that we developed can be used in integration with logistics as it emphasizes personalized sales reports for each product and brand and in this way the specialists from Logistics Department can observe in real time the availability of products to the distributors' level.

Conclusions

In the context of Value chain management approach, the companies must use in an optimal combination all the communication channels with customers: the dealers, the customer care services, the web portals and other CRM techniques, in order to assure the customers' satisfaction. The performing companies are focused on three strategic priorities: the increase of customers' life cycle, the increase of the average expenditure for each customer and the decrease of costs associated to customers' acquisition using the new information and communication technologies.

We consider that the multidimensional analysis applied to the information gathered in the SQL Server database provides a real support for the managers responsible for the business development focalized on profitable customers, in the constraints imposed by the principles of Value chain management. The OLAP technique that we simulated emphasizes the interdependences between the different variables of a CRM system, focusing on the promotion of the customer value.

The complex CRM techniques integrated in Value chain management approach includes: human resources with adequate background (technical assistance and customer care representatives, marketing specialists, CRM database administrator), Internet based applications that allow the information management in a CRM database, documents flows that cover all the technical and functional features of the CRM systems, in order to offer flexibility and the quick integration capacity in the e-business.

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DESIGN IN VALUE CHAINS DEVELOPMENT: ADDING VALUE TO LOCAL PRODUCTS

Lia Krucken[1]

Abstract

The focus of the paper is on a novel identification of design expertise as a potential contributor to defining and augmenting value chains. The design approach, more than any other, seems to bring qualitative enrichment to this analysis, taking into account economical, and social, cultural and environmental perspectives. The main contributions of design thinking to value chains are: a) the visualization of the chain and the envision of futures, b) the proposition of strategies to add value to products, integrating knowledge from partners, c) the planning of innovative forms of intermediation between producers and consumers, d) the identification of "local qualities" that can be communicated to society, improving the products image and its region of origin. In order to illustrate the analysis application, the essential oil value chain is briefly presented. In conclusion, a systemic, integrated and multilevel approach is needed to support coordinated actions to add value to local products, thus promoting long-term sustainable development.

Keywords: *value chain analysis, identifying features, creating product value, biodiversity products, essential oils value chain*

1 Introduction

One of the principal characteristics of post-industrial society is the coexistence of currents that are economic, technological, and cultural, that involve flows of merchandise, information and ideas and even the currents that result from the geographic dislocation of individuals.

In this context, the role of the design profession is becoming increasingly more complex. Various factors contribute to the increase in the project focus of design throughout time. Initially centered on physical products, the scope of design is evolving in the direction of a systemic perspective. In fact, currently the principal challenge of design is to develop and support the development of solutions that require a expanding vision of the project, developing products, services and communication, in a form that is linked and sustainable.

A strong driver of investment in design is the necessities to create value for products, to strengthen and stimulate local development. Especially in the case of emerging economies, which seek to position themselves competitively, design represents a catalyst for innovation and the development of chains of equitable value, strengthening the image of the territory and its products and services. The example of essential oils is given as an example that illustrates the applicability of value chain analysis in the identification of opportunities and competitive strategies.

2 Value Creation and the Value Chain: concepts

The value chain can be understood to be a complex of participants who integrate their knowledge and competence to develop and make available products and services for society. It is a type of network which traditionally focuses on individuals and enterprises. In a wider view, we can also consider those participants who give support to the development of this network, in other words, the associations, research institutions and governmental and non-governmental organizations.

In this way, the process of creating value is developed by means of the exchange of information and knowledge, tangible assets and capital between individuals and organizations, between the production system and that of consumption. To understand this process it is essential to conceive sustainable solutions that benefit all the participants involved.

The value chain, according to GTZ (2007)[2] constitutes "an economic system organized around a particular commercial product. The coordination of business activities in a value chain is necessary to provide final customers

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[2] The German Agency for Technical Cooperation GTZ is an international cooperative enterprise for sustainable development with worldwide operations that provides forward-looking solutions for political, economic, ecological and social development.

with the right quality and quantity of the product." The value chain connects the different related business activities (production, transformation, marketing, etc.) required to bring a product or service from conception through the different phases of production and delivery to the final consumers, and final disposal after use.

3 The creation of value in post-industrial society

In post-industrial society, the creation of value is influenced by a complex of phenomena that undergo and provoke continuous rearrangement and progress. The possibilities of connectivity related to the development of information technology and communication, the globalization of markets and the relationships between local-global and vice-versa, as well as the growing perception of environmental limits have greatly influenced society and have stimulated changes to the industrial production model and in the forms of consumption.

In this scenario, knowledge is the basic resource for individuals and the economy. However, the creation of value results, precisely, from the integration of knowledge and competence of individuals and enterprises.

This integration has been studied by Normann and Ramírez (1995), who adopted the term "value co-production" to describe the "reciprocal relations between participants, that characterize the service economy". According to the authors, businesses compete in the market with offerings (which include physical goods, services and information) and not with isolated products. In order to produce offerings, the participants must act in a coordinated manner. Moreover, consumers are active partners in the production of value, and, thus, are considered value 'co-producers".

Citing the authors (Normann and Ramírez, 1995, p.40): "Presently the economic reality has attained such a high level of interconnection that many participants are involved in co-production relationships without realizing that they are working together with other participants. This would imply that many strategic opportunities are gravely, and in many cases, dangerously underestimated."

In fact, several of the principal characteristics of value creation today are the connectivity and interactivity between value producers. The principal differences between value creation in industrial and post-industrial societies have been pointed out by Ramírez (1999) and are summarized in Figure 1.

Industrial view	"Co-productive view"
Value creation is sequential, unidirectionally transitive	Value creation is synchronic, interactive
All managed values can be measured in monetary terms	Some managed values cannot be measured or monetized
Value is added	Values are co-invented, combined and reconciled
Value is a function of utility and rarity	Exchange is the source of utility and rarity
Values are 'objective' (exchange) and 'subjective' (utility)	Values are 'contingent' and 'actual' (established interactively)
Customers destroy value	Customers (co-)create values
Value 'realized' at transaction, only for supplier (event)	Value is co-produced, with customer, over time – for both co-producers (relationship)
Services is a 'separate' activity	Services configures a framework for all activities considered as co-produced
Consumption not a factor of production	Consumption managed as factor of production
Economic actors analyzed holding one primary role at a time	Economic actors analyzed as holding several roles simultaneously
Firm and activity are units of analysis	Interactions (offerings) are units of analysis

Figure 1. Two views of value production: industrial versus co-productive view.
Source: Based on Ramírez (1999).

Understanding the changes in the logic of creating value and developing a wide vision of this process are fundamental to the designer's function. The perception that the value of a product or service is established in an interactive form that contributes to reinforcing the role of design, in the mediation between the universe of production and that of the consumer. This perspective is supported by Manzini, Meroni and Krucken (2006), Krucken and Meroni (2006) and Moraes and Krucken (2008).

Aside from the incorporation of services into products, which jointly constitute offerings, are highlighted other dynamics which characterize a contemporary design project: the growing dematerialization of offerings; the necessity to develop support informational interfaces for the development and use of the product/service (and which make up part of the offering); the need, increasingly more urgent, to take into consideration the economic, environmental, social and cultural sustainability of production and consumption; and the increasingly more active role of the consumer and user. In this sense, the analysis of the value chain is configured as an important tool to sustain design contributions in a strategic perspective.

4 Analysis of the value chain

The value chain is made up of various types of actors (producers, micro, medium and large businesses), which are linked on various levels, as shown in Figure 2. All the participants fulfill functions in the creation of value, and in this manner, establish (spontaneously or not, consciously or not) a network.

These primary actors, associations, teaching and research institutions and governmental and non-governmental organizations are integrated. At the end, the final consumer – the last level – receives a product which is the result of the efforts and competencies of all these participants. It can be seen that the aggregate value increases significantly along the chain.

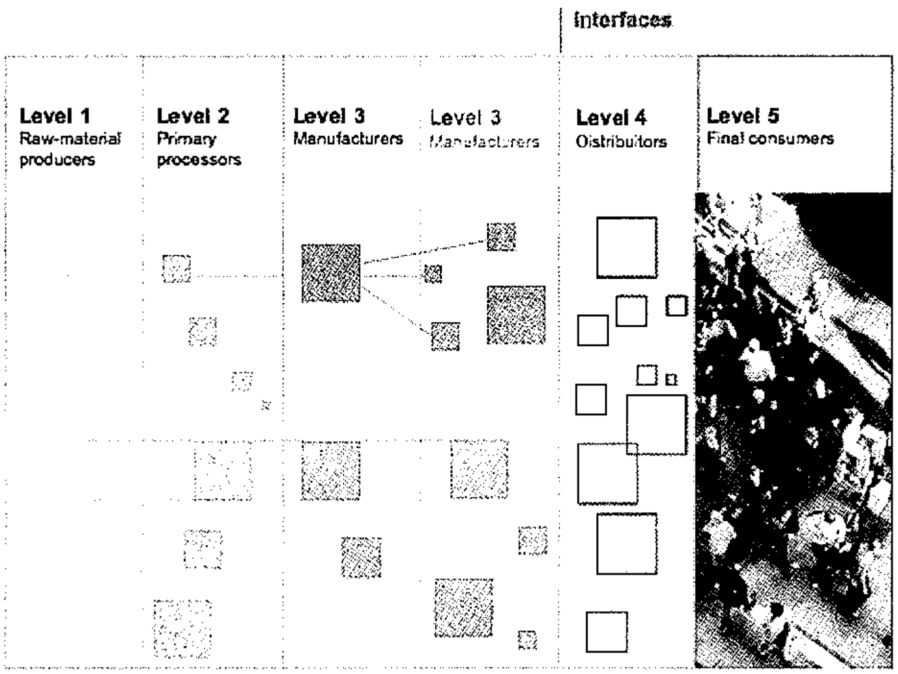

Figure 2. Diagram of possible arrangements that can establish a value chain.
Obs: All levels can be unfolded into many sublevels, as illustrated in the level 3 reappearance. The "distributors" level includes dealers, retailers and other commercial agents that can be active in the levels interfaces.

In this complex flow, which frequently involves different geographical regions, are further inserted commercial agents responsible for intermediation regarding merchandise. In the majority of cases, these participants significantly intervene in the value creation flow, stimulating demand by means of bargaining power and price control (of buying and selling).

The analysis of the value chain permits a visualization of:

a. strategies for retaining the greater proportion of the final value of the offering in the local sphere;
b. possibilities for the development of innovative products and services from the integration of participants′ competencies and resources of the territory, contributing to its socio-economic development;
c. opportunities for synergy between actors, strengthening interactions and promoting the competitivity of the entire chain.
d. opportunities for including new participants in the chain;
e. wants and needs for assistance related to production management, in design and commercialization;
f. market barriers and actions necessary for improving economic performance;
g. possibilities of interaction with research institutions and organizations that support the enabling and development of the infrastructure and favorable policies;

h. opportunities for systematized innovation, incorporating the production and consumption systems.

The easiest dimension to observe in the value creation process is economic. The social, cultural and environmental dimensions are frequently not easily perceivable and are difficult to measure. However, it is extremely important to take all these dimensions into consideration when formulating a project for a product or service.

5 Contemporary design perspective

We can see that design is an element that is visibly manifested when the product is already in the final form of commercialization, in the last steps shown in the value chain represented in the Figure 1. Yet, despite the fact that design is most apparent at this stage, the vision and planning of design permeates the entire process of value aggregation, directed towards the conversion of primary materials into final products aimed at the users.

It is important, however, to demonstrate the design concept, frequently interpreted in a restrictive form. After all, contemporary employment of design is characterized and stimulated by its systemic and strategic dimension.

The growing expansion of the projecting scope can be seen in various areas, such as design, engineering, economics, marketing and ecology. In expanding the limits of the project, incorporating dynamic factors in the proposal of solutions, designers are confronted by both great challenges and opportunities. Many transformations can also be seen in the context in which we live, strongly characterized by uncertainty and by the complexity of relationships and possibilities. A contemporary project however must be open to new events, foreseeing the necessity of change and incorporating the user as an active participant in the solution proposed. The innovative services enabled by ICTs progress (such as network and wireless communication, digital photography, mobile telephones etc) also highlight the need for flexibility in a project.

The systemic character of solutions (including products, services and information) reinforces the need to rethink the project culture and practice. In this "new" vision of design, the role of the designer is to facilitate and support the development of innovations in a community, acting as "promoters of diffuse project capacities" (Manzini, p. 20, 2004). According to the author, the designer can be considered a "project specialist", who acts in a complex network of actors/interlocutors (businesses, institutions, local entities, non-governmental associations, final users) as a "process facilitator".

As Thackara (2005) has shown, it is necessary to change the perspective of "design for" to "design with". The author shows that the transition of products into services reinforces the need to see "design as a service", involved in collaborative action models, continuous and open, that include the user. In this form, the authorship of a project, which produces new services for the daily life of a community, is either distributed or collective.

Adopting a systemic perspective of design implies developing competencies related to dialogue, symbolic analysis, to listening and acting in different contexts, to the integration of knowledge from various areas and to the development of transversal relations in society (Figure 3).

The lasted concept adopted by ICSID (2005) shows design as "a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanisation of technologies and the crucial factor of cultural and economic exchange". It deals with a very wide interpretation, which reinforces the mediating and transversal character of design. In fact, the capacity to transversally and qualitatively integrate knowledge from various areas and to establish a common language between the actors, by means of the conception of an artifact, physical or not, is appropriate to the discipline of design.

Systemic perspective applied to design projects	
Context	Complex and uncertain
Design characteristics	Dynamic, open to new events
Focus	Product and service systems
Values	Diversity, flexibility, sustainability, connectivity, interactivity
Authorship of the project	Distributed or collective
Role of the user	Actor who co-produces value and is part of innovation
Role of the designer	Facilitates and supports the collaboration and development of collective and systemic innovation
Required competencies	Dialogue, capacity to symbolically analyze, capacity to develop transversal relationships in society, ability to listen and act in different contexts, capacity to integrate knowledge from different areas.

Figure 3: Systemic perspective of design and the role of the designer.
Source: Krucken (2008).

As Margolin (2000) has pointed out, Design "is a contingent practice whose techniques, goals, and objectives are continually changing. What is fixed about design is that it is an art of conception and planning whose end result is a product, whether that product is a material object or an immaterial service or system. Design is also an integrative activity that, in its broadest sense, draws together knowledge from multiple fields and disciplines to achieve particular results. It has both a semantic dimension and a technical or operative one".

It is the sense of introducing this transversal viewpoint that design has much to contribute to the development of sustainable value chains. In the dynamic context of post-industrial society, the interpretative richness and visionary ability that are characteristic of this discipline can contribute to the development of a multiplicity of future solutions and scenarios.

It can be seen that the analysis of the value chain traditionally stressed economic aspects. The social cultural and environmental dimensions are frequently not emphasized, even thought they have been taken into consideration in the analysis process. It is true that the indicators related to these dimensions are less direct than those that are monetary and more difficult to measure. However, it is precisely these cultural and social values of the producing community that impel the development of the product and influence the search for more sustainable forms of production. This reinforces the need to conduct the value chain analysis by means of an integrated approach.

In conclusion, we can say that the design perspective applied to the value chain analysis is crucial for the identification of innovation opportunities at various levels:

1. in the aggregation of the values of offerings already existent, improving the system's performance;
2. in the design of innovative offerings, which will create potential for the territory's resources, participants and possible synergies from the existing system;
3. In the visualization of offerings and solutions that are completely original, involving alternative forms of distribution and furthering new relationships.

The first level is characterized as innovation of the incremental type, related to processes or products, while the second and the third constitute a systemic order. Design main contributions regards the planning of solutions that bring producers and consumers closer together; promoting the region of region and its resources; and revealing the cultural and socio-environmental heritage present in local products and in the integration between culture and technology, giving value to e knowing-doing and traditions. The importance of designing interfaces to integrate knowledge and make visible the interrelations developed into a cooperative project and their impacts is well illustrated by the "poster concept"[1], developed by the GTZ and the United Nations Development Program - UNDP.

6 Illustration: Value chain analysis of essential oils

Among biodiversity products, essential oils can be highlighted, having aroused increasing economic interest for the great potential in aggregate value that they possess. Essential oils are "concentrated aromatic oils present in various parts of the plant – leaves, flowers, seeds, roots and shells of certain fruits" (Food and Agriculture Organization of the United Nations - FAO, 1995). They are contained in mixtures of turpentine, ethers, alcohols and other volatile organic substances.

Many times, the characteristics of final products depend on these oils: aroma, fragrance and therapeutic effects. The aromatic components of an essential oil can determine its aroma or fragrance. For example: the essential oil of mint used in licorice and sweets, and that of vetiver grass (Vetiveria zizanioides), used in the perfume of the same name. In the same way, essential oils contain the active ingredients that determine the therapeutic effects of certain products. We can mention: the essential oil of chamomile (Matricaria chamomilla) which, due to its anti-inflammatory and anti-scarring properties, is widely used in facial and shaving crèmes; nutmeg (Myristica fragans) and eucalyptus (Eucalyptus citriodora), used in cough syrups.

In the literature can be seen a growing proliferation of studies on essential oils in the last few years, both in national and international spheres. The principal argument is that the cultivation of specific plants (vegetable matrices for the extraction of essential oils) can configure an alternative for small producers, whose usual crops are of lower aggregate value. However, in the majority of cases, studies cannot provide the development of a systemic vision- that investigates demand, markets, industrial sectors, final products, among other aspects – and, consequently, do not propose effective strategies for production. There are few consistent data and systemic studies on the sector. In fact, the greater part of the information is not available to the public.

The generic value chain of essential oils begins with the primary materials (aromatic, medicinal and perfume plants) and are consolidated in the consumption by the final consumer (cosmetics, food products, perfumes, medicinal and phytotherapic products), as showed in the Figure 4.

This flow involves five principal levels of participants and activities;

1. raw material producers: plant production:

[1] This poster is a tool to enable local communities to showcase their activities and contributions in relation to attaining the Millennium-Development Goals. GTZ prepared a users manual on how to prepare, create and present community-level work in a visual poster format, which clearly demonstrates the projects linkages and impacts. More information available at: www.gtz.de/en/themen/umwelt-infrastruktur/umweltpolitik/14936.htm

2. industrial processor: the first benefit from the raw material (extraction of the unrefined oil);
3. transformation industry: use of the essential oil in intermediary products (fragrances, aromatic compositions, blending), use of the intermediary product in final products (cosmetics, perfumes, food products, medicinal products);
4. distributors: commercialization and distribution of final products to participants wbo are employed in retail sales;
5. consumers and final users: choice, purchase and use of products.

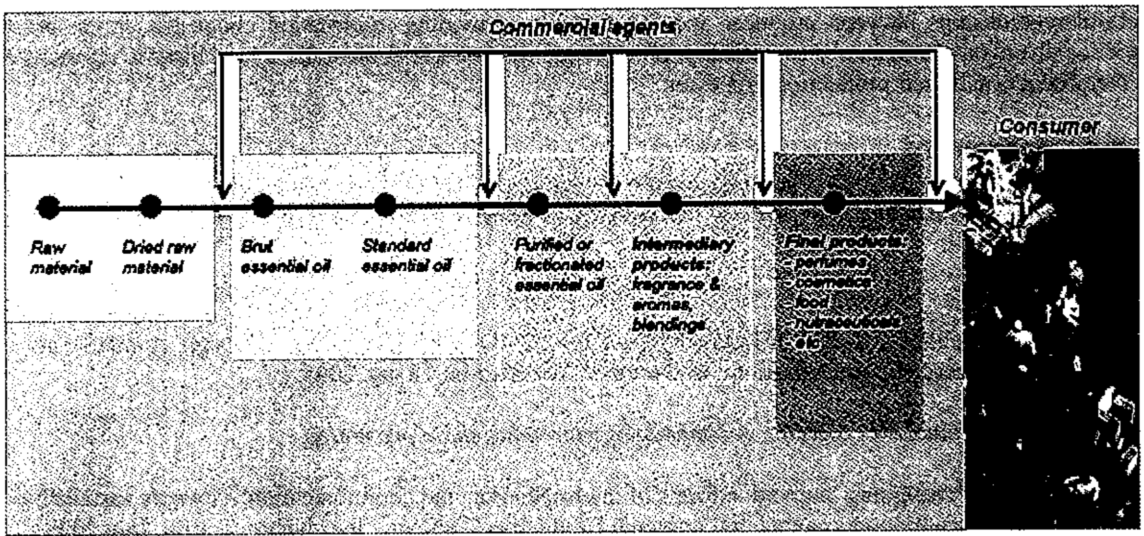

Figure 4. Essential oils value chain.

By means of the value chain analysis are identified three global strategies for creating commercial value for essential oils:

a. standardization of quality, in the case of commodities;

b. aggregation of the technological content, by means of isolating the compounds;

c. development of the "special products", promoting regional qualities related to the product.

The analysis of the systemic character of the essential oil sector in countries rich in biodiversity resources is especially important given the difficulty of converting them into an actual and durable benefit for the population. The sustainable use of local resources (sucb as plants from which essential oils can be obtained) depends on the abilities and competencies that go beyond the isolated boundaries of the diverse areas of knowledge. It is necessary to seek out the richness of disciplinary interfaces and invest in the development of a vision shared between participants from business, institutional and governmental sectors.

Value creation for resources and local products requires, above all, creating the awareness of the fact that the products are expressions of a community and, thus, must be considered as such. Sustainable use also depends on making producers and governments aware and conscious, and requiring basic conditions related to the quality of life within the community so that the resources are employed over the long term, instead of being rapidly exhausted. It is essential to develop ways to maintain the intrinsic value and exploit in a sustainable manner value in use in countries containing biodiversity resources.

In this sense, the attitude of businesses and national industries is crucial; they can encourage the integration of participants and stimulate the adoption of sustainable practices on the part of the other links in the value chain and can involve the consumer, communicating the intrinsic values in a sustainable value chain. In order that these actors invest in the development of products with this profile it is necessary to have requirements, norms and support from the government and research institutions. Finally, it is vital to create "synergy spaces" for the articulation of competencies necessary throughout the value chain, developing formalized relations between the participants and creating conditions for the development of shared strategies over the long term.

7 Final considerations

Understanding the value creation process, which involves the systems of production and consumption, is essential for visualizing sustainable solutions, whicb benefit all participants involved. The analysis of the value chain is a good example, as it fosters the identification of innovation opportunities, especially in relation to the design of product and service systems. It is necessary to develop and adopt tools that support the activities of the designer on a systemic level. The studies that have been carried out by GTZ (2007) can be very useful to bring this wide and strategic view of value chains.

It is crucial, therefore, to promote a design culture in business and industrial arenas, so as to exploit its systemic and strategic dimensions. Design is an important contributor to defining and augmenting value chains, by means of mapping the value chain, identifying opportunities and developing high value added products, promoting knowledge integration, and innovative propositions for products and services based on local resources. This perspective is in line with the widely acknowledged shift in design thinking being applied to services and support systems as much as physical products, and on the growing importance of collaborative projects and value co-creation.

The value chain analysis from the design perspective can also contribute to the identification and the awareness promotion of social, cultural and environmental aspects. In fact, great challenges faced by designers are related to the communication of product values and local qualities to global consumers and fostering of transparent and truthful relationships between producer and consumer by providing information about production processes and their social and environmental sustainability, product quality and origin, the cultural and historic elements embedded in the products and their production processes.

Acknowledgement

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THE ROLE OF DESIGN IN CREATING AND SUSTAINING BRAND EXPERIENCE

Aslı Çetin Yıldırım[1]

Abstract

In today's increasingly global market, 'competition', with its own rules, appears as the most vital determinant for the survival of brands. 'Being different' is advantageous only if it is sustainable, and brands can sustain their existence only if they are able to present their differences through indispensable experiences. Customer, on the other band, with the changes on the socio-economical conditions and technological advances, bas become one of the most important creators and transformers of products or services into experiences instead of being merely 'the buyer of a service or a product'. In this context, design of the interaction between the customer and the brand which leads to the creation of 'customer value' becomes a very important need for the companies.

This paper aims to searcb for an answer to the question of 'How design can contribute to the creation and sustainability of brand experience in the context of creation of user value?'. Design appears as one of the key elements that find opportunities for differentiation, sustain the gained differentiation by creating value, and transform that value into experience. Design is not only a process of giving form to products or services, but also is a process of producing user value as long as it is involved to the decision making in the very early stages. Two educational projects carried out under the tbeme of integration of design in the creation process of 'user value' and ' experience' are going to be presented in order to demonstrate the ideas argued on the paper.

Keywords: *Co-creation of value, experience economy, brand experience, experience design, service design, product design, design management*

I. Introduction

In today's global competitive environment, the firms have to differentiate themselves in order to ensure the continuation of their existence in an effective and sustainable way. By the transformation of traditional definition of the customer, most of the companies are becoming more and more aware of the necessity of this differentiation among others.

The raising awareness of tbe customers, as a result of the developing and widespread use of information technologies, takes out the customers from the point of being the one wbo merely take the decisions of buying/not buying to the point of being active members in the creation of product and/or service offered by the firms. This process, which also triggered the shift from the 'product-dominant logic' to the 'service-dominant logic', transforms the company-centric value creation processes and brings the concept of 'co-creation of value' to front. The active involvement of customers within the creation of value also points out the new ways of customer-firm interaction and puts forth the need for a new strategic planning and management approach which should be quite different from the traditional one. The hesitation of customers on continuing/not continuing for playing the role of being the economic value creator at the point of buying/not buying the products and/or services that companies created for them pushes the companies for searching new ways of establishing and maintaining the customer relationships. This search leads the companies to the organization and planning of processes in which the customers can be actively integrated into the value creation processes and establishes meaningful interactions with the product and/or service suppliers. This approach, which constitutes its new rules in providing the customer-brand relationship, points out an experience process in which the customer becomes the focus of the value creation and included in the creation of unique experiences with the brand. Recognising the inefficiency of traditional methods, companies start to constitute a new locus for establishing this relationship in order to help customers in building up emotional bounds with their brands. Such turns in the concept of value-creation and the relationship between the customers and the firms inevitably leads to the rise of a new dominant economy, experiential economy.

The role of design, in spite of being accepted as one of the most important strategic tools which differentiates companies in the global competitive environment, in the creation and pursuance of experience is often neglected witbin this new argument. Studies on the subject of managing the process of experience rarely give reference to the importance of the role of design. Furthermore, most of the studies focused on the concept of 'experience design' are handled under the theme of 'product design' and tbe role of design/designer during the processes of decision making and design of services is rarely examined.

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The aim of this paper is to provide a deeper understanding of how design can contribute to the design and decision making processes of 'experience' with focusing on service design. A conceptual framework on the concepts of 'co-creation', and 'experience design' constitutes the second part of the study. In the third part, two projects carried out under the undergraduate course of DM301 Design Project Management at Izmir University of Economics is presented in order to demonstrate in which ways design can contribute to the design of brand experiences. Finally, the results of the projects and further research are discussed.

2. Conceptual Framework

2.1. Reasons of the Change

The transformed customer behaviour, the behaviour of searching for unique and personalized experiences with the brand, mostly affected by the development and widespread use of communication technologies, pushes the companies to search new ways of establishing and maintaining meaningful interactions (Menor, 2002, Beverland, 2005, Whelan & Wohlfeil, 2006). Within the world of similar products and services with similar functions and similar offerings on the market, the question of what may be the main differentiator that makes a product or service preferable among the others constitutes the base for this search. Since the traditional ways of communicating brand to the customers become no more effective, companies focuses switches to different communication efforts. Whelan and Wohlfeil (2006) explain this transformation by noting that "Competitive advantages are increasingly gained by a shift towards the experiential dimension of consumer behaviour, which seeks to form emotional bounds and relationships between customers and their brands on a behavioural level. Therefore, a strong focus on how customers actually experience the communicated brand and its values is essential for marketing success. (Whelan & Wolhfeil, 2006:314)" As pointed out in the literature also, all these transformations lead to a shift in the dominant economy, shift to the experience economy (Pine & Gilmore, 1999, Prahalad & Ramaswamy, 2004, Pullman & Gross, 2004, Whelan & Wohlfeil, 2006, Chronis & Hampton, 2002) (Figure 1).

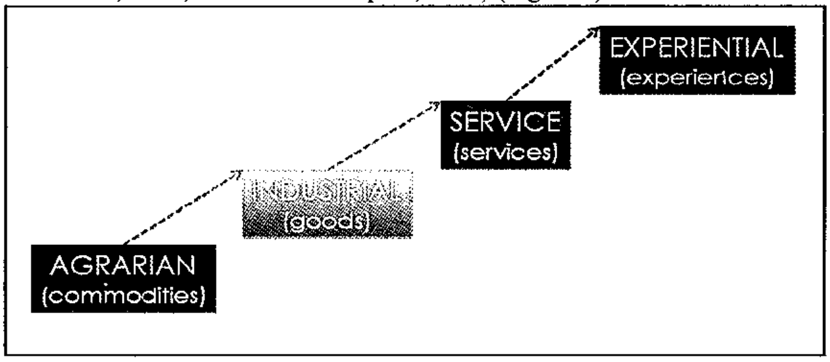


Figure 1. Transformation in dominant economy (Adapted from Pine & Gilmore, 1999).

The shift in the dominant economy paradigm also is a result, as previously mentioned, of and projects the change in the overall value system established between the customer and the firm. Moreover, the concept of creation of value focuses on the 'co-creation' or 'co-production' (Figure 2) of common values resulted from the interaction between the customer and the firm (Menor et al., 2002, Prahalad & Ramaswamy, 2004).

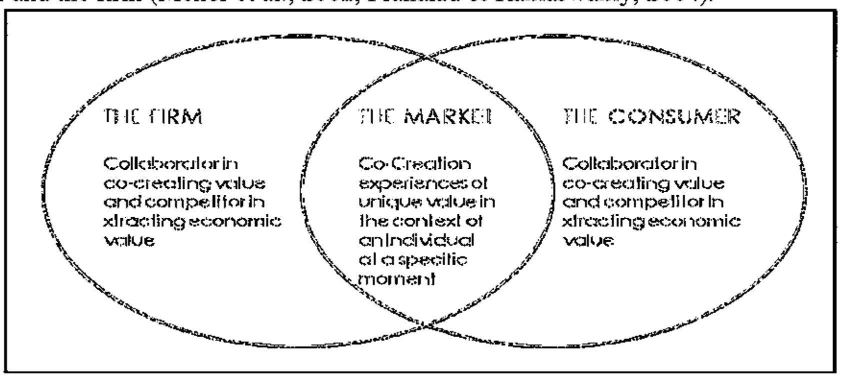


Figure 2. The Emergent Concept of the Market (Prahalad & Ramaswamy, 2004:11).

Value creation logic, as both the input and the output of the brand experience, points out to the creation of value together with the customer in a personal level instead of the creation of value for the customer by the company (Michels, 2001, Prahalad & Ramaswamy, 2004). This approach of common value creation that puts the customer at the centre of the value creation process as one of the creators also shifted the focus from the customers' cognition to the customers' affective experience under a changing communications landscape (Desmet & Hekkert, 2007). The economic value extracted from the customers' buying/not buying decisions based on the selection of the offerings by the firm turns into the long-term co-creation of value which has the locus on peoples' 'personally lived experiences' and 'customer-unique value'. This transformation also brings out the transformation of the subject of exchange from tangibles to intangibles (Whelan et al. 2006, Pine et al. 1999).

2.1. Experience Design

The shift of the focus of exchange from the tangibles to intangibles also brings the question of if intangibles can also be designed just like tangibles. As it is argued in most of the studies in the experience literature, experience, as an intangible notion, is a highly personal and emotional concept since it occurs as the result of some kind of a personal interaction (Desmet & Hekkert, 2007, Pullman & Gross, 2004, Payne et al. 2008, Rheinfrank & Evenson, 2004, Pine & Gilmore, 1999). The point in these studies is that, it is quite impossible to design the experience, since experience is not an attribute of the brand, and offered product or service related with the brand, but it is the consequence of a series of provisional and sentimental interplays between the individual and the offered product/service. As Whelan and Wolhfeil 2006 point out "...the reality is that it is up to the individual customer to obtain their own unique experiences with the brand. Thus experiential brand communication can only provide the platform on which consumers obtain their individual brand experiences. (Whelan & Wolhfeil, 2006:323)" The focus, from the point of design, in this relationship with the customer and the product/service offered by tbe brand is the design of the 'platform' or the 'context' on which the interaction occurs (Rompay & Hekkert 2004, Pullman & Gross 2004, Desmet & Hekkert 2007). Context here refers to the consolidative element of the relation between the customer, the company, and the values that are intended to be reflected through the interaction (Figure 3).

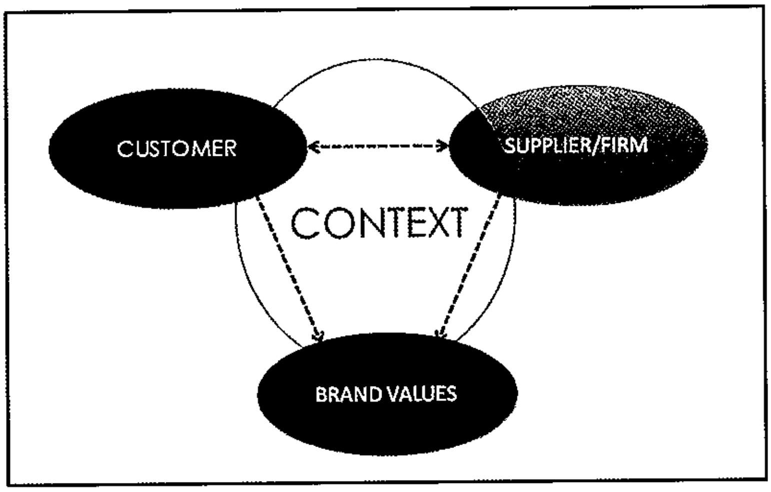


Figure 3. Context as the consolidative element of interaction.

The argument based on the reification of context also raises other questions such as wbich parts of the platform can be the subject for design. According to Pullman and Gross (2004) there exist two primary components of context which are physical context and relational context. Physical context includes the physical and tangible aspects of the context in which the interaction occurs, where; relational context refers to the interaction between the customers. They argue that "...an experience occurs when a customer has any sensation or knowledge acquisition resulting from some level of interaction with different elements of context created by a service provider. Successful experiences are those that the customer finds unique, memorable and sustainable over time, would want to repeat and build upon, and enthusiastically promotes via word of mouth. (Pullman and Gross, 2004:553)"

Similarly, Dubberly and Evenson (2008) represent the 'experience cycle model' in order to describe the steps of building the relationship between the customers and the products/services. The model they generated focuses on the touch points within the context in which design can contribute.

Rheinfrank and Evenson (2004) also focus on the touch points during the interaction between the brand and the customer in which the experience becomes tangible (Figure 4).

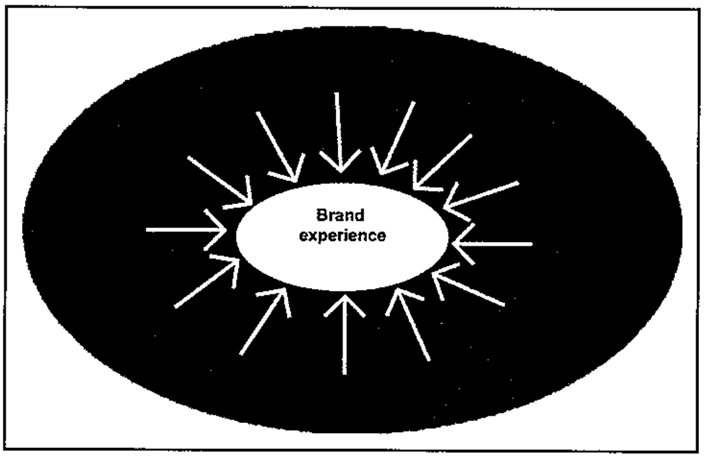


Figure 4. Brands As Experiences Rheinfrank and Evenson (2004).

Setting out on the propositions mentioned above, it can be argued that in the creation of the 'touch points within the context' designers can play active and important roles in three ways basically outlined as (1) Design of the physical context, (2) Design of the relational context (3) Strategic context (within a more managerial approach) (Figure 5, 6, 7).

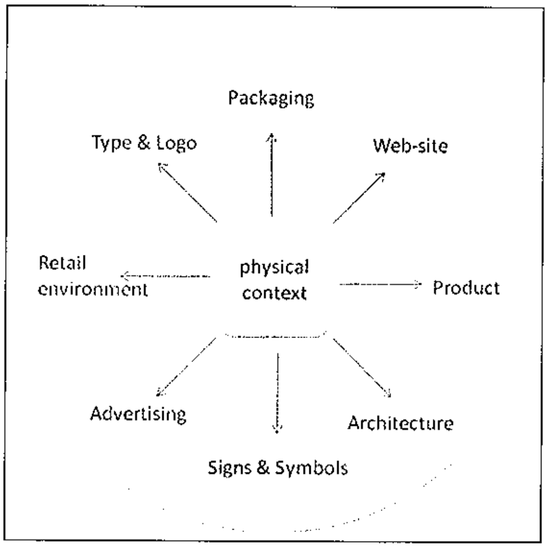


Figure 5. Design in the creation of physical context.

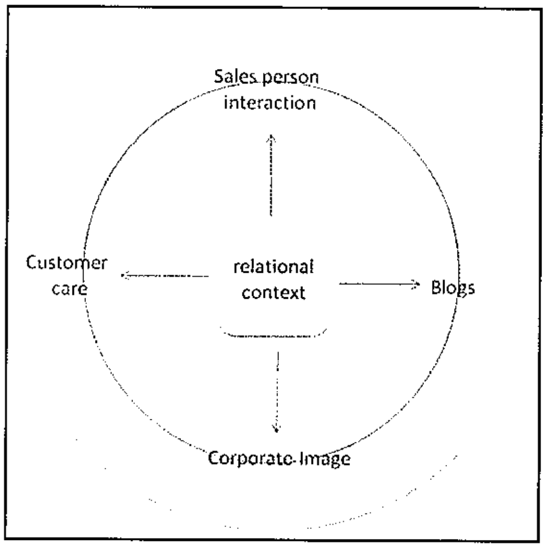


Figure 6. Design in the creation of relational context.

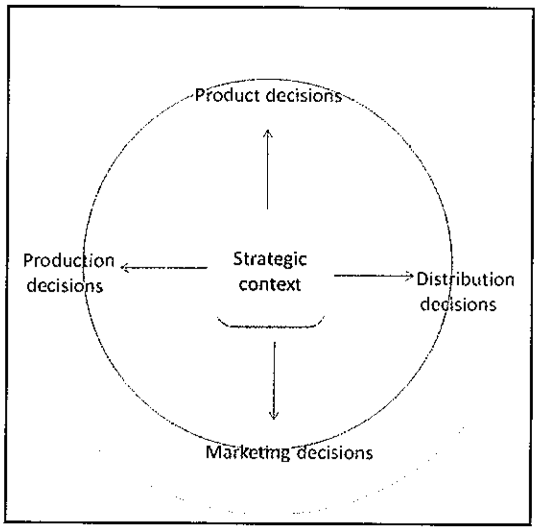


Figure 7. Design in the creation of strategical context.

3. Practices for Implementation

In this part of the study, two educational projects carried out under the undergraduate course of DM301 Design Project Management at Izmir University of Economics, in 2007-2008 academic year as a part of the curriculum of design management group, is going to be presented in means of demonstrating the argued subjects in the paper. Eacb project will be evaluated according to the level of the integration of design within the creation of the experience platform.

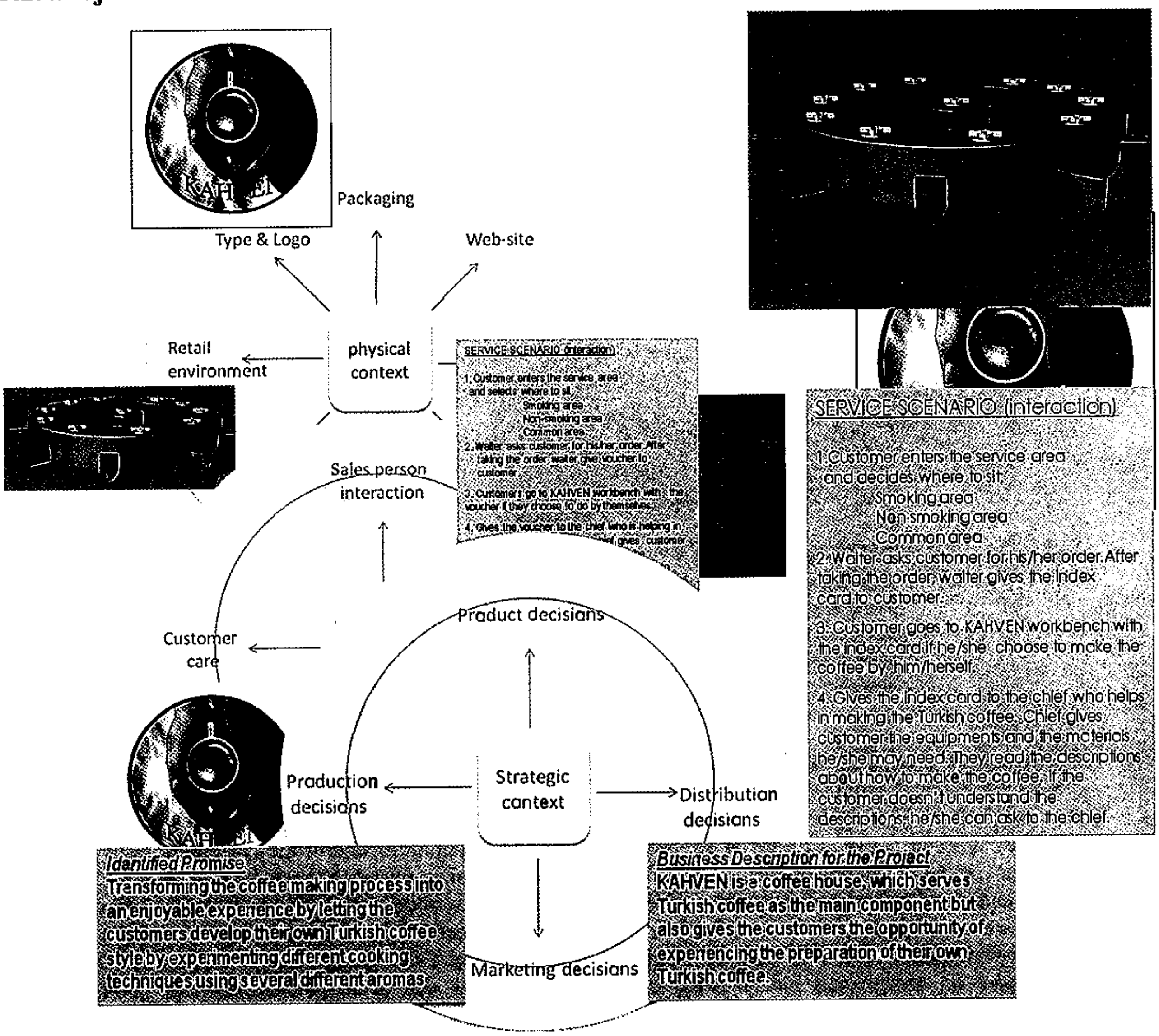
3.1. Overview of the Design Brief

By the beginning of the project, students are asked to design a Turkish coffee service concept considering the;

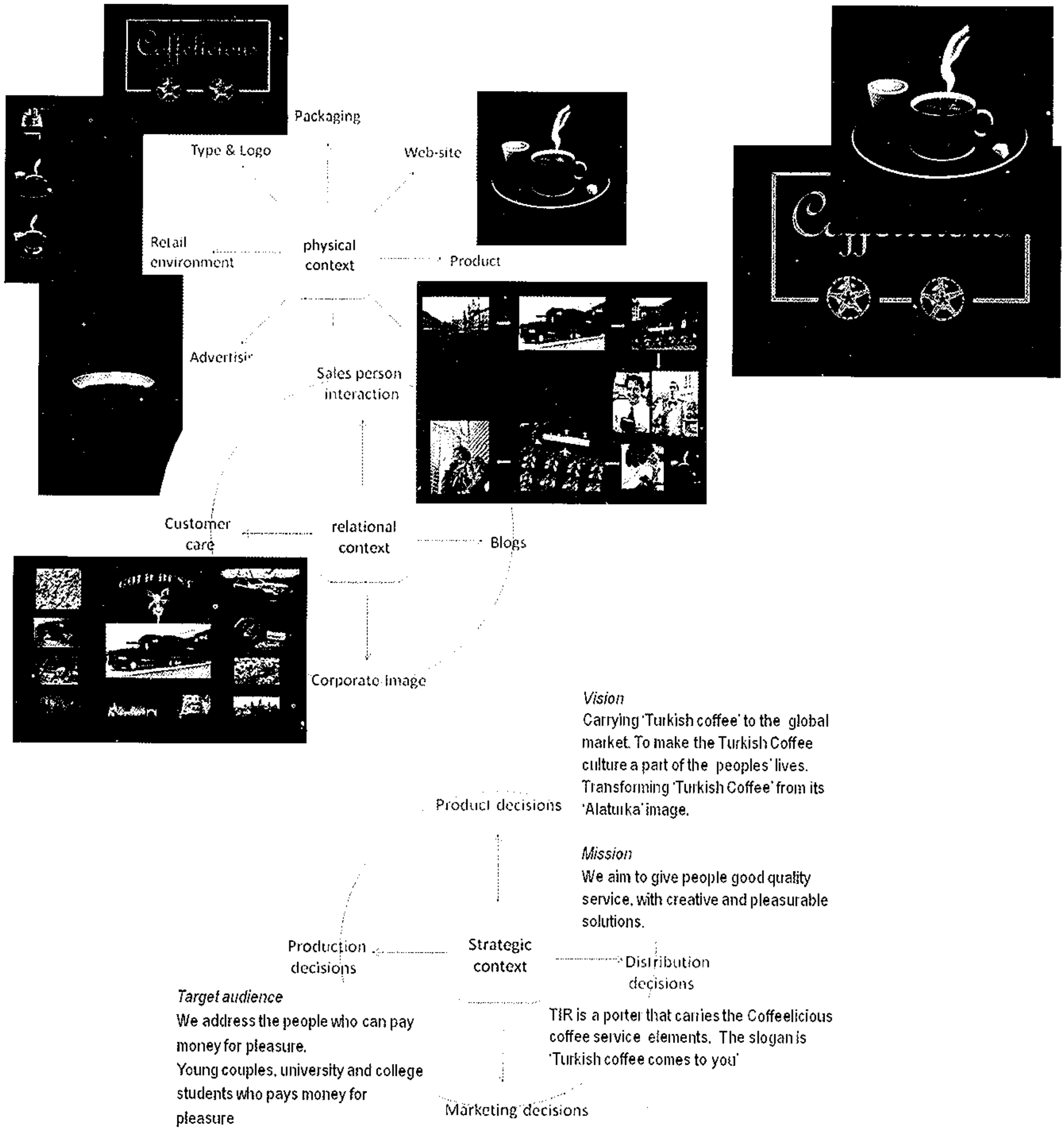
1. physical attribntes, process attributes, aesthetic attribntes, and associative attributes of the service offering
2. ways each attribute contributes to the objective of creating the experience.

They also asked to carry out a detailed analysis of the business environment and the market in order to identify the opportunities to enhance the value delivered by experience. At the end of the project they were expected to present their service business concept with the elements whicb customers directly or indirectly interact.

3.2. Project 1-KAHVEN



3.3. Project 2-COFFECILIOUS



4. Summary and Discussion

Many researchers point to the new era of experience economy and the transformation of product-dominant logic into service-dominant logic (Pine & Gilmore, 1999, Prahalad & Ramaswamy, 2004, Pullman & Gross, 2004, Whelan & Wohlfeil, 2006, Chronis & Hampton, 2002). The changing profile of the customers from merely being the 'buyer' of the products/services to the 'co-creators' of the value, pushes companies to search for new ways of communication with the customers. The active involvement of customers within the creation of value also points out the new ways of customer-firm interaction and puts forth the need for a new strategic planning and management approach which should be quite different from the traditional one. Establishing long-term emotional links with the brand based on unique and indispensible experiences becomes one of the most important points which link customers to brands.

The purpose of this article was to explore the relationship between design and experience. As examined in the article, design's contribution to the process of experience may be over the context, the consolidative element of the relation between the customer and the brand, in which the experience occurs. Since experience happens on an individual level, the design of the elements within the context, which are also called as touch-points by Rheinfrank

& Evenson (2004), with which the customer interacts, appears as the main platform for the integration of design. Based on the studies of Pullman et al. (2004) and Rheinfrank et al. (2004) three main parts of the context, (1) Design of the physical context, (2) Design of the relational context (3) Strategic context, are identified in which design can contribute in different levels. According to this classification, while design contributes in the design of the tangible elements of the interaction in the physical and relational parts of the context, in the strategic part, the contribution of design occurs more on the managerial level. Being accepted as one of the most important strategic tools which differentiate companies in the global competitive environment and in the creation and pursuance of experience, design, can also contribute to the decision-making process in the early stages of product, production, distribution, and marketing decisions.

It is intended, in this article, to make a practical contribution through the demonstration of mentioned possible contributions of design by presenting two undergraduate projects carried out under the curriculum of the course DM301 Design Project Management at Izmir University of Economics. A fourteen people group of students were included in the project whom all product design students studying under design management specialization area. The results of the projects also show that design contributes to the experience process in different levels. The design of the elements which reflects the value that the brand aims to give to its customers and the strategic integration of design into the decision process which will affect the further experiences tried to be exemplified with these projects.

In conclusion, this descriptive study intends to draw a framework in order to explain the importance of the integration of design into the context. Since the generated framework is demonstrated over the conceptual student projects, future work could focus on the measurement of integration in the real-world applications. Furthermore, the integration of design to the strategic context could also be another focus from the perspective of design management.

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SATISFYING THE EXPECTATIONS OF CUSTOMERS THROUGHOUT THE VALUE CHAIN: VALUE CHAIN IMPLICATIONS ON SUPERMARKETS VERSUS GROCERIES

Emir Özeren[1], Aslıhan Gizem Korkmaz[2] , and Elif Yücealp[3]

Abstract

There is a fundamental and revolutionary transformation of the industrial system over the role of consumer in modern value chain. This is the transformation of the role of consumer from passive audience or simply buyer towards active participant in co-creating value. Consumers today are increasingly engaged in a direct and explicit dialogue with companies to become an integral part in value creation process. Furthermore, consumers are becoming business collaborators who have as much to contribute to value creation as companies themselves do. This changing role of consumers through the value chain raised our enthusiasm to examine the overwhelming influence of consumers on value chain as the ultimate purpose of this study.

Keywords: Value Chain, Customer Satisfaction, Role of Consumer, Competitive Advantage, Supermarket Revolution

1. Introduction

Everyday people partake in a wide range of purchasing activities. The decision as to whether to purchase a good or a service or not is affected by a great many of factors such as price, promotion, advertisement, quality, after sales service and attitude of the salesperson. Consumers, usually unconsciously, give feedbacks to the companies by the fluctuations and changes in their buying behaviors. Thus, companies setting their sights on remaining competitive in the market, try to analyze and interpret buying behaviors of the consumers in order to achieve high levels of customer satisfaction and to establish long-lasting relationships with the customer.

In the traditional ways of doing business, receiving feedback from customers primarily depends on examining customer behavior at the point of sale. Which is, fundamentally, a limited source of information as this data solely reflects whether the product or service is preferred or not. On the other hand, an attentive researcher may ask many incidental questions with a view to discover the real causes of this observed behavior and respond accordingly.

Finding satisfactory and explanatory answers to the causes underlying the point of sale buying behavior of customers requires perceiving the process starting with input receipts and ending with the delivery of product or service to the ultimate customer. This process, in literature, is called the value chain.

With the changing trend in positioning of companies from traditional good or service seller to value conveyor, the importance of the value chains burst on the scene. Value chains, in this circular reasoning, are the paths the value is delivered to the customer. The theory of these paths value is delivered through, enables customers to get involved in the value creation process long before they face the end product at the point of sale. There is a fundamental and revolutionary transformation of the industrial system over the role of consumer in modern value chain. This is the transformation of the role of consumer from passive audience or simply buyer towards active participant in co-creating value. The new departure, while providing a platform for the customers to raise their voice and express their expectations, needs and demands accurately, also benefits the companies as it enables them to better understand the customers and to give timely response.

Consumers today are increasingly engaged in a direct and explicit dialogue with companies to become an integral part in value creation process. They are becoming business collaborators who have as much to contribute to value creation as companies themselves do. This changing role of consumers through the value chain raised our enthusiasm to examine the overwhelming influence of consumers on value chain as the ultimate purpose of this study. In the next section, the literature on value chain will be discussed. The principal subject matter, satisfying the expectations of customer throughout the value chain, will be explained. In the last section, practical and real life applications will be cited and conclusions will be noted.

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2. Literature Review

The main objective of this section is to give the reader a brief overview about the value chain concept. We aim to introduce the theoretical background of value chain process based on the previous studies prevailing in the literature. Examination of value chain is crucial for any business success or failure since ultimate customer satisfaction is directly linked with the value cbain. Today, organizations are increasingly becoming aware of the vitality of customer satisfaction and consumer loyalty while moving from a production oriented era towards a customer oriented era. It should be noted that this is a learning process for companies to review and reevaluate their existing business processes, organizational structures and some key business activities from the viewpoint of consumers. As Bennett and Forrester argued, firms are gradually shifting their emphasis from economy of scale, wbere a company relies on self-defined specifications and high volume production, to economy of scope, where a company gains the agility in offering largely customized products. (Bennett, & Forrester, 1993). When such characteristics above mentioned are taken into consideration, it is apparent that value chain analysis is becoming more significant and meaningful in our current era.

Let us examine the theoretical insights of the value chain which is a real breakthrough in our contemporary business. Professor Michael Porter from Harvard Business School introduced the concept of the value chain in his prominent book *"Competitive Advantage: Creating and Sustaining Superior Performance"* in 1985. (Porter, 1985). By the time of the publication by Porter (1985), a new era in the research and development of the concept of value had emerged. The notion that key processes across the supply chain form a value chain and the method of analyzing the value chain for competitive advantage was developed by Porter and soon diffused all areas of business literature. As Dekker stated, value chain analysis is a structured method of analyzing the effects of all the core activities on cost and/or differentiation of tbe value chain. (Dekker, 2003: 5). Costs can be reduced and/or differentiation can be enhanced throughout the value chain. A firm might select either the former or the latter or combine both of them successfully as in the case of Japanese companies.

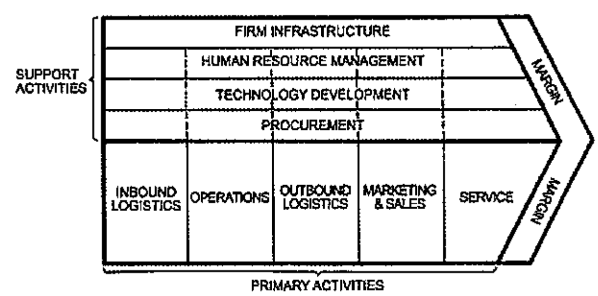
The concept of the value chain is considered as a strong and reliable tool which enables the firm's decision makers to diagnose and create competitive advantage in the marketplace. Value chain analysis begins with the separation of the particular underlying key business activities. As Porter argued it was these underlying activities that contained the seeds of competitive advantage.

Meanwhile, when we look at the literature carefully, we bave noticed that McKinsey bad already done a similar study in the early 1980s called *"business system concept."* Accordingly, a firm is a series of functions such as production, sales and marketing, and that insights could be gained by analyzing how each was performed relative to competitors. On the other hand, Porter brougbt a criticism about this study because of tbe fact that it remained too much at the broad functional level. Namely, it did not break down eacb function into its individual constituent units or activities unlike Porter's model.

As we have mentioned earlier, Porter identified two main sources of competitive advantage which are a lower relative cost advantage and a form of differentiation. The central argument related to this approach lies in the fact that succeeding either lower cost or differentiation strategy depends heavily on all discrete activities that a firm undertakes. Managers should be able to understand the behavior of costs as well as identify existing or potential sources of differentiation by disaggregating these business activities into strategically relevant groups.

Having stated the major sources of competitive advantage, it will be much better to go further insights about the value chain. First, we should begin by defining wbat the value is before going into details about the value chain. Barbon stated: *"By value, is to be understood the price of things; that is, what anything is worth to be sold..."* (Barbon, 1969:2). Nowadays, the concept of value is defined differently and has often a pronounced market orientation. Coyle et al. state: *"An important consideration is that value must be viewed from the customer's perspective, because it is value to the customer that is most important."* (Coyle, Bardi, & Langley, 1996: 548).Most contemporary writing on the topic of customer value stresses this concern from the viewpoint of the customer. According to Porter, value is defined as *"the amount buyers are willing to pay for what a firm provides."* (Porter, 1985: 38). Therefore, the value chain was designed to display total value and consisted of firm's value activities and its margin (the difference between total value and the collective costs of performing the value activities) As it has been illustrated in Figure 1, the generic value chain for a single firm consists of three main components which are primary activities, support activities and the margin.

Figure 1 The generic value chain model



Source: Porter (1985, p. 37)

Let us briefly examine those key activities that took place in the value chain. Primary activities include the creation of the product, its sale to the buyer and after sales service. There are five types of primary activities which are inbound logistics, operations, outbound logistics, marketing and sales and service. Inbound logistics includes warehousing, materials handling and inventory control. Operations consist of activities that turn inputs into finished products. Outbound logistics consist of activities that store and distribute products to customers. Marketing and sales are related to activities that make the buyer to purchase the product by advertising and sales force operations and etc. Finally, service includes the activities which maintain the value such as installation. Support activities are the ones which support primary activities. These are procurement, technology development, human resource management and firm infrastructure. Procurement means systemic purchasing. Companies need to purchase the required items in the cost effective manner while maintaining superior quality. Procurement's job is to provide the relatively cheap but quality raw materials on time. Technology development is broader than research and development. It also contains engineering and process development. Human Resource Management includes the selection, training, development and compensation of all employees within the organization. As Porter points out that the skills and motivation of employees and the costs involved may be critical to competitive advantage. Firm infrastructure includes general management activities as well as finance, accounting, legal, corporate affairs and quality management. After all, it should be said that the purpose of analyzing the value chain is to identify areas that might provide competitive advantage. Firms should identify their own individual value activities within particular industry. Each of the main categories in the generic value chain can be subdivided into discrete activities. For example, let us assume sales and marketing activity. It could be separated into marketing management, advertising and promotion. This process of subdivision may continue down to increasingly narrow activities if they are discrete.

Even though we have discussed the significance of disaggregating a firm into its strategically relevant activities in the value chain and gaining competitive advantage by performing these strategically important activities more cheaply or better than its competitors, one should not think that the value chain is a series of independent activities. On the contrary, it is an interdependent system rather than being independent. Competitive advantage emerges from linkages among the activities in the value chain. Managing such linkages is a more complex organizational task than managing value activities themselves. This leads us to say that the ability to manage linkages yield a sustainable source of competitive advantage. In the literature, Gattorna and Walters point out the same concern: The value chain identifies the linkages and interdependencies between and among suppliers, buyers, intermediaries and end-users. Its primary benefit is the ability to examine these linkages and identify the "value" that is created for customers (or that which may be created), and how this in turn creates competitive advantage for a company. (Gattorna, & Walters, 1996: 99).

Furthermore, it should be said that it is beneficial to extend the value chain concept as value system. Individual firm's value chain is inevitably embedded in a larger stream of activities. At least three additional value chains should be taken into consideration which are supplier value chains, channel value chains and buyer value chains. Therefore, managers should understand not only their own firm's value chain, but also how it fits into the industry's overall value system. In other words, competitive advantage does not just emerge within the firm. Instead, it can be achieved by looking at the whole system and recognizing that different firms can adjust and improve their own value system.

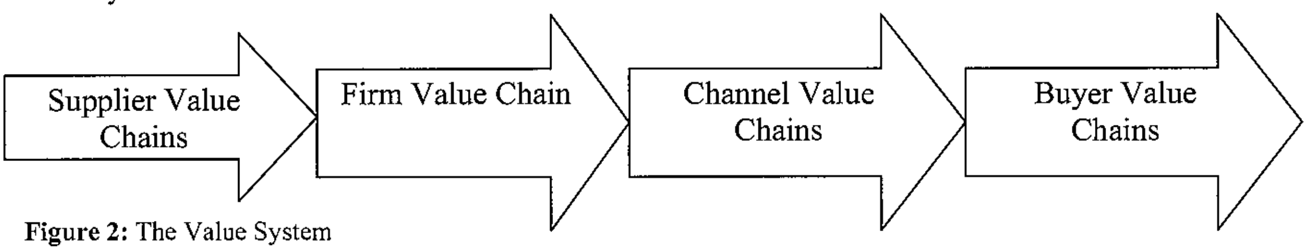


Figure 2: The Value System

Normann and Ramirez argue that the focus of analysis should not be on the fixed activities along a value chain, but on the value creating system itself, where mutual value is created as a consequence of cooperative interactions. (Normann, & Ramirez, 1993: 65-77) Clearly, supply chain profitability is limited by consumers' perceived value gained from obtaining or consuming the product and their willingness to pay for it. For value chains to be sustainable several conditions apply: a chain needs to generate sufficient value for each member; consumer requirements must be communicated accurately throughout the chain; and the relevant types of consumer value a product represents must be revealed and communicated to the target market. Superior knowledge of customers' perceptions of value is recognized as a critical success factor in today's competitive marketplace. Despite this, the voice of the consumer is often poorly integrated within the value chain. The voice of the customer is a description of the consumer value from the consumers' view point. There is a continuum of research and practitioner material regarding the methods for capturing and analyzing the voice of the customer. (Griffin, & Hauser, 1993: 1-27). Merely listening to the voice of customer is not enough; firms should understand and characterize the voice of customer and use the appropriate techniques to translate the voice of customer into meaningful product and process features. (Knowles, 2002:57-80).

For instance, Quality Function Deployment (QFD) is a system for translating customer requirements into appropriate product attributes in a meaningful language for the designers and engineers. (Akao, 1990). It is equally valid to think of QFD as a way of identifying the true voice of the customer.

Having stated the many aspects of the value chain, we should also bring a point of criticism about Porter's value chain model. There are numerous discussions in the literature indicating that Porter's value chain model was codified in a way that made it more suited to manufacturing rather than service industries. The model has been criticized for being too linear, too unidirectional and too sequential.

The creation of value in value chains is often expressed as a successive or stepwise process in which value increases along a value chain. In the last decade or so, since Porter (1985), scholars have intensively discussed – explicitly or implicitly, in terms of value, value chains, value added chains etc – value as a successive creating process in different contexts, applications and considerations. For instance, the following authors have in some way or another involved the concept of value chain in their articles: Freeman and Liedtka (1997), Evans and Wurster (1997), Handfield et al. (1997), Rayport and Sviokla (1995), Preece et al. (1995), Forge (1994), Gustin et al. (1994), Womack and Jones (1994), Drake (1993), Webster (1992), Brathwaite (1992), Robert (1991), Hergert and Morris (1989), McGinnis and Kohn (1988), Johnston and Lawrence (1988), Fredericks and Venkatraman (1988), Berkowitz and Mohan (1987) and Kogut (1985). The unifying feature and point of departure in these publications is the value creation as a successive process. Scholars in recent years have argued for a more consumer driven value process. Durgee et al. (1996), Cavuoto et al. (1996), O'Connor (1995), Partridge and Perren (1994), Clark (1993). Normann and Ramirez (1993) regard the creation of value as a process of value constellation; that is, the value creating process is not sequential.

3. How Is Customer Satisfaction Ensured Through the Value Chain ?

Customer satisfaction is an evident fact for those firms willing to entrench their positions in the market by keeping their current market share and even increasing their share if there exists any possibility. Understanding the needs and behaviors of the customers is the primary step in ensuring customer satisfaction. In other words, if the companies do not know what their target market demands, they can not satisfy their customers, and inferentially their product or service will not sell in the market.

Though, it is not only the product or service that has to meet the expectations of the customer but it is a whole chain of operations and activities the product or service passes through. This chain, called the Value Chain in literature, includes a wide range of activities. Looking below at Figure.3, a simple value chain starts with design and development stage and ends with consumption and recycling.

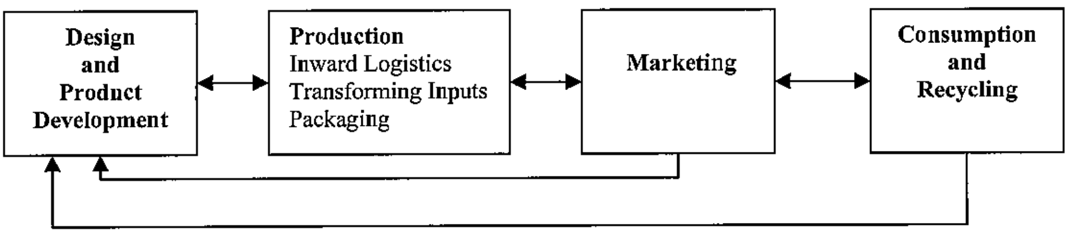


Figure. 3 Value Chain (Kaplinsky and Morris, 2001)

In today's consumer-focused world, the companies which utilize the involvement of consumers in their value chains, are more adaptive to the changing needs and demands of customers in their target markets, and so more successful they are. Building competitive advantage on ultimate consumer involvement in the value chain requires intense communication with the consumers at every stage of the value chain. This communication mainly takes form feedback receipts from customers.

Companies may receive feedback in two ways which are direct feedbacks and indirect feedbacks. Direct feedbacks can be counted as questionnaires, interviews, point of sale communication, toll-free support lines and official websites of the companies. Direct feedbacks are advantageous to companies, since they can directly communicate with the customer and step in where necessary. Per contra, indirect feedbacks are more difficult to realize and most of the time the results are already obtained and company's controlling power on communication is weak. Increases and decreases in sales, complaint platforms, open-communication media that enables free flow of word of mouth are indirect feedback forms. Yet, these are not under the control of the company and sometimes, as in the case of sales decrease, it is too late that the customer is already lost to a rival company.

According to the different stages of the value chain, consumer feedbacks differ at each step. What a firm has to do is to establish close relationships between the consumer and the company and form a ground for the consumers so that they can express their demands and expectations clearly.

3.1 Design and Product Development

The value chain starts with the imaginative power of the designer. It is a hard work reading consumers' minds and developing a brand new product that satisfies them while performing artistry. Thus, using focus groups, using test marketing and questionnaires helps the designer better understand the customer.

3.2 Production

Production stage is composed of three sub-stages which are inward logistics, transforming inputs, and packaging. Inward logistics is the step where inputs arrive at the company. For some products, the method of transportation influences production schedule, the quality of the goods that are being transported or the cost of the final good. Then at the transformation stage, to comply with the standards the customer expects from the company, superior communication is necessary. After the transformation stage, the last stage of production, packaging, is also related to marketing. The packages used by the company must not offend the eyes of the consumers. Furthermore health standards must be satisfied.

3.3 Marketing

Another stage of value chain which is vital for a product's sales strategy is marketing. A good marketing plan can sell even an unsuccessful product. On the other hand, sometimes a strategic mistake made in advertisements, for example, offensive advertisements due to cultural differences can harm the sales of a successful product.

3.4 Consumption and Recycling

At this stage, a company has to know how to touch the right key. The environmentally conscious consumers give emphasis on recyclable products.

4. The Examination of Supermarket Revolution in Turkey From The Value Chain Perspective

Turkey, like most of the developing countries, has witnessed a "supermarket revolution" due to the build-up of demand factors, which were the results of major supply factors such as FDI liberalization, manufacturing sector growth and improved infrastructure. (Reardon *et al* 2007). As a result of those changes, the traditional retailers with disorganized chains were challenged by the take-off of western type of retail formats and started to be replaced by the supermarkets. The supply-side factors played a very important role in changing the shopping patterns, expectations and the involvement of consumers in retail value chains. The demand-side factors are mainly the results of urbanization, female participation in the workforce and increased mobility, which resulted in changing needs like the need for increased bulk shopping and lower product assistance.

4.1 Supply Side Factors:

The main driver of this revolution in Turkey was the trade and FDI liberalization in early 1980s, which was led by the replacement of import substituted industrialization strategy by export-oriented strategy, followed by Customs Union in 1996 and resulted in economic growth and internationalization. These structural changes in the economy resulted in the rapid growth rates accompanied by the investments of multinational retail chains in Turkey like the most of the developing countries.

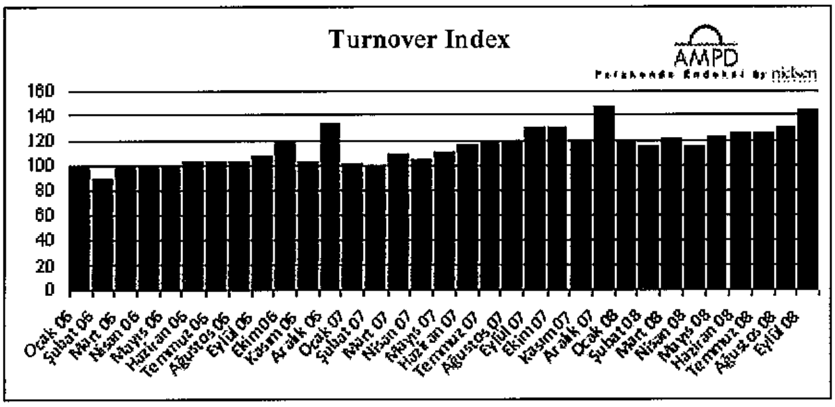
4.2 Demand Side Factors:

The reflections of this structural change in the economy were "the suburbanization of population growth, increased personal mobility and car ownership, being widespread usage of deep freeze and credit cards, rising demand for consumption goods, and changes in transportation, electronics and computer technologies." (see extensive reviews on retail change in Dawson (1980), Guy (1994), Bromley and Thomas (1993), Rogers, (1984), McGoldrick (1984) etc.) The retail environment adapted itself to the new socio-economic conditions, which shaped the needs and the wants of new type of Turkish consumer. The organized retailing chains including supermarkets, discount stores and hypermarkets unsurprisingly started to penetrate the big cities (Ankara, İstanbul, Izmir) that have higher urbanization rates. A number of multi-purpose shopping centers and shopping malls have established in the major cities of the country such as in İstanbul (37), Ankara (13), İzmir (8), Konya (6), Bursa (5), İzmit (4) (Turkish Council of Shopping Centers & Retailers, members' list, 2006).

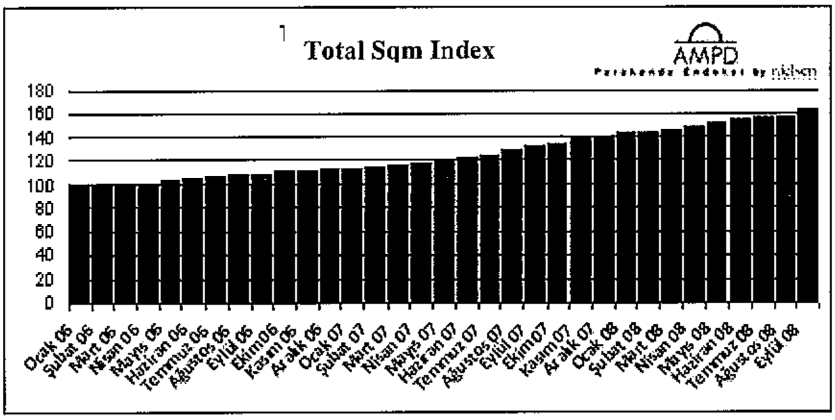
REGION	TOTAL POPULATION	URBAN POPULATION	% URBAN POPULATION / TOTAL
Ankara	4.466.756	4.140.890	92,70%
İstanbul	12.573.836	11.174.257	88,87%
İzmir	3.739.353	3.175.133	84,91%
Antalya	1.789.295	1.127.634	63,02%
Aydin	946.971	536.758	56,68%
Gümüşhane	130.825	60.781	46,46%

Source: TURKSTAT, Urban Statistics, 2007

As the supermarkets started to penetrate the big cities, grocery stores were challenged by the competitive advantages of supermarkets since the traditional retail patterns and structure were altered. According to a recent research by the Turkish Council of Shopping Centers & Retailers, organized retail chains have increasingly been capturing the market in size, number and consolidating through sales in YTL and sales volume.



Source: Turnover Index, January 06 – September 08, Turkish Council of Shopping Centers & Retailers



Source: Total Square Meter(Sqm) Index, January 06 – September 08, Turkish Council of Shopping Centers & Retailers

According to a recent research, which was conducted on 6169 households in 34 cities in Turkey by Ipsos KMG showed that the seveo largest organized retailers captured the non-durable goods market at a considerable level.

	% households shopping	% Share in the spending on non-durable goods	Average Check (Annual turnover / number of customers)
BIM	54,3	5,0	196 YTL
MIGROS	41,1	2,7	137 YTL
CARREFOUR	24,3	2,1	N / A
TANSAŞ	20,6	2,2	225 YTL
ŞOK	19,1	0,8	91 YTL
DIA SA	13,6	0,8	129 YTL
TESCO KIPA	9,6	1,1	435 YTL

The rapid increase in sales and volume puts forward the need for explaining what gives the organized retailers (supermarkets, hypermarkets, discount stores) the competitive advantage.

4.3 Value Chain Implications: What differentiates the supermarkets from the grocery stores in the eyes of customers?

It takes a long discussion to explore what makes a supermarket more attractive than a grocery store or the opposite of it. It is a fact that the Turkish retail market is dominated by traditional grocery stores which have 70 % share, while supermarkets and hypermarkets count for 15 %. Contrary to this large dominance, the number of supermarkets, hypermarkets and chains increased from 2135 (1998) to 8258 (2008) while the number of grocery stores decreased from 155,000 to 113,000 in the last ten years (Determination of the Number of Retailers Research, AC Nielsen, 2008). This natural selection process for the traditional retailers (the groceries) is subject to endless discussions between two parties. What gives the supermarkets the competitive advantage over the groceries?

A recent study by Reardon and Gulati in February 2008 discusses that "the two basic sources of conflict between the supermarkets on one side and the traditional retailers and supermarket suppliers on the other are (1) inequality of power based on supermarkets' greater concentration and scale and greater access to technologies and commercial practices because of that scale; and (2) the practices and strategies through which supermarkets wield their power, magnifying their initial advantages through pricing, quality, location, payment, and contracting." (Reardon and Gulati *et al* 2008) To better understand the foremost differences between a typical grocery store and a supermarket, the value chain elements, the sources of competitive advantage will be explained. Michael Porter's generic value chain model will be utilized.

Both groceries and supermarkets are the intermediaries for the producers to get access to final customers; however those two show different characteristics when it comes to the value chain implications.

4.3.1 In-bound logistics

The supermarkets, first of all have a considerably high bargaining power over the suppliers since they order in large quantities. Since the supermarkets are the intermediaries, which are available for bulk shopping, they become the main buyers for each supplier. Due to the large store sizes (the size of a grocery store is below 50 square meter(sqm) and a larger grocery store's (markets) varies between 50–100 sqm while a small supermarket's size is slightly below 400 sqm and an average supermarkets' varies between 1000 – 2500 sqm.) they have the ability to buy, warehouse and sell in large quantities, The supply chain efficiency plays an important role in working with lowered prices; the average purchase price and in turn, the selling price. This provides the consumers to find a wider product range with lower prices than the prices in groceries. As a result the supermarkets enjoy the economies of scale by decreasing the prices yet higher margins. (Gross margin: 10 – 15 % for groceries; 15 – 17 % for supermarkets) (Retail Sector Report, Rıfat Sait, 2006) What makes this efficiency sustainable is the self-service concept, in which the customers can do shopping on their own without product assistance that's why the customers take part in ensuring the efficiency of the retail system. On contra the groceries work with smaller quantities and try to serve the customers. The only competitive advantage of groceries is tab payments for their acquaintances.

4.3.2 Technology development and operations

Next, the supermarkets have the ability to reconfigure their supply chains around the customer preferences by continuously monitoring the change in needs and wants of customers and optimizing the mix of goods based on sales patterns. This involves data mining and *"market-basket"* analysis, which is the practice of identifying the general mix of items a particular shopper will buy in an average trip to the store (Foote and Krishnamurthi, 2001). The technological infrastructure enables them to follow-up the customer trends through bar-code scanners and club / loyalty cards which is used to calculate the frequency of buying on the product and customer profile (customers' life stage, shopping habits, what they buy, their response to promotions etc.) basis. Therefore, the customers inevitably become a major part of the value chain, where the products required in stock are steered towards the data on true consumer demand gathered by those cards rather than warehousing the entire product repertoire. *"This gives the customers a better targeted offer and at the same time ensure exactly the right stock is in the right place, eliminating another source of order amplification and enhancing both the customer experience and the effectiveness of the supply chain."* (Daniel T Jones, Philip Clarke, & Chestnut, 2002). The traditional retailers do not have technological infrastructure, and show lack of integrating their supply chains with the customer demands that's why they cannot respond to the needs and wants of the customers and increase their operational efficiency.

4.3.3 Marketing / Sales

Widespread credit card usage is one of the most important demand side factors, which stimulates bulk shopping and provides the customers with relatively increased purchasing power. Since the organized retailers provide the customers with many payment options through a wide range of credit cards, their attractiveness for the customers, due to the installment advantages, has arguably a more positive effect on disposable income. Since the grocery stores do not work with high sales volumes, most of them have no credit card agreements. The tab purchases can not even replace the advantage offered by high number of installments.

Conclusion

As a result, large body of evidence in the literature demonstrates that today supply chain management is emerging into value chain management, which recognizes the importance of demand in addition to supply as Marzian et al., argued. (Marzian, McLaughlin, & Andraski, 2003). The point of origin of any supply chain activity should take into account the values that are or are going to be of importance at the final consumer market. Michael Porter has popularized the term value chain to mean the entire production process from the input of raw materials to the output of the final product consumed by the end-user. It is called a value chain because each link in the process adds some value before the product or service is delivered to the ultimate customer. Under these circumstances, not only the product but also the entire chain of business activities from raw material through to the final point of consumption should be effectively managed to deliver the end-consumer's value. In today's world, the traditional retail formats are being replaced by contemporary ones, which can monitor and react to consumer preferences faster, while reconfiguring their supply chains around the consumer demands. On the other hand, the consumers are increasingly becoming a part of the value chain as the supermarkets use more of the monitoring tools in order to customize their sales / merchandising methods and steer the sales towards the consumer-related data gathered from those practices. They also have the competitive advantage of low cost operations resulting from working with large volumes and enjoy economies of scale when compared to small groceries.

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PACKAGING VALUE OF COSMETICS PRODUCTS: AN INSIGHT FROM THE VIEW POINT OF CONSUMERS

Mert Topoyan[1], Zeki Atil Bulut[2]

Abstract

Difference between consumers' and business chains' perceptions on value is the major factor determining the success of a value chain. Thus integrating the voice of consumer in the value chain is critical to gain competitive advantage. However, this situation cannot be achieved in most cases. One of the issues, which seems to be disregarded in determining the value to consumer is packaging. Value added through packaging seems controversial in many sectors. On the other hand, in some sectors like cosmetics, packaging design and materials can easily become a crucial part of the value of product. Thus, a value based packaging design approach becomes inevitable. This study aims to discuss the main attitudes driving the consumers to purchase a cosmetics product from the value based packaging point of view. To achieve this goal, a survey is conducted to collect data from female university students around Turkey. Then this data is used in a structural equation model. Results and future research opportunities are discussed.

Keywords: Packaging, consumer value, cosmetics sector

1. Introduction

One of the critical success factors effecting firms to be successful in competition driven marketplace is consumers' perceptions of value on their products. Despite this, the voice of the consumer is often poorly integrated within the value chain (McEachers & Schröder, 2004). Traditional marketing strategies assume that customers involve (e.g. search, assess, purchase, use) with products or services mostly at the end of their value chain as finished market offerings (Mascarenhas *et al.*, 2004). While moving from traditional marketing era to a consumer oriented era, companies notice the importance of customer satisfaction and loyalty. Because of customer satisfaction and loyalty is on the focus in consumer oriented era, companies increasingly overrate integrating the voice of consumers within the value chain. Consequently, created value for consumers in value chain provides competitive advantage for companies.

The value chain of a company traditionally has been viewed as a static construct from suppliers to distribution channels (Fine *et al.*,, 2002). Businesses in the twenty-first century have to overcome the challenges of satisfying the demand of customers' unique and rapidly cbanging needs (Gunasekaran *et al.*, 2008). In order to cope with changing customer needs and expectations, forward-thinking companies try to find bow to integrate the voice of consumers' into the value cbain. In tbis situation, not only the product but also the entire chain of business activities – from raw material through to the final point of consumption – should be effectively managed to deliver the end-consumers' value (Christopher, 2005).

2. Cosmetics Products As The Target Area of Study

Cosmetics products are predominantly aesthetic feelings oriented products. Packaging design can be assumed to have more effect in consumers' choice behavior in cosmetics products since visual properties of products are also contribute to aesthetics. Aesthetic properties are subjective properties, thus can be regarded as perception based. Since consumer perceptions can be said to be more critical in assessing the value of these products, cosmetics products are assumed to be more sensitive in value assessment. Owing to these facts, cosmetics sector was preferred to evaluate the consumers' assessment of packaging value.

3. Literature Review

It is necessary to focus on customer needs to understand customer value in value cbain. A value chain is defined as "the linked set of value-creating activities all the way from basic raw material sources for component suppliers

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through the ultimate end-use product delivered into the final customers' hands" (Shank, 1989). Key processes and analysis about value chain were firstly introduced by Porter (1985). Subsequently, value chain analysis was used in the accounting literature (Hergert & Morris, 1989; Stephens & Archambault, 1998; Shank & Govindarajan, 1992) and operations management literature (Main & Short, 1989; Rainbird, 2004; Sankaran & Mouly, 2006).

The relationship between firms and customers is one of most important relations in value chain. Certainly, customer satisfaction is the ultimate goal of any sustainable business (Zokaei & Simons, 2006). Several models developed to measure customer satisfaction adopted the value perceptions of customers as an antecedent of customer satisfaction (Juhl *et. al.*, 2002; Türkyılmaz & Özkan, 2007). Walters and Lancaster (1999) have stated that value is created by any product or service attitudes, which motivates the customer to buy product. According to Woodall (2003), attributes of products and services which help to create customer value can be divided into two groups:

- Factors that decrease customer's costs,
- Factors that enhance customer's benefits or help to satisfy customer's needs.

3.1. Value Concept and Components of Value

Value concept is mostly related with the benefit created for the user of a product. There are many factors which effect benefit of a product to customer. Ferrell, et al. (1998) specified these factors as product quality, customer service quality and experience based quality. Some other authors measured value as a construct of hedonic and utilitarian dimensions (Voss, *et. al.*, 2003). Owing to the fact that benefit, and therefore value concept is much of a matter of perceptions, a suitable measurement model for value should focus mostly on perception measures.

Hence, in this study, we tried to measure perceptions of consumers on value. Dimensions of value were considered as pricing value (customer cost), functional value, brand value, perceived quality and packaging value. Rather than using the total value perception as a single factor effecting customer satisfaction, we separated these dimensions to figure out their individual effects.

Product value (functional value), which represents "the customers overall assessment of the utility of a product based on perceptions of what is received and what is given" is important for customer services (Zeithaml, 1988). The term functional value involves product characteristics and its benefits to customers. Therefore customer perceptions about functional value consist of product attributes.

According to Best (2002), brand value is another factor that create value to customer. Because of brand embodies everything about firm and product in all customer touch point, it creates value by helping customers decision.making process. The brand proportion conveys the benefits offered by the brand. These benefits may be functional, emotional, or self-expressive (Aaker, 1996). The intent is to consider the benefits that distinguish a brand from its competition. The value proposition expresses the underlying logic of the relationship between the brand and the customer (Cravens & Piercy, 2006).

Customers' view of perceived quality is the culmination of how they experience product performance (Terblanche, 2006). Product performance is the degree of customization and freedom from differences, or how reliably the product meets its specifications (Johnson & Ettlie, 2001). Some researchers brought out that perceived quality had a significant effect on perceived value (Dodds, *et. al.*, 1991). Rangaswamy, *et. al.* (1993) found that marketing communications that promote quality can enhance product value. In our study, we hypothesized that perceived quality directly effects customer satisfaction in value chain.

3.2. Packaging Value

Although packaging is most commonly regarded as a way to protect the product, an often overlooked component of packaging is the capability of better reflecting the sense of product attributes to consumers who might assess these attributes valuable. Using new and innovative packaging designs, increasing perceived benefits to consumers – thus increasing value added- can be achieved. Value is added when packages are designed for aesthetics and ability to deploy positive information to consumers and at the same time preserve the product qualities through time and from the environment (Gonzalez, *et. al.*, 2007). For decision made at the point of purchase, packaging undertakes elevated importance relative to other communication tools because of its easy availability (Underwood & Klein, 2002).

The cosmetics industry requires packaging materials that provide efficient barriers, preserve product effectively and increase the life of cosmetic products. Packaging helps consumers to understand the contents of product and usage. Consumers' packaging choice is generally an economic decision made by comparing costs and benefits ratio. However, packaging has not only functional utilities. As a marketing tool, packaging has some important roles (Peters-Texeria and Badrie, 2005). Packaging can create competitive advantage to firms. Distinctive and innovative packaging with aesthetic presentation can intrigues consumers and changes their interests. Innovative packaging impresses consumers with its color, image, scent, design, etc. Therefore packaging has a vital role on consumers' perceptions and also firms' competitiveness. Besides functional usage of packaging, consumers' hedonic choice criteria is also effective in creating packaging designs, especially in predominantly aesthetic feelings oriented products.

3.3. Customer Satisfaction and Brand Loyalty

Many studies on consumer behavior have been conducted on customer satisfaction (Yi, 1993; Oliver, 1999). Despite earlier study researched global functions of customer satisfaction (Griffin & Hauser, 1993), recent studies have been focused on to analyze attribute-level conceptualization (Mittal, *et. al.*, 1998). Attribute-level antecedents of satisfaction include functional symbolic and experiential benefits (Suh & Yi, 2006). Customers have some expectations about values of marketing mixes that firms presents. Customer satisfaction can be defined as differences between customer expectations and their level met. Customer satisfaction increases while perceived performance of product is high.

According to Oliver (1999), brand loyalty was used by many researchers to describe a number of phenomena in marketing. Researchers and marketers simply defined loyalty as a behavior of the customer (Punniyamoorthy & Roj, 2007). But in their earlier study, Jacoby & Kyner (1973) referred that brand loyalty has a complex mixture of attitudinal and behavior elements and many other research shows that brand loyalty bas a psychological elements (Fournier, 1998).

In our conceptual model (Figure 1); packaging value, functional value, perceived quality, brand value and price value effect customer satisfaction and customer satisfaction subsequently effects brand loyalty.

4. Methodology

In this study female university students were selected to analyze value perceptions on cosmetics products. This restriction found its basis on the assumption that women consumers are more sensitive on cosmetics. In this way, data collected from of 25 randomly selected universities representing all geographic regions of Turkey. This number constitutes about 22 % of all universities in Turkey. Because of students in a university can be assumed randomly distributed in region of origin, the collected data was assumed to represent the population of female consumers in Turkey in relevant age group.

Data collection took between 14th April and 20th May, 2008. Of the 2500 questionnaires posted, 1646 returned. This means a respond rate of 65,8 per cent.

SPSS for Windows 16.0 and LISREL 8.70 applications were used to conduct analysis. Collected data was subjected to elimination in order to obtain the analysis sample. After eliminating missing values, 450 cases were selected randomly using SPSS for Windows's random number generation option. Sample size was restricted to 450, because it is suggested that for larger sample sizes, structural models are tend to generate poor fit results. (Achjari & Quaddus, 2004).

4.1. Measures and Survey Instrument

Survey instrument was designed regarding the studies of Voss, *et. al.* 2003. Mouri, 2005, Punniyamoorthy & Raj, 2007, Juhl *et. al.*, 2002, and Türkyılmaz & Özkan, 2007. Resulting survey instrument consisted of 29 questions to evaluate value perceptions on packaging, functional attributes, perceived quality, brand and price, and customer satisfaction and brand loyalty.

4.2. Reliability Analysis

The questionnaire was pilot-tasted on 60 respondents for reliability. Since the results of pilot-test showed acceptable reliability values (Cronbach's α= 0,861), scale was applied to rest of the sample. The scale used gave an α = 0,852 reliability value, and this was acceptable since the α value is over the requested value of 0,70.

Also to ensure the content and construct validity of scales used, factor analysis was used. All scale items were confirmed to accumulate in related factors.

4.3. Conceptual Model

Conceptual model of the study is proposed considering the previously developed models of European Customer Satisfaction Index (ECSI) (Juhl et. al., 2002), American Customer Satisfaction Index (ACSI) (Türkyılmaz & Özkan, 2007), and works of Mouri (2005), Voss et. al. (2003).

Figure 1 represents the hypothesized relationships in conceptual model. These hypothesis were analyzed in the structural model.

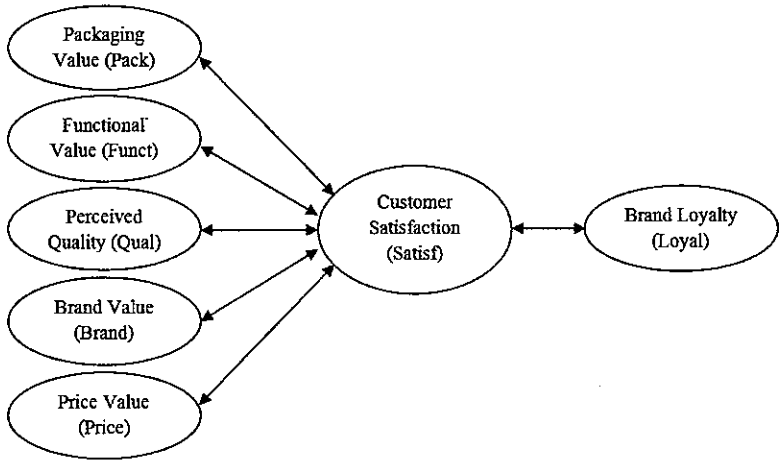

Figure 6 Conceptual Model of Study

4.4. Measurement Model

Packaging and functional value perceptions were assumed to comprise two dimensions of hedonic and utilitarian value perceptions. These dimensions were integrated in the model with total factor loadings. PFactorGrp1, PFactorGrp2, FFactorGrp1 and FFactorGrp2 represented hedonic dimension for packaging value, utilitarian dimension for packaging value, hedonic dimension for functional value and utilitarian dimension for functional value perceptions respectively.

Measurement model of study was analyzed using LISREL 8.70 and generated good fit values for χ^2/df = 2,84, Root Mean Square Error of Approximation (RMSEA) = 0,064, Goodness of Fit Index (GFI) = 0,94 and Adjusted Goodness of Fit Index (AGFI) = 0,90. These values are required to take values less than 5 for χ^2/df, and more than 0,90 for GFI and AGFI. Although suggested RMSEA value is less than 0,05 and observed value is 0,064, it can be tolerated while the value is under 0,08 (Streiner, 2006; Jaros, *et. al.*, 1993). Considering these values, measurement model was accepted.

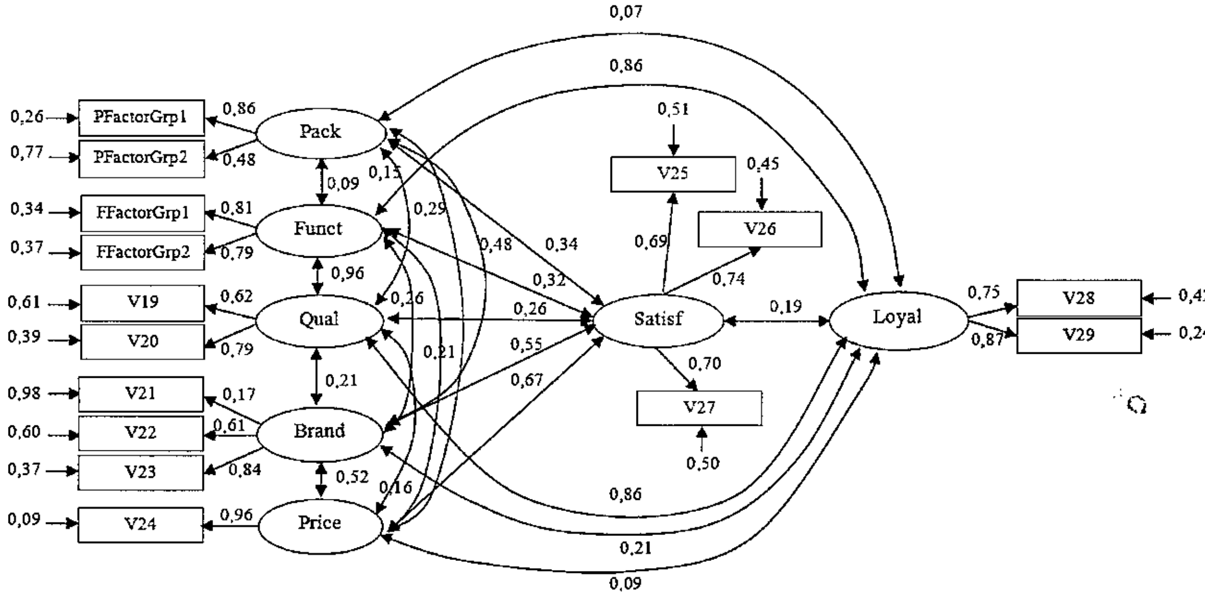

Figure 7 Measurement Model

4.5. Structural Model

Structural model was also analyzed using LISREL 8.70. Structural model generated fit values of χ^2/df = 2,065, RMSEA = 0,049, GFI = 0,96, AGFI = 0,93 and Comparative Fit Index (CFI) = 0,98. These values suggested that the structural model is acceptable.

Figure 3 comprises standardized R^2 values for hypothesized relationships. As it can be seen from values in the Figure 1, although most hypothesis suggesting effects of value perception variables on satisfaction approved, most of the relationships were moderate to low.

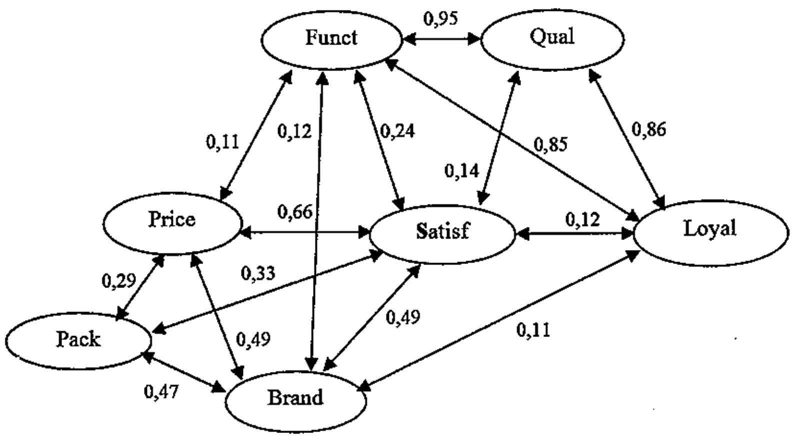

Figure 8 Structural Model

5. Conclusions

Regarding tbe proposed structural model, it is found that packaging value perceptions of consumers is related with three components of model. These components are price and brand value perceptions and customer satisfaction. Although none of these relations can be regarded strong, effect of packaging value on brand value perceptions has the strongest relation ($R^2 = 0,47$) among them. This value represents a moderate effect. Likewise, other values $R^2 = 0, 33$ and 0,29, which are between packaging value and customer satisfaction, and packaging value and price value respectively, can be regarded as moderate but weaker relationships.

Reviewing the structural model relationships, there can be found some interesting results about packaging value of cosmetics products. First of all, packaging value perceptions has no relationships with value perception caused by functional and quality attributes of products. Based on this result, it can be said that consumers of cosmetics products do not regard packaging as an integral part of functional or quality attributes of products. However, as explained above, packaging value is related with price and brand values and customer satisfaction. Regarding these relationships, three resulting statements can be extracted:

i. Consumers expect more sophisticated packages from known brands.
ii. Consumers are willing to pay more on better packages.
iii. Better packaging designs positively influences customer satisfaction.

Companies operating in cosmetics sector can benefit these results while developing product strategies in the following ways:

i. If a company has a known brand, it should invest in packaging design of products more than generic or less known brands. Because it is predicted that customer expectations on packaging design of those products will be higher.
ii. If a company is willing to increase its product price, one optional strategy can be investing in packaging design of product.
iii. Companies can use packaging design improvements in order to contribute customer satisfaction improvement.

However, it should not be overlooked that all strategy options suggested above are predicted to have moderate effects. Hence, in order to achieve their goals, it is suggested that companies must incorporate several different options regarding tbe other dimensions took part in the proposed model of the study.

All those suggested options require good communications with customers. Customer voice sbould be represented well in providing products and services. As a limitation of the study, from a packaging value focus, the question "what makes a packaging design valuable to customer?" will find its answer in customers' opinions. Thus companies should establish close relationships with their customers and incorporate them into the value chain.

6. Further research

This study evaluates only packaging related issues on proposed model. As it can be seen on conceptual, measurement and structural models, other factors have some interesting relationships to analyze. For example, structural model shows tbat there is a very weak relation between customer satisfaction and brand loyalty. Also, another interesting result shows that functional and quality related issues have strong effect on brand loyalty and very weak effect on customer satisfaction. Another remarkable result is the strongest effect of price on customer satisfaction compared to the other factors.

All those explained and other relations of the model should be evaluated in further detailed studies.

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FACTORS OF VALUE CREATION IN LEAGILE SUPPLY CHAINS: A CUSTOMER PERSPECTIVE

Danuta Kisperska-Moron[1], Artur Swierczek[2]

Abstract

The added value generated in manufacturing and lagistics processes may be considered as a primary criterian af supply chains' classificatian. On the ane hand, the supply chains may concentrate on the increase of internal efficiency (e.g. far stakeholders, awners, employees) thraugh reducing and eliminating waste (muda), an the ather hand, they may focus an maximization af value delivered to customers. The first group cancerns lean supply chains, the latter ane is linked ta the agile supply chains. In practice, the twa extreme types are combined in one successfully designed leagile supply chain.

The major portion af value created in any supply chain results from the perfect order fulfillment. The perfect arder represents ideal perfarmance measured by many variables cancerning complete delivery on the requested date, with accurate dacumentation, and in perfect canditian.

The aim af the paper is to verify if leagile supply chains significantly determine the level af perfect arder fulfillment in terms af its main characteristics. For that purpase the factor analysis is employed. The research is carried out in companies operating glabally in Eurape, North America, Asia, Africa and Australia. The canclusians obtained from the empirical study demanstrate factors of value creation in leagile supply chains, which play the most significant role far customers.

Keywords: Leagile supply chain, Supply cbain desigu, Customer-orieuted valne creation

1. Introduction

In supply chaius valne is created by efficient sourcing, manufacturiug, and distribution processes. The maiu role of adding uew valne to prodncts is to enhance customers's perception of a product's value by creating economic utility. There are four economic ntilities adding value to a product or service: form ntlility, possession utility, place and time utility (Bloomberg et al. 2002). Form utility is mostly created by mannfacturing through production process. However, also logistics operations in a supply chain adds that value through break-bulk operations in the plant, warebouse and transport terminals. Possession ntlility is based on tbe transfer of ownership from one channel member t o another. It is being done mainly by sale of a product or service whicb creates the value added benefit. Place utility refers to moving a product from one point to anotber point wbere demand exists. Due to that, customer can find a product where it is needed. Finally, time utility is baviug the product available wheu demanded.

For customers, at least three perspectives of value exist: economic, market and relevancy value (Bowersox et al. 2003). Traditional value is economic value built upon the economics of scale in operations as tbe source of efficiency. For the customer it means bigh quality at a low price. Another value perspective is market value connected to economies of scope effectiveness. Here customer has conveuient products assortment and choice. Business success depends also on relevancy involving customization of value-adding services producing a unique product or service bundle for each customer.

The simultaneous achievement of economic value, market value and relevancy value (known as integrative value proposition - Bowersox et al. 2003) becomes the major task of supply chain management. It requires proper operational performance in terms of its speed, consistency, flexibility and malfunction recovery. To achieve satisfying level of that performance two strategies can be applied: lean thinking (Womack & Jones 2003) or the concept of agility (Harrison et al 1999). In practice those two concepts are often connected with "leanness" adopted to upstream processes, followed by agility thereafter. Such a strategic concept has been referred to as "leagility" (Naylor et al. 1999).

Our main research question was: *how the factars of value creatian differ in manufacturing campanies operating in combined lean and agile enviranment due to the praportion between the degree of leanness and agility in particular systems?*

The remaining part of the paper has been organized in the following sections: literature review on leagile manufacturing and perfect order concept, research framework and methodology, demographic profiling of the obtained clusters, analysis of customer-oriented factors of value creation in leagile supply chains and conclusions.

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2. Leagile supply chain – literature review

The lean approach to manufacturing concentrates on inventory reduction and move towards just-in-time environment (Christopher, 2005). Lean organizations operate in relatively stable, largely controllable and predictable environments, maintained by cooperative long-term trading relationships between partners in supply chain (Peck et al. 2001). Classic lean supply chain and manufacturing performance are focused on achievement of low cost and not over-servicing the customer (Gattorna, 2006). Agility denotes the ability to match supply with demand, more readily adaptive to turbulent environment and rapid changes in industry. The focus in agile manufacturing and supply chain is on being fast and smart in aligning with demanding customers or in other words "first, fast and best".

Leanness is about doing more with less. Lean producer usually would be a mass producer that has succeeded in eliminating waste from his operations (Duguay et al. 1997). However, some authors discuss lean manufacturing referring to Japanese practices and experience (Fujimoto, 1999; de Haan and Yamamoto, 1999; Oliver et al. 2000). Their interpret leanness as operations targeting to produce "what, when needed but perfect".

The flexible producer demonstrates the ability to adapt to its environment. Agile manufacturing supporting agile supply chain operations is market-sensitive, network based, with process alignment and virtual operations (Christopher, 2005). The best adapting organization would be the agile manufacturer thriving and prospering in an environment of constant and unpredictable change (Maskell, 2001).

Some authors indicate that leanness and agility in a supply chain do not have to exclude each other, however, lean supply manufacturing and supply chain paradigm, with its focus on advanced standardization as the way to improved efficiency, can discourage innovation, differentiation and complex learning needed to carry on the change (Dubois, Gadde, 2000). The assumption of this paper is that leagile practices in companies provide a combination of different aspects of utility being the source of value added in supply chains.

3. Perfect order as the source of value

Leagile practices at manufacturing firms may influence the level of customer service in a supply chain. The term "customer service" in this paper has been used in a very broad sense and denotes not only a function or activity that has to be managed, such as order processing, invoicing and postsale support, but mainly deals with the total corporate philosophy and attitude leading to the planned action in the company and the market (Stock and Lambert, 1987). There are some classic elements and indicators of customer service such as (La Londe and Zinszer, 1976) :

1. Availability of an item, representing the ability of the supplier to satisfy customers orders within a time limit (accepted generally for a particular item). The number of stock outs is a usual measure of product availability.
2. Delivery time, elapsing between receipt by the supplier of a firm commitment for an order and receipt of the goods by the customer.
3. Reliability, meaning the supplier's commitment to maintain a promised delivery schedule.
   Accuracy of quantities and products ordered.

In leagile operations environment managers focus attention on both flexible order performance as well as on zero-defect performance. Therefore, logistics processes have been subjected to the same Total Quality Management efforts as manufacturing and other processes. In practice, it resulted in creation of the concept of "perfect order". There is a plethora of articles which place a great emphasis on "perfect order" concept (Novack and Thomas, 2004; Montgomery et al. 2002; Rushton et al. 2000). However, from a practical point of view, the concept of "perfect order" introduced by Bowersox et al. is perceived as the most compact and clear, and thus, can be effectively applied in empirical studies (Aramyan et al. 2007). In the opinion of Bowersox et al. perfect order denotes complete delivery, on time, at the right location, in perfect condition, with complete and accurate documentation (Bowersox et al. 2003). In other words, it means that total order cycle performance must be executed with zero defects. The concept of perfect order enables managers to measure the performance of the logistic system and how well that system creates all utilities for customers.

Research results presented in this paper are based on a large set of variables representing the above mentioned aspects of customer service included in the concept of "perfect order".

4. Research framework and methodology

4.1. Data collection and sample

The main research instrument used for this study was a questionnaire developed by the Global Manufacturing Research Group consisting of several sections examining, besides general demographics of surveyed companies, such aspects as: competitive goal measurement, internal manufacturing practices, manufacturing planning and control information systems, outsourcing and supplier relations, sales forecasting, purchasing practices. The whole questionnaire contained several hundreds of variables and led to the creation of a database extremely rich with informative value. There is no single meta-theory for guiding a development of GMRG survey. Instead, many aspects of general manufacturing practices were a subject of investigation. Data collected within a fourth release of a survey has been collected by researchers from several countries in Europe, North America, Asia, and Africa.

For the purpose of the research presented in this paper only a portion of that data (selected variables) has been used. Originally 49 variables with diverse scales were a subject of initial analysis. The opinion items were gathered using 5-point Likert scale, and on the other hand, the descriptive measures were filled in directly (e.g. average time from start to completion, index of manufacturing throughput time, etc.). The preliminary analysis has shown that distributions of the selected variables were skewed. Finally, only 27 of the items were used for the further investigation.

The total sample employed for this research consisted originally of 861 manufacturers. As a result of initial data analysis, screening and elimination of observations with missing values 501 companies remained as a subject of further analysis. This group embraced manufacturers from Albania, Australia, Austria, China, Shanghai, Fiji, Ghana, Italy, Macedonia, Nigeria, Poland, Sweden, Thailand and USA.

The majority of the survey companies operate in electronic and other electrical equipment industry (26.6 percent), followed by industrial, commercial machinery and computer equipment (12.2 percent) and food industry (10.0 percent). The other industries are also represented in the sample but with a much smaller share. It is important to note that companies from other miscellaneous industries occupy 9.5 percent of the total sample.

The examined companies were not subject to random selection and the items included in the questionnaire are not stochastic variables. Instead a non-probabilistic extraction of the data set was used. It means that a descriptive (not a stochastic) approach was employed in the presented research. Although the research sample of 501 companies is relatively large, the obtained conclusions can by no means be generalized to the entire population of companies in the analyzed industries. The results of the research indicate only certain tendencies and may be used to the further in-depth studies.

4.2. Research methodology

In order to reveal factors of value creation from the perspective of customer two-step statistical analysis was employed.

The first step was the reduction of the many variables available through factor analysis in order to highlight the main underlying multi-item factors of value creation. Factor analysis was performed on the variables reflecting multidimensional aspects of customer service which involves total order cycle performance from order receipt to delivery and error free invoicing. In order to perform the factor analysis a principal component analysis (PCA) with Varimax Rotation was employed. PCA was performed to structure the collected information and the Varimax Rotation was employed to reduce multicollinearity among variables. The analysis was conducted on standardized variables.

The inspection of anti-image correlation matrix has led to the elimination of 5 variables whose a measure of individual sampling adequacy is below a nominal cut off point of 0.5. In the result of factor analysis 1 variable was excluded as it indicated factor loading below a nominal cut-off point of 0.65 [1]. Finally, factor analysis which was carried out on 21 items, enabled to identify the following set of constructs (Table 1):

- Factor 1: comparison of companies' performance with their major competitors in terms of product performance, order fulfillment speed, delivery speed, delivery as promised, delivery flexibility, flexibility to change output volume, flexibility to change product mix, manufacturing throughput time, new product design time,
- Factor 2: investments made by companies in the manufacturing throughput time reduction, Total Quality Management, ISO 9000 Certification, Supplier Certification, Statistical Process Control in the last two years,
- Factor 3: indices of change of cycle time, manufacturing throughput time and delivery speed within two years,
- Factor 4: changes made to the plant's bills of materials and investments in Six Sigma and ISO 14000 Certification,
- Factor 5: average number of days late for customers' order.

The number of factors was determined according to the analysis of the percentage of variance explained and the Kaiser criterion (Aczel. 1993). KMO coefficient score indicating a suitability of the sample for factor analysis in a space of 21 variables is 0.877 which is a very good result (Bryman & Kramer. 1999). Bartlett's test of sphericity demonstrated sufficiently high value for the extracted factors at $p <= 0.000$ (Approx. chi-square 5108.9, $df = 210$).

As shown in table 1, the obtained factors explain almost 65 percent of total variance. The Cronbach's alpha coefficients were calculated to check the internal consistency of extracted factors. Alpha score of transformed variables in three instances (Factor 1, 2, 3) is above the nominal cut-off point of 0.7. Considering the rule provided by George and Mallery, the obtained results of alpha coefficients suggest a good internal consistency of those three extracted constructs (George & Mallery. 2003). The alpha score for factor 4 is lower than a nominal cut-off point of 0.7 which is a questionable result. As the content of the construct is divergent, we decided to split the three variables forming the factor 4 into two groups of items. First group consists of investments in Six Sigma and ISO 14000 Certification (achieving alpha coefficient at 0.766) and the second construct was formed by one variable - annual permanent changes made to the plant's bills of materials. The splitting of factor 4 resulted in producing the total of six factors, used for the further analysis.

The second step of the study was the classification of the sample into homogenous groups through cluster analysis. The criteria for classifying the sample into clusters were the six factors extracted in the previous step. On the one hand, it enabled to investigate which dimensions of value creation play an important role in the extracted groups of companies, and on the other hand, it allowed to reveal clusters' major characteristics in terms of some demographics and the level of leagility in supply chains.

Table 1. The selected factors measuring value creation in leagile supply chains from the perspective of customer.

Factor loadings Extraction: Principal Components Analysis (PCA) Varimax Rotation					
Variables used	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
product performance	0.539				
order fulfillment speed	0.470				
delivery speed	0.816				
delivery as promised	0.790				
delivery flexibility	0.822				
flexibility to change output volume	0.786				
flexibility to change product mix	0.786				
manufacturing throughput time	0.706				
new product design time	0.609				
index of the change of cycle time in 2 years			0.871		
index of the change of manufacturing throughput time in 2 years			0.936		
index of the change of delivery speed in 2 years			0.876		
average number of days late					0.834
annual permanent changes made to the plant's bills of materials				0.594	
investments in Six Sigma (Green belt/ Black Belt)				0.786	
investments in ISO 14000 Certification				0.811	
investments in manufacturing throughput time reduction		0.563			
investments in Total Quality Management		0.733			
investments in ISO 9000 Certification		0.803			
investments in Supplier Certification		0.823			
investments in Statistical Process Control		0.687			
Cronbach's α	0.885	0.820	0.873	0.627	unifactor
Eigenvalue	6.5681	2.5404	2.2390	1.228	1.003
% total variance explained	23.466	15.878	11.781	8.331	5.213
Cumulative % variance explained	23.465	39.343	51.124	59.455	64.667

At first in order to determine the number of clusters a hierarchical cluster analysis with Ward's partitioning method and squared Euclidean distance was performed (Sagan. 2003). In the result of the analysis four clusters were formed. The number of groups was obtained through the greatest increase in the agglomeration coefficient while minimizing a number of clusters (Ketchen & Shook. 1996). The greatest increase corresponds to the grouping of all cases from four to three clusters.

The number of four clusters was used to perform K-Means Cluster Analysis to assign each case to the appropriate cluster. The criterion of the cluster membership was the minimal Euclidean distance between each case and classification center represented by centroid (cluster center). The results of the cluster analysis are shown in Table 2.

Table 2. Clusters obtained on the base of value creation factors (standardized score).

	Clusters			
Factors	1	2	3	4
comparison of companies' performance	-0,07	0,00	**-1,66**	0,09
investments in mfg time reduction and quality std.	-0,46	**0,67**	-0,46	**-0,93**
indices of change	-0,23	0,04	**-1,60**	**0,05**
changes made to BOM	**2,56**	-0,26	0,84	-0,34
investments in Six Sigma and ISO 14000	**0,71**	0,45	-0,34	**-0,56**
average number of days late for customers' order	0,39	-0,08	4,94	**-0,18**

The results of K-Means Cluster Analysis was compared with the class assignment obtained from the Hierarchical Cluster Analysis. On the basis of the results of two partition methods the contingency table was constructed and Rand Index calculated. The measure of agreement showed that 67.5 percent of pairs of objects are placed in the same class. It means a sufficient level of agreement and confirms a correct choice of K-Means Cluster Analysis as the leading clustering method (Krieger & Green. 1999).

Cluster 1 contains 8.8 percent of research sample of companies which indicate the highest level of annual changes made to Bill of Materials. The firms of this group invest, to the great extent, their resources (money, time and/or people) in the area of Six Sigma and ISO 140000 Certification. Cluster 2 includes the largest group of 55 percent of cases in the sample. The firms of this cluster invest their resources in the manufacturing throughput and setup time reduction and quality standards such as Total Quality Management, ISO 9000 Certification, Supplier Certification and Statistical Process Control. Cluster 3 contains the smallest share of 1.4% of companies in the sample. This group indicates the lowest level of comparison with major competitors and the highest average number of days late for delivering customers' orders. The companies of the cluster 3 report the lowest change of indices concerning cycle time, manufacturing time and delivery speed in the last 2 years. The last cluster 4 includes almost 35 percent of the sample. The companies from this group indicate the lowest level of investments in the manufacturing throughput and setup time reduction, quality management and in the area of Six Sigma and ISO 140000 Certification. On the other hand, this group reports the highest changes of indices in cycle time, manufacturing time and delivery speed in the last 2 years and the lowest level of changes made to Bill of Materials and the smallest average number of days late in delivering customers' orders. Although, cluster 3 represents a very small share of the sample, due to consistency of the obtained results, we decided not to reject that cluster from further analysis.

5. Demographic profiling of the obtained clusters

The clusters presented have been analyzed considering their major characteristics, such as industry type, country of origin, number of employees in analyzed forms and the share of domestic capital in companies' ownership (Tables 3 and 4).

Table 3. Industry distribution of the clusters.

Industry type	Clusters			
	1	2	3	4
Food And Kindred	**8.3%**	**12.8%**	0.0%	6.5%
Lumber and wood	4.2%	3.1%	0.0%	3.9%
Chemicals	0.0%	4.8%	0.0%	5.9%
Rubber and plastics	4.2%	3.1%	0.0%	5.2%
Primary Metal	**8.3%**	4.4%	0.0%	3.3%
Fabricated Metal	0.0%	2.6%	0.0%	**11.8%**
Industrial/Commercial Machinery/Computer	**12.5%**	**12.8%**	**16.7%**	**11.1%**
Electronic/Electrical Equipment/Components	**45.8%**	**28.6%**	**66.7%**	**19.0%**
Stone. Clay. Glass. And Concrete Products	0.0%	4.4%	0.0%	3.9%
Miscellaneous manufacturing	4.2%	10.6%	0.0%	9.2%

It is important that in each of the clusters companies from electronic/electrical and equipment/components sector prevail which may be partially caused by a large share of companies representing this industry in the whole sample.

Table 4. Distribution of the clusters by country of origin

Country of origin	Clusters			
	1	2	3	4
Australia	2,3%	2,9%	0,0%	7,5%
Austria	**9,1%**	0,7%	0,0%	1,1%
China	**15,9%**	**13,1%**	**14,3%**	6,9%
Fiji	6,8%	**30,7%**	0,0%	7,5%
Italy	0,0%	4,0%	0,0%	**16,1%**
Korea	**40,9%**	9,9%	**14,3%**	6,9%
Poland	6,8%	5,8%	0,0%	**17,2%**
USA	**9,1%**	**21,2%**	**71,4%**	**19,5%**

Table 4 shows the composition of the sample by selected countries of origin. One should note that the clusters include quite diverse share of companies from different countries. The companies from Korea comprise almost 41% of the cluster 1 followed by 15.9% firms from China and 9.1% of companies from Australia and USA. Cluster 2 includes mostly companies from four countries, namely Fiji (30.7%), USA (21.2%), China (13.1%) and Korea (almost 10%). In the smallest cluster 3 dominate firms from USA (71.4%), China and Korea (both with a share of 14.3%). Cluster 4 contains quite even share of companies from USA (19.5%), Poland (17.2%) and Italy (16.1%).

Cluster 1 is characterized by companies with the highest average number of employees and the lowest share of domestic capital in companies' ownership. On the contrary, cluster 4 has the lowest average number of employees and the highest share of domestic capital in ownership of the examined firms.

The analysis of major characteristics of the obtained clusters shows that in all 4 clusters similarly companies belong to two industries: industrial/commercial machinery/computer equipment and electronic/electrical equipment and components industry, however, the share of each of them is somewhat different. Only in cluster 4 the sector of fabricated metal is represented by third major industry whereas in cluster 1 and 2 it is food and kindred products. On the other hand, the analysis reveals that there is a high level of diversity in distribution of clusters by country of origin. In cluster 1 a prevailing position is reported by Korean companies while companies from Fiji and USA dominate in cluster 2. The American companies have a largest share in cluster 3. The participation of firms from USA is the highest in cluster 4 but they are followed by Polish and Italian companies with a similarly high share in this group. In synthesis, it should be noted that clusters 1 and 2 contain mainly the companies from Asia and USA while in cluster 4 the European and American firms dominate.

6. Analysis of customer-oriented factors of value creation in leagile supply chains

In order to investigate the factors determining the creation of value from the customer perspective in leagile supply chains, we compared the results of the clusters and the percentage of manufacturing orders falling into four categories, namely engineer-to-order, make-to-order, assembly-to-order and make-to-stock. Those categories reflect a location of decisions made in a supply chain concerning a structure of manufactured and delivered products. To be consistent with a theory, it is important to note that lean part of the supply chain is rather connected with assembly-to-order and make-to-stock practices while agility in supply chains is linked to the engineer-to-order and make-to-order activities (Mason-Jones. & Towill. 1999; Hoekstra. & Romme. 1992). These two concepts can be practically combined into a leagility and the location a share of manufacturing orders classified into the one of four respective categories may indicate a level of leagility in supply chains.

The distribution of medians of manufacturing orders in four categories is very even in the sample and ranges from 11.5% to 15.0% for engineer-to-order, assembly-to-order, make-to-stock and 32.0% for make-to-order category. The breakdown of the four clusters by the four levels of leagility in supply chains is presented in Table 5.

Table 5. Distribution of the clusters by the diversity of leagility in supply chains (median scores).

	percentage of manufacturing orders			
Clusters	Engineer-to-order	Made-to-order	Assembly-to-order	Make-to-stock
1	5,0%	30,0%	6,0%	1,5%
2	20,0%	30,0%	18,0%	16,0%
3	0,0%	20,0%	65,0%	5,0%
4	10,0%	40,0%	5,0%	10,0%

The companies from cluster 1 report that a share of 30.0% of incoming orders is custom made. This result may explain a high level of annual changes made to the Bill of Materials as well as the largest extent that the companies of this group invest their resources in Six Sigma and ISO 14000 Certification. The obtained results seem to be consistent with the major characteristics of the cluster, as it is formed mostly by Korean and Chinese companies operating in electronic and other electrical equipment/components. This sector requires from companies to be innovative and specialized in manufacturing the most advanced and automated technologies. In order to address the most refined needs of customers, the companies from this cluster may be forced to adjust their products and make many annual changes to the BOM. It would mean that companies from this group develop, on the basis of partnership, cooperation with customers at the initial stages of product design. The great number of annual changes made to BOM may also result from problems in procurement process and purchase orders delivered from suppliers. When those problems occur, the companies often have to look for substitutes and change the structure of the final product to fit the replaced elements. The complexity and a high frequency of changes in Bill of Materials comprising large number of components, often resulted in a correspondingly high probability of defective final products. Therefore, the companies employ a Six Sigma framework which is a technique that allows companies to enhance their bottom line by designing and monitoring everyday activities in ways that minimize waste and resources while increasing the level of customer service. The obtained result is consistent with previous studies conducted by Andersson et al. (2006). High tech industries represented by majority of companies in cluster 1 with innovative and automated technologies may also be in line with the increase of companies' social awareness of environmental problems which reflects a customer oriented character of environmental management and demonstrates that the part of value creation for customer includes proactive steps to be taken by an organization to preserve and protect natural environment. This view is also supported by Chattopadhyay who claims that environmental management integrates general principles in order to ensure prudent use of non-renewable resources and preservation of environment (Chattopadhyay. 2001). The concept has been supported in operational terms by the development of the ISO 14000 standards. Based on the literature review, Chavan concludes that "the benefits gained from ISO 14000 Standards certification are mainly related to clean/green and effective operations, and market expansion, as well as improvement in company image for most companies" (Chavan. 2005).

The companies in cluster 2 indicate quite even and similar level of leagility in supply chains. They report a relatively large (though the lowest in four categories) share of orders made to stock. The companies in that cluster indicate that investments in manufacturing throughput time and setup time reduction is an important element in their operations. It may suggest that, due to make to stock strategy applied in the companies of this group, the processing time is somewhat longer and generates larger levels of work-in-progress (WIP). This result is in line with previous empirical studies which suggested that throughput time is connected to several performance indicators, and long throughput times tend to generate inventory or work-in-progress, which, by absorbing working capital, increases financial costs (Blocher. Garrett & Schmenner. 1999). Therefore, the traveling time of semi-product in a manufacturing process should be kept to a minimum and any necessary traveling is performed along a few simple and well-defined routes. This view is supported by the results of earlier research conducted by Wemmerlov and Hyer who noticed that in manufacturing programs set-up times were reduced by an average of 41.4 per cent whilst throughput times were reduced by 24.3 per cent (Wemmerlov & Hyer. 1989).

The obtained results may also suggest that regardless of the characteristics of manufacturing orders in a supply chain, the companies from cluster 2 operating in electronic and other electrical equipment/components, industrial/ commercial machinery/computer equipment and food/kindred industries are forced to undertake a continuous improvement process embracing Total Quality Management, ISO 9000 Certification, Supplier Certification and Statistical Process Control. These results seem to be consistent with the literature, as the companies should seek to meet or exceed customer expectations by providing goods in accordance with the required customer service standards (Mersha. 2000). It is a vital element of every company's mission and strategy.

Cluster 3 seems to be strange, as its share in a whole sample, and thus its representativeness, is limited. There is a prevailing share of companies from USA operating mostly in electronic/electrical equipment and components. The companies in this group report a large share of products (65.0%) to be assembled to order. As the decisions about a structure of the products are located relatively close to the market and customers in assembly to order concept, it may explain the highest reduction of cycle and manufacturing throughput time reported by companies of this cluster. However, it is notable that the companies of the group indicate the highest average number of days late in case of delayed deliveries.

The companies from cluster 4 indicate a large share of 40.0% of orders falling to the custom made category. This group consists of European and American firms operating mostly in electronic and other electrical equipment/ components, industrial/commercial machinery/computer equipment and fabricated metal products. The distribution of manufacturing orders falling into four categories is similar to cluster 1. However, considerable differences in the factors of value creation among two clusters may be observed. Although the companies from this group report a high share of custom made orders, they also indicate the lowest level of changes made to Bill of Materials. The companies from this cluster might not have problems in the purchase of components and therefore they do not need to change the structure of the final products. The small number of changes made to BOM may determine a low probability of defects occurring in the products. Therefore the companies from this cluster do not invest their resources in Six Sigma. It is interesting to note that the companies of this group are not very keen to invest also in the other quality standards such as Total Quality Management, Statistical Process Control, ISO 9000 Certification, Supplier Certification and ISO 14000. It may suggest that the level of quality systems is already bigh, and does not need much improvement, however, that problem requires further in-depth research. The companies also do not invest in manufacturing throughput time and setup time reduction and probably therefore they report the highest increase of indices connected to cycle time and manufacturing throughput time within two last years. It suggests that logistical time compression of physical flows might be highly related to the extend of investments made by companies. On the other hand, it may be observed that the firms from this cluster indicate the lowest average number of days late for delayed customer orders. Though the companies do not invest their resources in the area of manufacturing throughput and setup time reduction, when a delivery of customer order is delayed they minimize a number of days late.

7. Conclusions

Our research contributed to answering the main research question and helped to identify the main factors of value creation in "leagile" operations. Those factors stay in accordance with the main idea of "perfect order" as the concept combining zero-defect efforts toward typical market, economic and relevancy value for customer. Several robust factors were identified showing the dual character of "leagile" operations. Those factors correspond to the main forms of value: market, economic and relevancy . There are differences in value creation between the clusters determined on the basis of factors creating value. They result from the level of agility and leanness in manufacturing operations but also from the type of industry and practices typical for regional markets.

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A STUDY ON USER ACCEPTANCE OF PORT COMMUNITY SYSTEMS

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Abstract

Port community systems (PCS) are computer networks which link up the port with all the companies that use it, including haulers, rail companies, shipping lines, feeder ports, shippers and customs officers. Although these systems have promising benefits for the users, a lot of companies are reluctant to adopt them. Thus this paper tries to derive the factors that affect PCS adoption. For this purpose a research model was constructed using Technology Acceptance Model (TAM). In order to confirm the model a questionnaire survey was conducted targeting the sea and land carriers located in the Busan Port area. According to the results, a direction of improvement was suggested for better PCS adoption.

Keywords: port community systems (PCS), electronic data interchange (EDI), technology adoption, Busan Port

1. Introduction

In the world of globalization, due to various changes in the international port logistics environment, such as increasing amount of international trade and container throughput, advent of ultra-large container vessels, changing customer demands, developments in information technology and new handling equipments, concerns about security and environmental issues, the advanced ports around the world are in a severe competition to ensure their container throughput and strategic position as "hub" ports. In order to confront this competitive pressure, ports are investing in infrastructure and improving their operation systems. These investments can be categorized in four general groups. First, ports have to provide deep berths to enable the safe docking of ultra-large container vessels. It would require construction of new berths or deepening the existing ones. The second one is related to new handling technologies and terminal automation for rapid handling of containers, such as advanced container cranes with tandem spreaders that can handle four 20-foot-containers and two 40-foot-containers at one time, driverless automated container carriers, and automated yard cranes that are remotely controlled. Terminal automation not only increases the container handling efficiency but also enables huge savings in operational costs. Thirdly, along with the terminal automation, the terminal operating systems (TOS) are also improved. Terminal operating systems are "computer systems available for organizing the container terminal itself" (Jeffrey, 1999). A typical TOS manages the flow of containers through the terminal, plans loading/unloading schedules and yard transfer operations, processes the containers transported into the terminal by rail or road, and notifies shipping companies and trucking companies about the locations of containers (Choi et al., 2003). Modern TOS applications use artificial intelligence to determine the optimum position of the container according to their shipping schedule and coordinate the operations within the terminal in order to increase the overall efficiency of the operations. Finally port community systems, which are "computer networks which link up the port with all the companies that use it, including hauliers, rail companies, shipping lines, feeder ports, shippers and customs officers"(Forward, 2003) are being implemented in order to reduce paperwork and facilitate the information flow related for port operations and customs declarations.

All these factors are necessary for the ports to keep competitive advantage. On the other hand research related to port community system development and adoption is relatively insufficient when compared to terminal operating systems and handling equipments. However port community systems require the participation of various organizations with different characteristics, often challenge them to integrate their systems or change their business processes. Previous studies state severe resistance of the port users which causes failure of the projects (Keceli, Choi & Park, 2007) or delays and additional costs (Jeffrey, 1999). Therefore, it can be concluded that there is necessity for determining factors affecting technology acceptance of port community systems. Thus, the purpose of this study is to derive the factors affecting the adoption of port community systems by the port users.

2. Theoretical Background

2.1 Electronic Data Interchange (EDI)

Port community systems are generally based on Electronic Data Interchange (EDI) technology. According to UN/EDIFACT, EDI is "electronic transfer from computer to computer of commercial or administrative transactions using an agreed standard to structure the transaction or message data" (van Heck & Ribbers, 1999).

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Nowadays, the information within an organization is mainly processed by computers, but the data transfers between organizations are mainly based on papers, forms or printouts. EDI technology enables data transfer between organizations' databases without printing. The data is converted through data converter, transferred via e-mail, internet or a dedicated line, and decoded on the receiver side. The key to EDI is using the same data format on both sides of the transfer (Vincent, 2003).

Using EDI can lead important benefits to an organization, sucb as faster exchange of data without errors, reducing the communication costs, streamlining logistic processes, resulting in reduction of lead times, on time delivery and inventory reductions, improving the competitive position, e.g. by creating new kinds of services (van Heck & Ribbers, 1999). The study of Jimenez-Martinez and Polo-Redondo (2004) categorizes the benefits of EDI into three groups, i.e. direct benefits, such as paper savings, avoiding repetitive administrative procedures or reduction in administrative personnel, indirect benefits, such as avoiding errors, faster payments/improved cashflow, and finally strategic benefits, such as increasing business relationships with companies using EDI or improving customer loyalty.

Although the promising benefits of EDI, a lot of companies are reluctant to implement EDI (van Heck & Ribbers, 1999). The study of Suzuki and Williams (1998) addresses this resistance behavior and states that the resistance is due to uncertainty, lack of standards, and low perceived benefits.

Thus, there are plenty of previous studies about EDI adoption in various contexts and industries. These papers will be referred in detail for research model formulation in the following chapters. But most of these studies focus on information exchange between buyers and suppliers; bowever none of them targets adoption of port logistics related EDI or port community systems.

2.2 Port Community Systems

Traditionally, port users deliver cargo related documents and forms for port service requests through paper-based methods, such as sending a fax or handing in the documents directly. Sending the documents via e-mail also became a common practice due to the diffusion of the internet. The delivered information must be typed again into the port's information systems. Such typing works consume time and are vulnerable to typing errors. Port community systems allow the users to make service requests and input their information directly into the port's information systems. Such a system drastically decreases paperwork, improves data quality, enables data integrity among different stakeholders, and supports the port management for operations (Vincent, 2003; Zygus, 2006).

Rodon and Ramis-Pujol (2006) define port community systems as "an electronic platform that connects the multiple systems operated by a variety of organizations tbat make up a seaport community," and tries to explain the integration of an organization to an existing port community system. Rodon et al. (2007) analyzes the PCS in port of Valencia and tries to indicate the importance of standardization in B2B context. Mila (2007) give an overview about PCS and presents the results of a survey about the characteristics of PCS in 27 ports. Diop (2007) describes the basic characteristics of a PCS, indicates suitable architecture and explains the designs of PCS in Port of Dakar. Smit (2004) compares PCS of three ports in Europe; port of Antwerp, Hamburg and Rotterdam, on the basis of their architectures.

There are a few studies on port community systems; most of them are descriptive in nature (Rodon, J., Ramis-Pujol, 2006), i.e. the case studies on Portnet in Singapore (Applegate et al., 2001) or TradeLink in Hong Kong (King & Konsynski, 1990). They do not tackle the problem of the factors that affect the users' adoption of PCS. On the other hand the study of Keceli et al. (2007) states that the user resistance to adopt information systems offered by Kumport (a private port in Turkey) resulted in the failure of the system, whereas Forward (2003) states that getting the members of the port community in Cyprus actively involved in the system was more difficult than expected, which caused delays in the completion of the system. Thus, Cyprus Ports Authority directed its efforts at training and education. Thus more study on user acceptance of PCS is necessary. The results of the study can be directly utilized in future PCS implementation projects, and the success of the systems can be guaranteed with proper understanding of the factors affecting the adoption of such systems.

2.3 Port Community Systems in the World's Advanced Ports

Port community systems have various forms and characteristics in each and every port. Among them, Portnet in Port of Singapore is tbe one that is most studied in previous research. Port of Singapore Authority's (PSA) Portnet is the representative port community system since it is totally connected to PSA's terminal operating system (CITOS) and custom declaration system (TradeXchange) of Singapore government. Besides Portnet, Data Communications System (Dakosy) and COAST (Container Authorization System) of Port of Hamburg, Customer Plus Programme and OnePort Ltd. and Tradelink of Port of Hong Kong, PortofRotterdam.com, Virtual Port and WebJonas of Port of Rotterdam, PORT-MIS and KTNET in Busan Port can be considered as some of the well-known port community systems around the world. When the functionalities and services of these systems are examined, it can be easily concluded that not all of these systems offer full services required by the port community, but some of them only offer a portion of the services, depending on the major stakeholders of each system. These functions can be classified under three major categories, namely port management related tasks, customs related tasks, and online platforms for electronic commerce among the port users.

3. Research Methodology

3.1 Research Method

In order to derive the factors affecting PCS adoption, this research uses a questionnaire survey targeting the corresponding representatives of shipping companies and land transport companies in the Busan Port region. The collected data will be analyzed with SPSS and AMOS software packages using structural equations method.

3.2 Research Model and Hypotheses

On the basis of the previous studies on adoption of information systems similar to PCS, such as Electronic Data Interchange (EDI) and other inter-organizational information systems (IOIS), a research model was derived as shown in Figure 1.

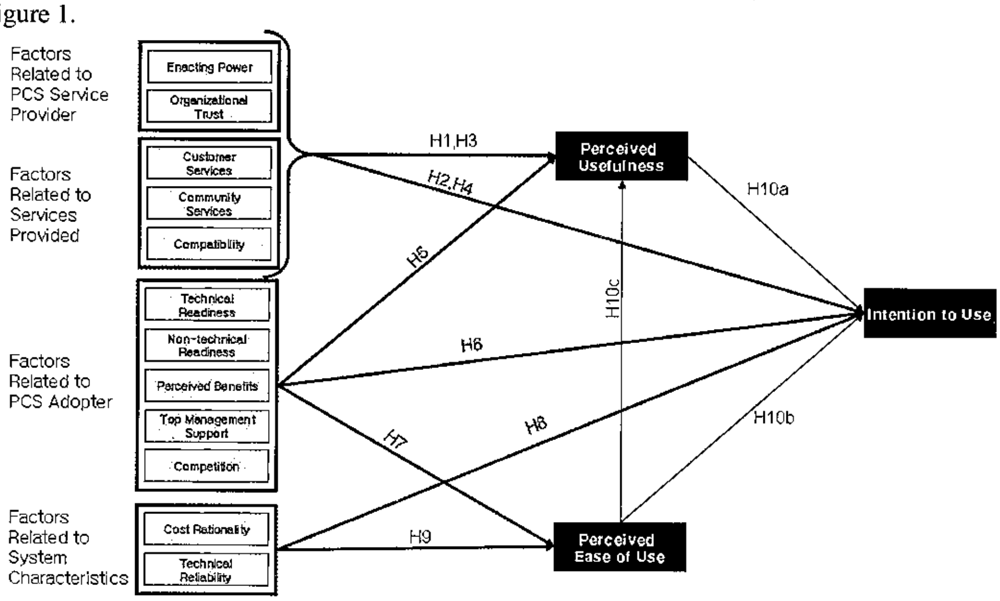

Figure 1 Research Model

According to the research model, independent factors affecting intention to use PCS are divided into four categories, namely factors related to PCS service provider, factors related to services provided, factors related to PCS Adopter and factors related to system characteristics. Factors related to PCS service provider refer to the power of the provider to influence the decision of the adopter, and the trust of the adopter towards the provider.

Factors related to services provided refer to customer services, community services and compatibility. Customer services are additional services offered by PCS to a single customer, which could not be achieved through other modes of communication, whereas community services are defined as additional services offered by PCS facilitating commerce between various customers, which could not be achieved through other modes of communication. Compatibility refers to the extent to which an innovation is perceived as consistent with existing procedures, value systems and needs of potential adopters. (Crum et al., 1996).

Factors related to PCS adopter refer to technical and non-technical readiness of the adopter, perceived benefits from PCS, top management support and competitive pressure on the adopter. According to Chwelos et al. (2001) the readiness of a company to adopt the new system is defined by measures whether a firm has sufficient IT sophistication and financial resources to undertake the adoption of EDI. IT sophistication captures not only the level of technological expertise within the organization, but also assesses the level of management understanding of and support for using IT to achieve organizational objectives. To be more specific, technical aspects of readiness such as hardware and software capabilities are considered separately from non-technical aspects such as know-how, expertise and financial readiness. Competition is considered as the ability to maintain or increase competitiveness within the industry (Chwelos et al., 2001), whereas top management support refers to the innovativeness and involvement of CEO (Al-Qirim, 2007).

Finally, factors related to system characteristics refer to the rationality of the cost of using the system over its benefits and the technical reliability of the system, i.e. the ability of the system to perform a required function under stated conditions for a stated period of time (Walls et al., 2006). These factors are the main differences between conventional EDI based on value added networks (VAN) and XML/EDI systems based on the web (Hsieh and Lin, 2004; Ratnasingham, 1998).

In accordance with the research model, the research hypotheses are derived as shown in Table 1.

4. Research Results

Before the actual survey, a pilot test was conducted on ten responsible employees of a shipping company in Busan. After verifying that the contents of the questionnaire are consistent and easily understood by the respondents, actual questionnaire survey was conducted in April 2008. The self-administered questionnaire was consisted of 7-point Lickert scale questions, and the survey was conducted by direct visits to the sea and land carrier companies in Busan Port region. The demography of the respondents are given in Table 2.

Table 2. Demography of the respondents

Characteristics		Sea Transport Companies	Land Transport Companies
Number of respondents		107 out of 139	86 out of 114
Response rate		77%	76%
Distribution of ranks	Clerk	43.88%	37.5%
	Deputy chief	19.39%	25%
	Chief	24.49%	17.5%
	Manager	7.14%	7.5%
	Executive officer	5.10%	7.5%
	President	0%	5%
Average years of work experience		7.2 years	6.6 years

Table 1. Research Hypotheses

No.	Hypothesis	Source
H1a	Enacting power has significant positive impact on perceived usefulness	Grandona,E. E. ,Pearson, J. M. (2004); Lua,J., Yaob, J. E., Yu, C.S.(2003); Hu, P.J.H., Clark, T.H.K., Ma, W. W. (2003); Liao, C., Chen, J.L., Yen, D. C. (2007), van Raaij, E. M., Schepers, J.J.L. (2008)Lee, K.C., Kang, I.W., Kim, J.S. (2007)
H1b	Organizational trust has significant positive impact on perceived usefulness	Pavlou (2003)
H2a	Enacting power has significant positive impact on intention to use	Ngai, Gunasekaran, (2004); Seyal et al. (2007); van Heck & Ribbers, (1999), Hart & Saunders, (1998); Akos, N. (2004);
H2b	Organizational trust has significant positive impact on intention to use	Crum et al. (1996), Holmes, Srivastava, (1999), Carter and Bélanger, (2005); Hart & Saunders, (1998);
H3a	Customer services has significant positive impact on perceived usefulness	Lee et al (2003);
H3b	Community services has significant positive impact on perceived usefulness	Lee et al (2003);
H3c	Compatibility has significant positive impact on perceived usefulness	Venkatesh, Davis (2000); Sun, Zhang, (2004); Achjari and Quaddus (2002); Quaddusa & Xu (2005); Tung, F.C., Chang, S.C. (2008), Fu, J.R.,Farn, C.K., Chao, W.P. (2006), Wua, J.H., Wang, S.C. (2005)
H4a	Customer services has significant positive impact on intention to use	Seyal et al. (2007); Lee et al (2003);
H4b	Community services has significant positive impact on intention to use	Seyal et al. (2007); Lee et al (2003);
H4c	Compatibility has significant positive impact on intention to use	Lee (1998), Crum et al. (1996), Al-Qirim (2007), Zhu et al. (2002); Carter and Bélanger (2005); Premkumar & Roberts (1999); Ramamurthy & Premkumar (1995);
H5a	Technical readiness has significant positive impact on perceived usefulness	Lin et al. (2005);
H5b	Non-technical readiness has significant positive impact on perceived usefulness	Lin et al. (2005);
H5c	Perceived benefits has significant positive impact on perceived usefulness	Amoako-Gyampah, K., Salam, A.F. (2004); Ramayah, T., Lo, M.C. (2007)
H5d	Top management support has significant positive impact on perceived usefulness	Sun, Zhang (2004); Liao and Raymond (2000); Quaddusa & Xu (2005);
H5e	Competition has significant positive impact on perceived usefulness	Quaddusa & Xu (2005);
H6a	Technical readiness has significant positive impact on intention to use	Lee (1998); Chwelos et al. (2001); Ngai, Gunasekaran (2004), van Heck & Ribbers (1999), Wang et al. (2004), Zhu et al. (2002); Ramamurthy & Premkumar (1995);
H6b	Non-technical readiness has significant positive impact on intention to use	Chwelos et al. (2001); Ngai, Gunasekaran (2004), van Heck & Ribbers (1999), Crum et al. (1996), Holmes, Srivastava (1999), Zhu et al. (2002); Fernandes et al (2006); Premkumar & Roberts (1999); Ramamurthy & Premkumar (1995);
H6c	Perceived benefits has significant positive impact on intention to use	Lee (1998); Chwelos et al. (2001); Ngai, Gunasekaran (2004), Seyal et al. (2007), Suzuki, Williams (1998), van Heck & Ribbers (1999), Crum et al. (1996), Wang et al. (2004), Al-Qirim (2007), Carter and Bélanger (2005); Murphy & Daley (1998); Akos, N. (2004); Fernandes et al (2006); Premkumar & Roberts (1999); Ramamurthy & Premkumar (1995);
H6d	Top management support has significant positive impact on intention to use	Lee (1998), Ngai, Gunasekaran (2004), Seyal et al. (2007), Crum et al. (1996), Wang et al. (2004), Al-Qirim (2007), Fernandes et al (2006); Premkumar & Roberts (1999); Ramamurthy & Premkumar (1995);

H6e	Competition has significant positive impact on intention to use	Lee (1998), Ngai, Gunasekaran (2004); Crum et al. (1996), Al-Qirim (2007), Fernandes et al (2006); Premkumar & Roberts (1999);
H7a	Technical readiness has significant positive impact on perceived ease of use	Lin et al. (2005)
H7b	Non-technical readiness has significant positive impact on perceived ease of use	Lin et al. (2005)
H7c	Perceived benefits has significant positive impact on perceived ease of use	Amoako-Gyampah, K., Salam, A.F. (2004); Ramayah, T., Lo, M.C. (2007)
H7d	Top management support has significant positive impact on perceived ease of use	Sun, Zhang (2004);
H7e	Competition has significant positive impact on perceived ease of use	Henderson, R., Divett, M. J. (2003)
H8a	Cost rationality has significant positive impact on intention to use	Lee (1998), Crum et al. (1996), Al-Qirim (2007), Akos, N. (2004), Premkumar & Roberts (1999); Ramamurthy & Premkumar (1995); Lee et al (2003); Tung, F.C., Chang, S.C. (2008)
H8b	Reliability has significant positive impact on intention to use	Lee (1998), Ngai, Gunasekaran (2004), Suzuki, Williams (1998), van Heck & Ribbers (1999), Carter and Bélanger (2005);
H9a	Cost has significant positive impact on perceived ease of use	Hertzum, M. (2002)
H9b	Reliability has significant positive impact on perceived ease of use	Liao and Raymond (2000); Arning, K., Ziefle, M. (2007); Lu, C.S., Lai, K.H.,Cheng, T.C.E. (2007); Ahn, T., Ryu, S.W., Han, I.G. (2007)
H10a	Perceived usefulness has significant positive impact on intention to use	Davis et al. (1989), Venkatesh, Davis (2000); Seyal et al. (2007); Carter and Bélanger (2005); Liao and Raymond (2000); Lee et al (2003);
H10b	Perceived ease of use has significant positive impact on intention to use	Venkatesh, Davis (2000); Crum et al. (1996), Carter and Bélanger (2005); Liao and Raymond (2000); Premkumar & Roberts (1999); Ramamurthy & Premkumar (1995); Lee et al (2003);
H10c	Perceived ease of use has significant positive impact on perceived usefulness	Liao and Raymond (2000); Quaddusa & Xu (2005); Tung, F.C., Chang, S.C. (2008)

In order to verify whether the hypotheses are accepted, the questionnaire results were analyzed structural equation modeling. The model fit results are given in Table 3, all of which are in acceptable limits.

Table 3. Model Fit Values

Indicator	Value	Criterion of Acceptance
CMIN/Df	1.049	< 2
NFI	0.995	< 0.95
RMSE	0.016	< 0.05

The regression values and the acceptance of each hypothesis are given in Table 4. In this table, the accepted hypotheses that have a P value less than 0.001(i.e. accepted in almost 100% of the cases) are marked with three asterisks, the ones with a P value less than 0.01 (i.e. accepted in more than 99% of the cases) are marked with two asterisks and the ones with a P value less than 0.05 (i.e. accepted in more than 95% of the cases) are marked with one asterisk. The hypotheses with a P value more than 0.05 are rejected.

Table 4. Regression values

Hypothesis	H1a	H1b	H2a	H2b	H2c	H3a	H3b	H4a	H4a	H4b	H4c
Estimate	0.07	0.21	-0.1	-0	0.11	0.09	-0	0.12	0.12	-0.2	-0.1
P	0.11	0	0.26	0.88	0.04	0.11	0.98	0.15	0.15	0.03	0.4
Decision	R	**	R	R	*	R	R	R	R	*	R
Hypothesis	H5a	H5b	H5c	H5d	H5e	H6a	H6b	H6c	H6d	H6e	H7a
Estimate	-0.1	-0.1	0.29	0.13	0.28	0.09	0.14	0.02	0.38	-0.1	0.13
P	0.08	0.15	***	0.01	***	0.08	0.02	0.84	***	0.16	0
Decision	R	R	***	**	***	R	*	R	***	R	**
Hypothesis	H7b	H7c	H7d	H7e	H8a	H8b	H9a	H9b	H10a	H10b	H10c
Estimate	0.15	0.2	0.08	0.16	0.03	0.13	0.1	0.22	0.29	0.07	0.34
P	0.01	0.01	0.17	0.01	0.54	0.06	0.03	***	0	0.4	***
Decision	**	**	R	*	R	R	*	***	**	R	***

Finally according to the results, squared multiple correlations of the dependent variables indicate the percentage of dependent variables explained by the independent variables. In this cases 62.5% of perceived ease of use, 75.3% of perceived usefulness and 64.1% of intention to use is explained by the independent variables, thus one can conclude that the research model is powerful enough to explain the dependent variables by the given independent variables.

5. Discussion on the Results

On the basis of the results, top management support appears to be most important that has positive impact on PCS adoption, followed by non-technical readiness, competition, perceived benefits, organizational trust, compatibility, technical reliability, technical readiness and cost rationality, respectively. Enacting power and customer services have no influence on PCS adoption whereas community services have a negative impact. When previous research on technology acceptance was surveyed, it can be easily concluded that the results of the study is in compliance with previous research on technology acceptance of various other systems in individual and organizational level (Jeyaraj et al., 2006; Sabherwal et al., 2006).

According to the research outcomes, the impact of perceived usefulness is 0.28, which is higher than that of perceived ease of use (0.09). This means the probability that use of the system increasing the user's job productivity is considered to be more important than the system being easy to use itself.

Among each factor group, the one with maximum total impact on intention to adopt PCS was factors related to PCS adopter (0.774), followed by factors related to PCS service provider (0.051), factors related to system characteristics (0.029) and factors related to services provided (-0.113) respectively. These results imply that the successful acceptance of the system by the users mostly depend on the user, rather than the service provider or the system itself. Thus user involvement is considered to be essential for the success of the system.

Non-technical Readiness, being more important than Technical Readiness, implies that know-how transfer, human resources cultivation, training, etc. can significantly contribute to PCS adoption. Also financial support as incentive can also contribute to adoption.

The results point out that additional customer services have no significant impact on PCS adoption for users in Busan Port area. This implies that the main functionality of the system, such as submission of required documents, customs declarations and application for port services are adequate for the adoption of the system; even the system offers no additional services, such as transshipment management, container management, or other logistics and supply chain management solutions. But the results should not be interpreted as "additional services should not be offered"; since such services are means for creation of economic value added and revenue for the provider. But it appears to have no influence on the users for making the decision to adopt the system.

On the other hand, community services appear to have negative influence on the system adoption. This implies that an e-business platform that enables online business relations between port related companies actually decreases the level of intention to adopt the system. On the basis of the interviews made with field experts, it was discovered that the companies in Busan Port area are reluctant to use a centralized portal site for e-business. There were several projects on this subject, but they all got cancelled due to low level of use. For example Empty Vehicle Management System, promoted by KL-Net was designed to display the cargo information on a public network and to assist the land transport companies with fleet management and operation planning. But the response of the companies was not friendly, since the system was considered as a threat to the competitiveness of their company by enabling every company to access every single cargo that appears in the system. On the other hand field experts from adopter companies claim that their in-house B2B systems are much cheaper and effective than those services offered by the service provider company.

Generally, trust towards service supplier becomes more and more important when reliability of the system decreases (Ratnasingham, 1998). In the case of Busan Port, reliability of the system is ranked more important than the trust towards the service provider.

From system development point of view, our results indicate that compatibility is more important than Technical reliability, which is also more important that cost rationality. It implies that PCS development projects should start with analyzing not only business processes, but also belief/value systems of the adopters. Then, a robust network to avoid congestion, and secure transactions should be ensured for reliability. Finally a Web-based XML/EDI system should be considered for lower transaction costs. At the beginning VAN-based EDI systems were preferred because of high reliability and speed. But as XML/EDI-based networks are rapidly gaining ground since the internet technology has matured and become available for a wider base. According to our results, reliability of the system appears to be more important than cost of the system. Thus issues like network capabilities, standardization and security must be emphasized in system development,

As the result of the factor analysis, among various benefits that PCS offer, the users are more interested in increased operational productivity, rather than cost reduction or enhanced relations with business partners.

Finally, enacting power having no impact on PCS adoption indicates that potential users in Korea would adopt the system if they perceive the benefits, even if it is not forced by the government.

6. Conclusions

In this study, the factors affecting PCS adoption by the sea and land carrier companies were examined. A questionnaire survey was conducted to test the impact of various factors on PCS adoption. According to the results; among four factor groups, factors related to PCS adopter appeared to have the most important influence on PCS adoption. Factors related to PCS adopter consist of top management support, adopters' technical and non-technical readiness, competition and perceived benefits. On the other hand, additional services, such as logistics solutions or e-Business functionality among the PCS users have the least impact on the system adoption.

Thus on the basis of the research results; following conclusions are drawn;

1. Since factors related to PCS adopters have the most significant impact on PCS adoption, future PCS development projects must be conducted by emphasizing close relations with potential user in order to ensure their understandings about the benefits of the system.
2. Government support to improve potential users' technical infrastructure and training programs to improve their technical know-how would increase the probability of successful technology acceptance.
3. As perceived benefits of the system, users are more interested in operational productivity, rather than cost reduction or improved business relations.
4. Reliability of the system is considered to be more important than cost, thus security, encryption and networking issues must be fully considered in PCS development.
5. Users consider e-Business on an open platform as a threat to their competitiveness. Thus more detailed analyses are needed to develop a business model to overcome this issue.

The research results are exposed to several limitations. First of all, it was very difficulty to access questionnaire respondents due to limited number of potential respondents. In order to ensure high response rates, the questionnaires were distributed directly to the respondents. Negative attitude of some respondents against questionnaire was observed. It is also difficult to generalize the outcomes for other ports around the world, since PCS adoption behavior differs significantly in different countries (Vincent, 2003). Thus contribution of this study is mainly focused on verifying the model for future PCS adoption studies. Due to limited time and physical resources, the survey was limited to the users in Busan. Therefore future research for other ports around the world is needed. Finally; again due to limited time and physical resources, the survey was limited to sea and land carriers. Thus future research on other stakeholders of a port community, such as service providers, bunkering, vessel crew management, brokers, ship inspections, immigration ...etc. is definitely needed.

Port community systems are very rich in research topics. First of all, security and reliability issues must be solved for successful implementation of internet based PCS. When technical issues are solved, it would be possible to implement more reliable and cheaper systems. Another important research subject would be enhancing the study to an international level. Thus the differences in PCS adoption behavior according to national and port related factors could be seized. Finally, more detailed analyses are needed to fully understand the resistance behavior of the users against B2B services offered through PCS. Hence design of a B2B network that would create added value while maintaining users' competitiveness could be possible.

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SUPPLIER DEVELOPMENT IN THE TURKISH AUTOMOTIVE INDUSTRY

Arif Özver Ergin[1]

Abstract

In the Turkish Automotive Industry, the major motivation of Supplier Development is to reduce costs, improve quality, and improve delivery performance. Supplier Development, which has Sourcing, Project and Mass Production stages, is handled with managerial commitment of the supplier and direct involvement of the car maker. Recently, global legislations and regulations also encourage OEMs to develop their suppliers.

Keywords: Supplier Development, Supplier Quality Improvement, Supplier Improvement

I. Introduction

Concepts recently known as the Supplier Development, Supplier Improvement or Supplier Quality Improvement have been developed within the automotive industry in Turkey. Turkish automotive industry principally dominated by the OEMs, Original Equipment Manufacturers, including Renault, Tofaş, Toyota, Hyundai, Honda, Mercedes have straight and clear expectations about quality, cost and delivery performance from their suppliers. Even tough OEMs have enormous know-how and experience based on the history of decades, Turkish local suppliers are contrarily new and their capabilities are limited. Therefore Turkish OEMs have been trying to develop their suppliers regarding to quality, cost and delivery performance.

2. Turkish Automotive Industry

2.1. History of Turkish Automotive Industry

Turkish automotive industry had begun production in 1950. In the 1960s, the first steps were taken towards establishing an automotive industry with the aim of "import substitution," and ever since it has been closely integrated with the EU automotive industry. In the beginning of the 1990s, the fact that the demand, especially for passenger cars, was on an upward trend and reached a consistent 25 percent annually, resulted in heavy investment in the motor vehicle and parts and component industries. It was during this time that rapid steps were taken in the areas of capacity increase, in addition to renewed technology and investments in new models geared especially towards competition, as well as in the areas of research and development. It was also during this time that contemporary manufacturing techniques were implemented following intense training programs as well as the establishment of quality management systems enabling these firms to obtain international certification, such as ISO.

After the year of 1990, automotive industry was accelerated to open the world market. Therefore motor vehicles import has increased continuously. Especially after the 'Custom Union' during the '90s, it became necessary for the industry to protect its market share by manufacturing new models of vehicles and importing models not manufactured in Turkey. Since the beginning of the 1990s, incentives have been provided to invest in the manufacturing of new, current model vehicles. During this period, the import-of technology and foreign capital partnerships were made easier and supported. Contemporary manufacturing techniques were applied after intense training programmes, especially through the establishment of quality management systems. As a result, foreign partners established their facilities in Turkey within their own global strategic development projects. This process enabled facilities in Turkey to manufacture goods to sell in international markets across the world. Thanks to its intense efforts during the past 5 years, the Turkish automotive industry has pursued its adaptation to the relevant technical regulations and has established an efficient and exemplary co-operation with public institutions in the transformation of the EU regulations to national regulations and their implementation.

With intense worldwide competition, each year firms now introduce new models or face lifts on existing models to the Turkish market simultaneously with global launches. Within the various segments of the Turkish market, a total of around 130 different brand/model passenger cars are now being supplied. Fiat, Ford, General Motors, Renault, Toyota, Honda, Hyundai are all taking advantage of its proximity to fast growing markets and low labor costs. Substantial export-orientated investments have placed local manufacturers in the perfect position to attack regional markets.

Automotive production, which was around quarter of a million units in 2002, dramatically increased and exceed one million unit vehicle production in 2007 as seen in the Figure 1:

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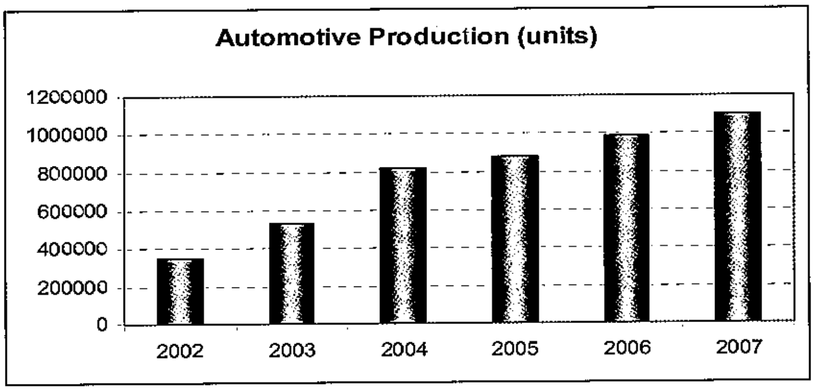

Figure 1. Turkish Automotive Production between 2002 and 2007

2.2. Turkish Parts and Components Industry

In tbe beginning of the 1990s, the rapidly increasing world demand for motor vehicles resulted in significantly increased investment in the Turkish parts and components industry. Development continued apace. Until now the Turkish automotive parts and components industry has reached a level, where it can answer the need for the vast majority of items for the necessary parts and components required for locally manufactured vehicles. Due to the high export potential and Turkey's regional advantages, foreign capital has been showing an increasing interest in the automotive parts and components industry in Turkey. By year 2002 there were 185 foreign company partnersbips in the industry, which are led by European Union companies. Consequently, exports have also expanded until now. Direct exports exceed US $3 billion, of which around 70% being shipped to European countries. Turkish companies in the automotive sector have been steadily improving the quality of their products, management and employee skills, and making advances in their cost and delivery processes, all in order to be able to compete with global competitors

Opportunities for foreign investors to do business with Turkish automotive suppliers industry include: Total exports of the Turkish supplier industry are now realizing over US$1,9 billion, destined for 155 countries. Companies are supplying to major European producers such as GM, VW and Ford. Of the total automotive parts exports from Turkey, 69% are destined for the EU. Leading importing countries are France, Germany, Italy and UK. Due to the high export potential and regional advantages of Turkey, foreign capital is now showing an increasing interest in the automotive supplier industry in Turkey bas had a strong component sector and in recent years has developed a highly competitive components industry providing products compatible with brands such as GM, Mercedes, BMW, Opel, Toyota and Ford. The Turkish auto parts industry with its large capacity, wide variety of production and high standards, supports automotive production and the vehicles in Turkey (around 7.3 million vehicles) and also has ample potential for exports. Turkish automotive manufacturers are in direct contact with 1120 local auto parts manufacturers for procurement and 70% of these companies are SME's (Small Volume Enterprises). It is known that the total number of auto parts manufacturers in Turkey far exceeds 1120. The production value of the auto parts industry was above 4 billion U.S Dollars in 2003.

3. Supplier Evaluation

3.1. Sourcing Stage

Supplier evaluation is a continual process within purchasing departments and forms part of the pre-qualification step within the purchasing process. It often takes the form of either a questionnaire or interview and includes appraisals of various aspects of the suppliers' business including capacity, financials, quality assurance, organizational structure and processes and performance. Based on the information obtained via the evaluation, a supplier is scored and either accepted or rejected as one, which can be used to procure materials or services from. If rejected, the supplier is generally not made available to the assessing companies' purchasing team. Once approved, a supplier may be reevaluated on a periodic, often annual, basis.

There are various benefits associated with an effective supplier evaluation process. Generally this is associated with mitigation against poor supply and benefits typically include resultant sourcing from suppliers that provide higb standards of product and service levels whilst offering sufficient capacity and business stability.

Associated problems with supplier evaluation include resource and cost commitments in establishing and maintaining a system, challenges with gathering data and subjective scoring which may result in in-accurate assessment. In the study of Wasti et al. based on Questionnaire data from 51 buyers in automaker firms and 72 supplier firms;, three relationship types (captive supplier, market excbange, and strategic partnership) were identified both in the buyer and supplier data. Significant differences were observed in terms of contextual (product and supplier characteristics), managerial (information exchange and cooperation), and social climate variables (mutual understanding, payoff equity, and satisfaction). Turkish buyers were found to strategically segment their suppliers based on product and supplier characteristics, whereas supplier groups were differentiated along social climate variables:

* The Turkish results differ somewhat from the ones for developed countries, which suggest that more work should be conducted in emerging economies. Future research that uses matched pairs of buyers and suppliers may provide in-depth insights.
* The results demonstrated a perception (hence, communication) gap between buyers and suppliers in how they differentiated relationship types. Strategic partnership led to cooperation in both samples, and to satisfaction, mutual understanding, and equity in the supplier sample.
* This study used data from both parties, contrasted buyer-supplier relationships in an emerging market with those in developed markets, and highlighted the effects of the industry's historical evolution on the present state of buyer-supplier relationships, (Wasti, S. Nazli; Kozan, M. Kamil; Kuman, Ayca, 2006).

3.2. Deciding on Suppliers to Develop

Generally car makers generally follow their suppliers' performance with PPM for quality and DPM for delivery. Turkish OEMs generally introduce Supplier Development programs for small suppliers with insufficient quality and delivery performance:

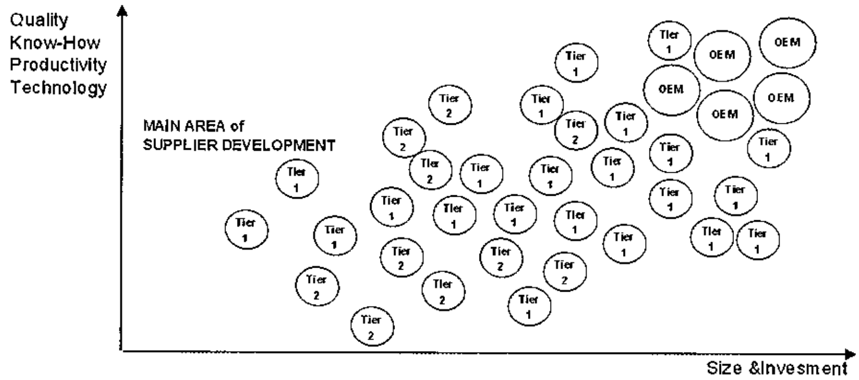

Figure 2. Main Area of Supplier Development

4. Supplier Development

There is a wide literature about Supplier Development in US. Major corporations in US are using 'hands-on' approach to improve their suppliers' manufacturing processes and administrative systems. Working side by side with their suppliers' employees, customers are improving quality, reducing cycle times, cutting costs, and increasing capacity. The results of these efforts are impressive. A manager at General Motors, whose group has completed supplier development projects with more than 2,000 suppliers, cites average supplier productivity improvements of more than 50 percent, lead time reductions of up to 75 percent, and inventory reductions averaging 70 percent during their one-week workshops. On one project alone, Honda of America's Best Practices (BP) team reduced a supplier's costs by more than $200,000 per year by changing the layout of a welding process, (Janet L. Hartley and Thomas Y.Choi, 1996). Formal activities undertaken by customers to improve the performance and capabilities of existing suppliers are referred to as supplier development. All of the major auto assemblers in the U.S. and some first-tier suppliers now have formal supplier development programs in place. For example, the Toyota Supplier Support Center in Lexington, Kentucky helps suppliers and other companies adopt lean manufacturing concepts. Ford has a team of "kaizen engineers" who are constantly on the road facilitating Supplier Developments through one-week workshops. Despite all these formal supplier development programs in place in U.S. firms, the dynamics of putting such a program into place have not been widely discussed in the literature. There is also very limited study about Supplier Development activities in Turkey. However limited literature have been suggesting the same dynamics because the global companies like Ford, Toyota, Mercedes, Honda, Renault implement nearly same strategies in US and Turkey.

Turkish car makers and global part & component buyers primarily demand sustainable capacity supply with quality, cost and delivery performance from their supplier. At the beginning they select their suppliers according to capacity, quality, cost and delivery criteria. If there is a long term agreement, the supplier is invested. After all, when the supplier's level does not meet the customer's expectation, then the customers try to improve their Supplier Development about quality, cost and delivery.

Whenever main Turkish OEMs explain their capacity ramp up strategies and plans, Supplier Development has always been underlined as an important milestone. In his presentation of "Ford In Turkey: Growth Strategies, Current &Future Production Volumes &Further Development Plans" in AutoTurkey06, Nuri Otay, plant manager, pointed out supplier development as an important element of Ford strategies. In the same congress, Joseph Navarro from KARSAN also pointed out the importance of suppliers in his presentation namely: "Working in Collaboration

With Suppliers &OEMs to achieve maximum Growth, Ensure %100 quality to drive your business in Turkey". In AutoTurkey2006, A senior representative of Renault Turkey detailed "Achieving Continuous Competitive Advantage In Turkey regarding to Growing Production Volumes &Introducing New Models At Renault Turkey". He explained strategy and details behind Renault's success and growth in Turkey as:

-Current model production volumes and models
-Future plans for production increases
-Supplier localization &management strategies
-Development strategies

Some car makers have separate SD (Supplier Development) or SQI (Supplier Quality Improvement) departments to handle Supplier Developments and most of them hires engineers for supplier handling. Below some hiring call from Toyota, Mercedes and Fiat:

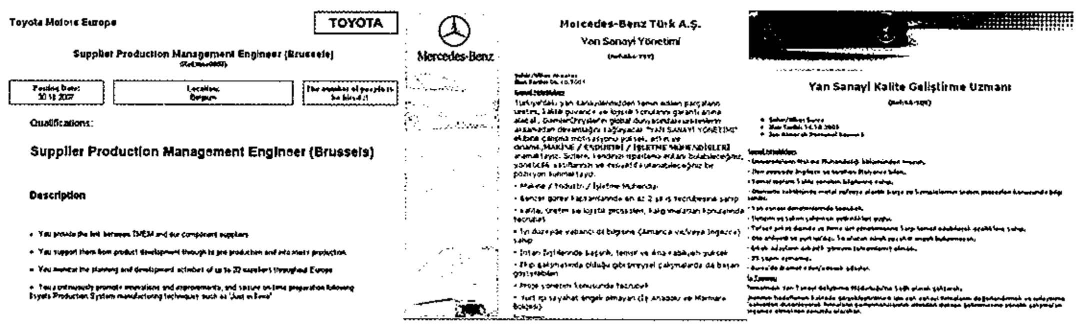

Figure 3. Engineering Positions related with Supplier Development in Kariyer Net

4. 1.Supplier Development Stages

Supplier Development might be examined in three main stages as seen in the Figure 2. First stage is sourcing, the next stage is project and the last stage is mass production. These stages will be explained separately through out the paper. Moreover there is an independent phase of the Supplier Development which is the Legislation &Regulation.

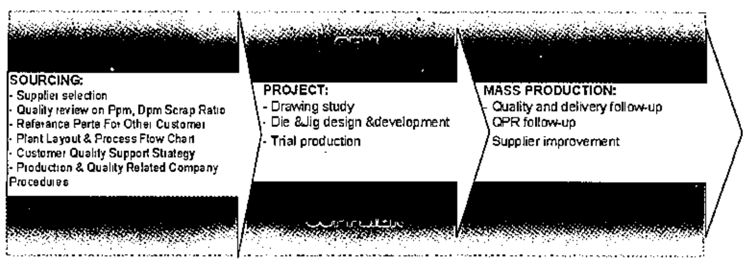

Figure 4. Supplier Development Stages

4.1.1. Sourcing &Substitution Involvement

Any business between Car maker and the supplier starts with sourcing and supplier selection. Need for Supplier Development gains importance in the time being of the business.

Strategic sourcing is critical for firms practicing the principles of supply chain management. It specifically deals with managing the supply base in an effective manner by identifying and selecting suppliers for strategic long-term partnerships, involving in supplier development initiatives by effectively allocating resources to enhance supplier performance, providing benchmarks and continuous feedback to suppliers, and in some cases involving in supplier pruning activities. Currently, the methodologies in practice for strategic sourcing have mostly been subjective in nature with few objective decision models focused at supplier evaluation, which are also not devoid of limitations.

R. Vokura and G. Zank suggest that the supplier development requires a long term cooperative effort. This effort can aid in upgrading supplier's technical quality, delivery and cost capabilities, (Zank and Vokura, 2002). In addition, the importance of purchasing and materials management continues to expand as organizations outsource some fabrication and assembly activities in order to focus on their core competencies. (Vonderembse and Tracey, 1998) This causes organizations to rely even more heavily on suppliers for design and production of component parts and subassemblies. As this reliance grows, performance increasingly is dependent on the actions and performance of suppliers. As firms continue to seek performance improvements, they are organizing their supplier base and managing it as an extension of their manufacturing system.

As a result, initial involvement to supplier & car maker partnership as sourcing and supplier selection is one of the major Supplier Development phases which include encouragement, hiring of educated people &direct worker and investment.

4.1.2. Supplier Development in the Project Stage

After the supplier selection and sourcing (confirming the potential that the supplier has enough human resources and equipments &layout capacity) stage, supplier teams and customer teams (teams may include people from quality, purchasing, engineering or project, production control departments) joint work a project. Within this project, supplier team supposed to study the customers' drawing, develop dies, jigs, control fixtures, arrange overall layout for production equipments, establish overall quality and delivery structure under the control of the customer.

Moreover some OEMs expect their suppliers to contribute to design &development. A TOFAŞ manager said that:

"Suppliers should increase their cooperation about co-design with us. Big OEMs including TOFAŞ has a capability for big investments. However suppliers have some doubts about R&D investment. R&D investment is very huge for most of the suppliers. Therefore suppliers want long term partnership if they are supposed to make big investment. Short term projects are mostly one or two years. Hence suppliers ask ~~themselves~~ what will happen 1-2 years later to hired people, layout, and machine expenditure. Therefore with the increase in new projects, more convenient investment atmosphere could be established. Therefore I advise Turkish suppliers to gain courage because new projects are coming to Turkey one right after the other. Turkish government has been also working on support policies.

We have two main expectations from our suppliers: Because of economic crises, most of the Turkish suppliers suffered some Turkish suppliers afraid of going through new projects. They are naturally afraid of investing. Turkish suppliers still have wait and see policy about hiring new people and investment. For example, MINI CARGO and 263 projects guarantee 8-10 years of supplier. However even after the sourcing and supplier selection, the supplier still waits to make necessary investment until the last minute. We have also experienced same thing in new LINEA. Even after the start of production, the supplier has not hired enough operators. Therefore they created capacity problems. Of course after some times later, they saw that everything is OK. We principally expect our suppliers to make plans, and invest on necessary resources", (Özoğul, Filiz, 2007).

Project stage between the supplier and the car maker, includes several cross interdepartmental activities, which at the same time contributes to the improvement of the supplier. As explained previous section, car maker firstly selects and sources the supplier. Then the project stage starts. Firstly, the car maker issues the draft and/or final drawing of the component which has been sourced. Supplier studies the details of the drawing within teamwork.

Car maker concentrates on capacity potential, process layout, general quality system, first in-first out and logistic systems of the supplier. If any lack point detected, related direction has been given to the supplier in the form of PFUS (Problem Follow-Up Sheet). At the came time supplier and car maker decides on production dies &fixtures, control fixtures as well. Small &mass production trials are done lastly and parts delivered to the car maker for approval. Car maker uses those parts on the vehicle for confirmation for fit &finish and performance. Please refer to Figure 5.

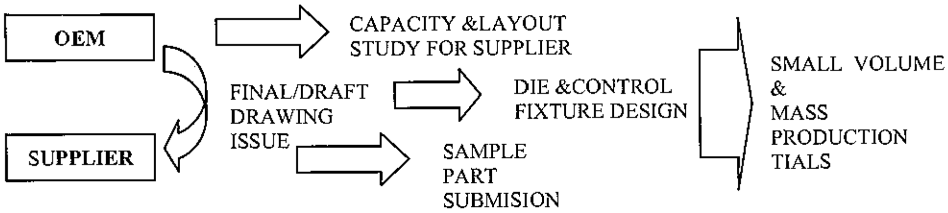

Figure 5. Project development between the supplier and the car maker

There are three main standards which defines customer and supplier collaboration. These are APQP, ISO 16949 and SQAM:

4.1.2.1. APQP (Advance Product Quality Planning):

Advanced Product Quality Planning is a process developed in the late 1980's by a commission of experts gathered from the 'Big Three' US automobile manufacturers: Ford, GM and what Chrysler was then. This commission invested five years to analyze the then-current automotive development and production status in the US, Europe and especially in Japan. At the time, the success of the Japanese automotive companies was starting to be remarkable in the US market.

APQP serves as a guide in the development process and also a standard way to share results between suppliers and automotive companies. APQP specify three phases: Development, Industrialization and Product Launch. APQP focuses on:

Up-front quality planning, determining if customers are satisfied by evaluating the output and supporting continual improvement. APQP consists of five phases: 1-Plan and Define Program, 2-Product Design and Development Verification, 3- Process Design and Development Verification, 4- Product and Process Validation , 5- Launch, Feedback, Assessment & Corrective Action

There are five major activities: 1-Planning, 2-Product Design and Development, 3-Process Design and Development, 4- Product and Process Validation, 5-Production

The APQP process has seven major elements: 1- Understanding the needs of the customer, 2- Proactive feedback and corrective action, 3- Designing within the process capabilities, 4- Analyzing and mitigating failure modes, 5-Verification and validation, 6- Design reviews, 7- Control special / critical characteristics

4.1.2.2. ISO Standards:

In order to assure their expectations, some OEMS, including, Ford, Fiat, GM, Chrysler, standardize their specific requirements. The Technical Specification, ISO/TS 169 49:2002 Quality management system, in conjunction with ISO 9001:2000, defines the quality management system requirements for the design and development, production and, when relevant, installation and service of automotive-related products. This Technical Specification is applicable to sites of the organization where customer-specified parts, for production and/or service, are manufactured. Supporting functions, whether on-site or remote (such as design centers, corporate headquarters and distribution centers), form part of the site audit as they support the site, but cannot obtain stand-alone certification to this Technical Specification. The aim of ISO/TS16949 is the development of a quality management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the supply chain.. It is based on ISO9000.

The requirements are intended to be applied throughout the supply chain. For the first time vehicle assembly plants will be encouraged to seek ISO/TS16949 certification. ISO/TS 16949:2002 were prepared by International Automotive Task Force (IATF) and Japan Automobile Manufacturers Association Inc (JAMA), with support from ISO/TC 176, Quality Management and Quality Assurance.

ISO/TS16949 = ISO 9001:2000 requirement + Automotive Requirement + Customer Specific Requirement. ISO/TS16949:2002 also requires: Failure Mode and Effect Analysis (FMEA), Advanced Product Quality Planning (APQP), Measurement Systems Analysis (MSA), Supplier system development, Incident Premium Freight, Preventive and Predictive Maintenance, Error Proofing, Statistical Process Control (SPC), Product Part Approval Process, Control Plan

4.1.2.3. SQAM (Supplier Quality Assurance Manuals)

There are also some OEMs, including Toyota, which have its own detailed SQAM, Supplier Quality Assurance Manual. The objectives of the SQAM are as follows:

- To clearly communicate Toyota's expectations and minimum requirements to the suppliers to assure the quality of supplied parts.
- Encourage open and free communication of ideas, information and early notification of problems between suppliers and Toyota.
- Develop an overall plan to assure a smooth Start of Production (SOP) at both Toyota and the supplier, based on effective project management and communication.
- Set out the Quality Assurance (QA) procedures and documentation, Suppliers must follow and use in order to support the management of an effective quality system based on built-in-quality, problem prevention and continuous improvement.
- Assure the complete vehicle quality requirements and satisfaction for Toyota's customers.

4.1.3. Supplier Development during Mass Production

Supplier development is a relatively new phenomenon. Traditionally, most suppliers managed their manufacturing processes with little customer input as long as the product met customer specifications. Customers provided hands-on technical assistance only when suppliers had major problems with short-term quality or delivery performance. Then, during the 1980s, U.S. supplier management practices underwent a paradigm shift. Companies reduced the number of direct suppliers used and began evolving from adversarial relationships to more cooperative ones with the remaining suppliers. Under the new paradigm, suppliers were given long-term contracts (often for the life of a product model), making supplier development an attractive proposition for both types of firms.

There has also been a trend toward an increased level of outsourcing. Industrial customers depend more on their suppliers for their products' end quality, performance, and cost than in the past. For example, 80 percent of the manufacturing cost of a Honda and 70 percent of the cost of a Chrysler automobile can be traced back to purchased components. So to ensure that end consumers receive the right product at the right price, industrial customers are actively intervening in their suppliers' operations. By initiating supplier development programs, customers become a catalyst for change in those organizations, (Janet L. Hartley and Thomas Y.Choi, 1996).

Customers typically have two objectives for supplier development programs. The first is to reduce costs, improve quality, and improve delivery performance by completing projects jointly while the customer is on-site. The second objective is to teach suppliers a systematic process they can use to continue making improvements. All the auto assemblers expected their suppliers to be self-sufficient in continuing a stream of cost reductions after they left. For suppliers, sustaining the change process on their own is a difficult task.

The type of administrative or manufacturing processes used by the supplier should also be considered. The industrial engineering techniques used during supplier development are more effective for labor-intensive assembly processes than for capital-intensive ones. Consequently, in labor-intensive processes it is often relatively easy to achieve impressive cost reductions during supplier development projects.

Janet et al. underlined that initially many suppliers were not as willing to participate in development. From their viewpoint, opening up their plant to customers was not an easy decision. During development, the customer learns much more about the supplier's operations and cost structure than can be gained through routine supplier visits. Suppliers even explained such as "[The customer] sees all your dirty laundry" and "[We] couldn't hide anything." Suppliers are more willing to participate in the development project if they believe the customer is serious about a long-term relationship. Nevertheless, suppliers are sometimes coerced into participating. For instance, one customer sent an ultimatum to a particularly reluctant supplier that the company would lose the customer's business if it did not participate in the supplier development program. The supplier not only ended up participating, but was successful in sustaining the change process and spreading the process improvement techniques to other facilities within its company, (Janet L. Hartley and Thomas Y.Choi, 1996).

Janet et al. suggested that Supplier Development needs to be anchored firmly in both the customer's and the supplier's organizations, leading to a joint team structure. All the major corporations have formed separate supplier development groups within their purchasing organizations, staffed primarily by manufacturing or industrial engineers. The most common approach--used by Honda, Toyota, Ford, and GM--is to have full-time specialists who conduct the supplier development projects, becoming experts in the process.

The most frequently used data source comes from direct observations of the supplier's production process. For example, Honda's supplier development teams use hand sketches of the operations on the shop floor to identify opportunities for improvement. These sketches also serve as documentation for "before" and "after" examples. General Motors and Chrysler use techniques such as process flow charts to identify the non-value-adding activities that should be eliminated. Transit, storage, waiting in queues, and inspection are non-value-adding activities to be eliminated.

Actual observation of the process is a key step for several reasons. On the shop floor, such opportunities for improvement as elimination of wasted motion or layout changes to improve ergonomics are often obvious to a trained outsider, who doesn't take the existing layout as a given. In one case, an operator used a small carton to hold assembly parts at her work station. But she had to leave her work station frequently to fill the small carton by dipping into a larger carton of parts. By moving the large container to a position next to the work station, the step of filling the smaller carton was eliminated.

Although administrative processes cannot be observed easily, using a flow chart to understand the processes can also identify non-value-adding steps. General Motors helped a hospital reduce its lead time for determining radiation treatment for oncology patients from eight days to 24 hours. Two changes were made in the process. First, the standard cases were segmented from the few that were unusual and required more time. Second, all the key players met simultaneously rather than sequentially to develop the treatment plan.

Another benefit of observing the process is that the team members are able to interact with the shop floor operating associates. Through interaction, the team builds support for changes from among those people who will be affected the most--the operators. And the operators are able to learn techniques for improving the process by watching the supplier development team. Several of the suppliers in US used the customer's development effort as a way to increase their employees' involvement in continuous improvement efforts.

Honda's supplier development specialists also recognize the importance of implementing operators' suggestions. In one of its supplier plants, an operator who had to bend over to use a light board for inspecting switches suggested it would be much easier if the light board were at a 45 degree angle. So during lunch that day the development team installed a stand to hold the light board as she suggested. When the operator came back from lunch, "she was so happy she almost cried." Employee involvement in process improvement can have other benefits as well. In one plant, absenteeism dropped from 14 percent to 4 percent after the supplier development efforts got under way.

As a GM manager commented, "Success gets everyone's attention." All the major auto makers in US with select a portion of their supplier's production plants called a "model line" to demonstrate the improvement techniques. Each model line selected is considered to have a lot of "low-hanging fruit" so that easily made changes can demonstrate dramatic results (for some commonly used improvement methods). According to Chrysler, the area around the model line may be painted and cleaned so that it grabs the attention of everyone in the plant.

The significant improvements in productivity that accrue from demonstrating the techniques using the model line generally win over those in the supplier's organization, such as middle managers and manufacturing engineers, who may have been skeptical of the potential benefits. Although the customers in this study consistently remarked that they preferred to work on a line producing parts for their company, they had occasionally worked on a model line producing another customer's parts if that was a major problem area for the supplier with all its customers.

Typically, the improvements made during supplier development include changing the process layout to remove bottlenecks and improve ergonomics. Layouts are often changed from functional ones, in which similar operations are grouped together, to cellular layouts, which are similar to "mini assembly lines." This reduces the time required for changing the equipment over from one product to another and simplifies the flow of the product through the process. Layout changes can improve productivity to the point at which the number of operators can be reduced. Employees whose jobs have been eliminated can be assigned to other areas of the process. Some suppliers use the freed-up positions to devote full-time employees to process improvement activities in their facility.

Another common improvement technique involves developing and implementing poka-yoke systems to build "mistake-proofing" into the production process. Poka-yoke systems are simple process changes used to prevent errors coupled with simple sensors that detect errors at their source. One supplier was assembling a part with a plastic cap that the operator occasionally forgot to install. The supplier development team installed a simple sensor to check every part for the plastic cap at that work station. Parts without the cap were rejected and immediately reworked, thereby ensuring that defective parts were not shipped to the customer.

Reduction in the time required to change from one product to another is a common improvement made during supplier development. When the dies or fixtures for a machine are being changed, production stops. Reducing the time required to set up for a different product effectively increases the overall capacity of the plant. Simple changes, such as having the proper tools and fixtures or dies stored near work stations, significantly reduce setup time. Through operator training, one supplier development project reduced the time required to change dies from an hour and a half to 30 minutes; another cut 65 minutes down to 10 minutes by ensuring that the proper tooling was readily available. Therefore car makers develop their supplier's quality, cost and delivery for sustainable supply of components during capacity increase and launch of new models.

In Turkey, more typical improvement items in the Supplier Development are: 5S (5S is a reference to a list of five Japanese words which, transliterated and translated into English, start with the letter S and are the name of a methodology. This list is a mnemonic for a methodology that is often incorrectly characterized as "standardized cleanup", however it is much more than cleanup. 5S is a philosophy and a way of organizing and managing the workspace and work flow with the intent to improve efficiency by eliminating waste, improving flow and reducing process unreasonableness. Moreover FIFO, (FIFO is an acronym for First In, First Out, an abstraction in ways of organizing and manipulation of data relative to time and prioritization. This expression describes the principle of a queue processing technique), Identification of OK and NG parts, Problem Solving and Reporting Techniques are concurrent supplier development ways.

As a result, the car maker firstly follows the supplier's quality status with DPM, defect per million unit, which is a key point indicator for quality and delivery performance. Then car maker, or the customer, makes a serious shop floor observation on the supplier. Listing up missing and insufficient items in the form of PFUS (Problem Follow-Up Sheet), supplier and customer teams established. Then plan is progressed and followed until necessary quality and delivery performance achieved and all open items closed. In mass production stage, general improvement items for Turkish Automotive Suppliers are: 5S, First in-First Out, Problem Solving and Reporting Techniques.

4.2. Legislation

One of the most powerful sources of Supplier Developments is legislation. Several organizations, especially EU and UN, have developed several legislations and regulations especially for safety and environment.

As a representative case, most recently issued, the End of Life Vehicle (ELV) of EU can be explained. ELV directive aims to generate environmental gains through increased levels of vehicle recovery and a reduction in the use of hazardous substances. ELV particularly underlines following items:

Prohibition on heavy metals

6. A producer shall ensure that materials and components of vehicles put on the market do not contain lead, mercury, cadmium or hexavalent chromium except in the cases listed in Schedule 1 to these Regulations.

Requirement for technical documentation

7. A producer shall at the request of the enforcement authority submit technical documents or other information showing that the materials and components of vehicles put on the market comply with the requirements of regulation 6 and Schedule 1.

8. A producer shall ensure that he keeps the information necessary for him to submit to the enforcement authority the documents referred to in regulation 7 for a period of four years from the date that he puts the materials and components on the market.

Figure 6. ELV Content

OEMs, main responsible for the regulations, study ELV directive and make a detailed plan for their in-house operations and for their suppliers as well. For Tier 1 suppliers, OEMs prepare audit and training plan, as ELV directive might be very difficult to understand by medium and small Tier 1 suppliers. Therefore OEMs audit and train Tier 1 suppliers. Then Tier 1 suppliers train and audit Tier 2 suppliers. Then Tier 2 suppliers train and audit Tier 3 suppliers and so far so on. -At the end, OEM aims to obtain a vehicle which does not contain a single part, containing any hazardous material as shown in the **Figure 7**.

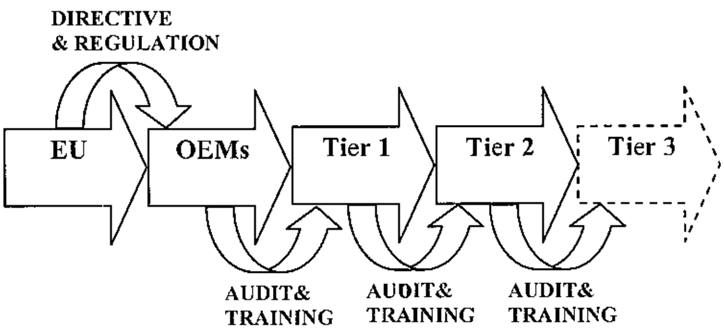

Figure 7. EU ELV, End of Life, directive follow through suppliers.

5.Conclusion

In this paper overall literature about Supplier Development is examined and related material in the Context of Turkish Automotive Industry is studied. Even Supplier Development is relatively new concept in Turkey; Turkish and Global literatures are in an accomplishment.

Turkish car makers, OEMs, develop their suppliers in order to reduce costs, improve quality and delivery performances through three main stages; first is in purchasing stage, second is project stage and the last is mass production stage. Moreover some legislations &regulations force both car makers and suppliers for improvement.

Main motivation of the Turkish car makers for the Supplier Development is capacity increase and launch of new models. Therefore car makers develop their supplier's quality, cost and delivery for sustainable supply of components during capacity increase and launch of new models. Typical improvement items in the Supplier Development are: 5S, First In, First Out, Identification of OK and NG parts, Problem Solving and Reporting Techniques.

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SUPPLIER SELECTION PROBLEM IN PRESENCE OF VARIOUS PRICE DISCOUNT OFFERS REGARDING THE BRANDS

R. Mohammad Ebrahim[1], J. Razmi[2]

Abstract

Supplier selection as an important element of supply chain management and logistics involves evaluation of many factors such as, cost of parts/materials, size of order, quality, delivery performance, etc. Therefore, this problem is categorized as multi criteria decision making problems. In this paper it is assumed that there are two groups of suppliers. The first group include suppliers with well-known brands and the second group include suppliers with sundry brands. Hence, a mathematical model is developed in which two types of discount schemes (all-unit and incremental discount) are considered. Hence, a multi objective formulation is developed for single item, multiple-sourcing, purchasing problem. The weighted sum of objective functions is calculated as the major objective function to be minimized. Due to the complexity of the problem a proposed Scatter Search Algorithm (SSA) is presented to solve this problem. Finally the proposed SSA is run for a set of problems and the corresponding logical outputs within reasonable computational times, shows the performance of the proposed SSA.

Keywords: Supplier Selection, Lot sizing, Branding, Price Discount, MCDM, Scatter Search, AHP

1. Introduction

Supplier selection is one of the most important components of production and logistics management in the competitive environment of the global market. As organizations become more dependent on suppliers the direct and indirect consequences of poor decision makings become more severe (Boer et al. 2001). Such decisions involve the selection of individual suppliers to employ and the determination of order quantities to be placed with the selected suppliers.

Many attributes affect a supplier's performance. Dickson (1966) identified 23 criteria that have been considered by purchasing managers in various supplier selection problems. Also Weber et al. (1991) found that 47 out of 76 articles which they reviewed, addressed more than one criterion for supplier selection decision making. Hence supplier selection problem is multiple criteria decision making (MCDM) problem and it is necessary to make a trade off between conflicting quantitative and qualitative criteria to select the best suppliers (Tracey 2001). One of the factors affecting such a decision making problem is the existence of suppliers with well-known brands. This situation can affect the supplier selection decision making from different aspects. For instance, innovation in design of these items, their high quality and also the impact that these brands may have on final customers are some of these aspects. Along with common suppliers there may be suppliers with well-known brands. In addition, other attributes such as quality and delivery etc. (which have been considered in the model) made the suppliers' brand and in order to be a world class manufacturer, the performance of suppliers is vital to receive the above goal.

In addition, Suppliers sometimes offer discounts. The motivation for using discount schemes stems from the fact that it tends to encourage buyers to procure larger quantities and to obtain operating advantages (such as economies of scale or reducing the cost of transportation) for the buyer. Usually, two types of discounts—all-units discount and incremental discount—are used for cost reduction (Benton and Park 1996). Considering both qualitative and quantitative criteria in this model and in addition, permitting two types of discount schemes simultaneously by suppliers under the situation which both common and well-known brands exist, make this model more practical in comparison with other previous studies.

2. Description of the Proposed Model

In this section, the model of the problem is developed under some assumptions. These assumptions are discussed in the following subsection.

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2.1. Assumptions and Notations

The following assumptions are considered in definition and the modeling of the problem.

- The buyer can purchase required quantity from multiple suppliers.
- The buyer is going to purchase only one item from suppliers.
- Two groups of suppliers (with common brands and with special brands) are taken into consideration.
- Each supplier can offer one of two discount schemes arbitrary.
- The total demand is known and the total purchased quantity is exactly equal to the total demand.
- The total demand and purchased quantities from suppliers are integer.

Notations

i: index of suppliers
k: index of discount intervals
x_{ik}: purchased quantity from supplier i in discount interval k (integer variable)
y_{ik}: binary variable; if the purchased quantity from supplier i falls on the interval corresponding to this variable then $y_{ik} = 1$, otherwise $y_{ik} = 0$
n: total number of suppliers
n_1: number of suppliers that offer all-unit discount
n_2: number of suppliers that offer incremental discount
l_{ik}: lower bound of the discount interval k offered by supplier i
u_{ik}: upper bound of the discount interval k offered by supplier i
p_{ik}: discounted unit price of the discount interval k offered by supplier i
d_i: defective rate of purchased goods from supplier i
h_i: late delivery rate of goods purchased from supplier i
w_i: total weight of supplier i calculated by AHP
K_i: index of the last interval offered by supplier i
D: total demand

2.2. Cost function

The total cost of purchasing depends only on the unit price of item. The price for commodity items usually offered in different discount schemes which can usually be seen in one of the following structures: All-unit discount and Incremental discount. In this section we propose a model in which both of these discount models are considered simultaneously.

2.2.1. All-unit discount

Under this discount model, supplier i discloses the all-units discount scheme (Nahmias, 2001) which depends on the quantity x_i purchased from supplier i. All-units model divides the range of possible order quantities into intervals with progressively lower unit costs. The unit cost corresponding to the size of a particular order is applied to every unit in the order. The cost function under all-unit discount policy can be modeled as follows.

$$\sum_{i=1}^{n_1} \sum_{k=1}^{K_i} p_{ik} x_{ik} \tag{1}$$

Where at most one of the variables x_{ik} for $k = 1,\dots,K_i$ can be positive and the rest must be equal to zero and it is assumed that $p_{i1} > p_{i2} > \cdots > p_{ik_i}$.

2.2.2. Incremental discount

Dolan et al. 1990 argued, however, that the supplier is often better served by the incremental discount model, which applies a lower unit price only to those units purchased in excess of each successive breakpoint (Rabin and Benton 2003).Under this discount model, supplier i discloses the traditional incremental units discounting scheme (Nahmias, 2001) which is dependent on the quantity x_i purchased from supplier i. This discount scheme applies a lower unit price only to those units purchased in excess of each successive breakpoint. The cost function under incremental discount policy has been modeled as follows.

$$\sum_{i=n_1+1}^{n} \sum_{k=1}^{K_i} \left(p_{ik} \left(x_{ik} - y_{ik} u_{i,k-1} \right) + y_{ik} \sum_{j=1}^{k-1} p_{ij} \left(u_{ij} - u_{i,j-1} \right) \right) \tag{2}$$

Where at most one of the variables x_{ik} for $k = 1,\dots,K_i$ can be positive and the rest must be equal to zero and it is assumed that $p_{i1} > p_{i2} > \cdots > p_{ik_i}$.

2.2.3. Total cost function

Let n_1 suppliers offer all-unit discount schedules and $n_2 = n - n_1$ suppliers offer incremental discount schedules. So by adding (1), (2) we have the cost objective function as it follows:

$$min\ Z_1 = \sum_{i=1}^{n}\sum_{k=1}^{K_i} x_{ik} p_{ik} + \sum_{i=n_1+1}^{n}\sum_{k=1}^{K_i} y_{ik}\left(\left(\sum_{j=1}^{k-1} p_{ij}\left(u_{ij} - u_{i,j-1}\right)\right) - p_{ik}u_{i,k-1}\right) \quad (3)$$

2.3. Defective items function

The buyer usually intends to minimize the number of defective items for improving product quality, to reduce costs related to quality, etc. This objective function can be stated as equation 4:

$$min\ Z_2 = \sum_{i=1}^{n}\sum_{k=1}^{K_i} d_i x_{ik} \quad (4)$$

2.4. Late Delivered items function

In order to reduce the total lead time of manufacturing, the number of production breakdowns, etc, buyers desires to minimize the total late delivered items purchased from suppliers. So, the third objective function can be defined as equation 5:

$$min\ Z_3 = \sum_{i=1}^{n}\sum_{k=1}^{K_i} h_i x_{ik} \quad (5)$$

2.5. Total weighted quantity of purchasing function

Depend on the purchasing strategies; various criteria can be taken into consideration in decision making process. For instance Dickson (1966) identified 23 criteria which can be used in various supplier selection problems. In addition Tracey (2001), Min and Galle (1994) and some other authors have proposed different criteria for supplier selection evaluation. We propose some factors according to table 1 including branding which affects the current problem. The suppliers with more popular brands get higher scores and this may lead to higher final weight. In spite of this positive impact the cost of these brands are usually higher than other sundry ones.

Table 1. Proposed Criteria for Supplier Selection Decision Making

Criteria	Sub-criteria	Criteria	Sub-criteria
Services	Length of guarantee period Available services during guarantee period Needed training for use of production	Brand	Level of popularity Impact on the buyer Marketing processes Innovation in design
Background of relationships	Length of the relation period Importance of relations Level of mutual satisfaction during relations		
Organizational level	Technological level Level of information technology Capital of the supplier Flexibility in manufacturing	Communication	Capability of getting in touch by the buyer Available information about supplier

In this paper we use the AHP method introduced by Saaty (1980), as the well known and useful MADM technique to obtain weights of each supplier which consists of three steps of making hierarchical structure, constructing the matrix of pair wise comparison ratios and calculating the total weights for each alternative.

So, the fourth objective is as follows:

$$Max\ Z_4 = \sum_{i=1}^{n}\sum_{k=1}^{K_i} w_i x_{ik} \quad (6)$$

2.6. Final objective function

In practical situations, for supplier selection problems, the weight of each criterion is different from others and it depends on purchasing strategies. Suppose that W_1, W_2, W_3 and W_4 are the weights of objective functions. We use the weighted sum of these four objective functions as the main objective function to be minimized. Before going farther, we have to normalize the coefficients of decision variables. We use linear normalization method (Shih et al 2007).

Linear normalization:

$r_{ik} = \frac{x_{ik}}{\max_{i,k}\{x_{ik}\}}$ for benefit attributes and $r_{ik} = \frac{\min_{i,k}\{x_{ik}\}}{x_{ik}}$ for cost attributes, where i is the index of suppliers and k index for intervals.

Since we intend to minimize the total weighted sum of these objectives, we regard the total weighted quantity of purchasing as cost attribute and the three other objectives as benefit attributes. So the final objective function after normalizing the coefficients can be stated as:

$$min \quad \sum_{i=1}^{n}\sum_{k=1}^{K_i} \alpha_{ik} x_{ik} + \sum_{i=n_1+1}^{n}\sum_{k=1}^{K_i} \beta_{ik} y_{ik} \tag{7}$$

Where

$$\alpha_{ik} = W_1 \frac{p_{ik}}{\max_{i,k}\{p_{ik}\}} + W_2 \frac{d_i}{\max_i\{d_i\}} + W_3 \frac{h_i}{\max_i\{h_i\}} + W_4 \frac{\min_i\{w_i\}}{w_i} \tag{8}$$

$$\beta_{ik} = W_1 \frac{\left(\left(\sum_{j=1}^{k-1} p_{ij}\left(u_{ij} - u_{i,j-1}\right)\right) - p_{ik} u_{i,k-1}\right)}{\max_{i,k}\left\{\left(\left(\sum_{j=1}^{k-1} p_{ij}\left(u_{ij} - u_{i,j-1}\right)\right) - p_{ik} u_{i,k-1}\right)\right\}} \tag{9}$$

2.7. Constraints

There are some constraints associated with tbe supplier selection problem. In the following these constraints are explained and modeled.

2.7.1. Demand constraint

This constraint implies that tbe total purchased quantity must be equal to the total demand of tbe buyer. Therefore we have:

$$\sum_{i=1}^{n}\sum_{k=1}^{K_i} x_{ik} = D \tag{10}$$

2.7.2. Discount intervals constraints

Variables corresponding to intervals must be equal to or between their lower and upper limits. Since at most one of the intervals offered by each supplier must be selected, the binary variable y_{ik} is utilized in these constraints. These constraints can be stated as equations (11) and (12):

$$l_{ik} y_{ik} \le x_{ik} \le u_{ik} y_{ik} \qquad \forall i = 1,\dots,n \quad \forall k = 1,\dots,K_i \tag{11}$$

$$\sum_{k=1}^{K_i} y_{ik} \le 1 \quad \forall i = 1,\dots,n \tag{12}$$

2.7.3. Capacity constraints

This constraint implies that the total purchased quantity from each supplier must be equal or less than the supply capacity of the nominated supplier. So we have tbe following relation:

$$\sum_{k=1}^{K_i} x_{ik} \le C_i \quad \forall i = 1,\dots,n$$

However, for $k = K_i$ we bave $x_{ik} \le u_{iK_i} = C_i$, so this constraint is already considered in Eq. (11) and adding the above constraint to the model is not bounding and is redundant.

2.8. The Final Mathematical Programming Model

The Final proposed mathematical model for supplier selection under discount policy can be formulated as follows:

$$min \quad \sum_{i=1}^{n}\sum_{k=1}^{K_i}\alpha_{ik}x_{ik} + \sum_{i=n_1+1}^{n}\sum_{k=1}^{K_i}\beta_{ik}y_{ik}$$

s.t.

$$\sum_{i=1}^{n}\sum_{k=1}^{K_i}x_{ik} = D$$

$$l_{ik}y_{ik} \le x_{ik} \le u_{ik}y_{ik} \qquad \forall i = 1,\dots,n \quad \forall k = 1,\dots,K_i$$

$$\sum_{k=1}^{K_i}y_{ik} \le 1 \quad \forall i = 1,\dots,n$$

$$x_{ik} \in \mathbf{Z}^+ \cup \{0\} \qquad \forall i = 1,\dots,n \quad \forall k = 1,\dots,K_i$$

$$y_{ik} \in \{0,1\} \qquad \forall i = 1,\dots,n \quad \forall k = 1,\dots,K_i$$

This model is a linear, integer programming model which has $1 + n + 2\sum_{i=1}^{n} K_i$ constraints and $2\sum_{i=1}^{n} K_i$ variables.

Goosens et al. (2007) shows that the supplier selection problem under all-unit discount policy is strongly NP-complete and no polynomial-time approximation algorithm with constant worst-case ratio exists for this problem (unless P=NP). In addition, Burk et al. (2008) discuss that purchasing problems under all-unit or incremental discount policy are categorized among NP-hard problems. Therefore, we apply a heuristic algorithm for our current problem which certainly can be classified in the NP hard problems.

3. Solving the problem via Scatter Search Algorithm

In this paper Scatter Search Algorithm (SSA) is considered as a population-based method. This methodology has been introduced by Glover (1977) as a heuristic for integer programming. The SSA Meta heuristic has successfully been applied to a variety of hard optimization problems (Rahimi-Vahed 2007).

In the original proposal, Glover described scatter search as a method that uses a succession of coordinated initializations to generate solutions. He introduced the reference set (*RefSet*) of solutions and several guidelines, including that the search takes place in a systematic way as oppose to the random designs of other methods (Martí 2006).

3.1. Scatter Search structure

The scatter search methodology is very flexible, since each of its elements can be implemented in a variety of ways and degrees of sophistication. In this section we illustrate the structure of scatter search based on the well-known "five methods" (Martí et al. 2006).

1. *A diversification generation method*
2. *An improvement method A reference*
3. *set (Ref-Set) update method*
4. *A subset generation method*
5. *A solution combination method*

Fig. 1 shows the interaction among these five methods.

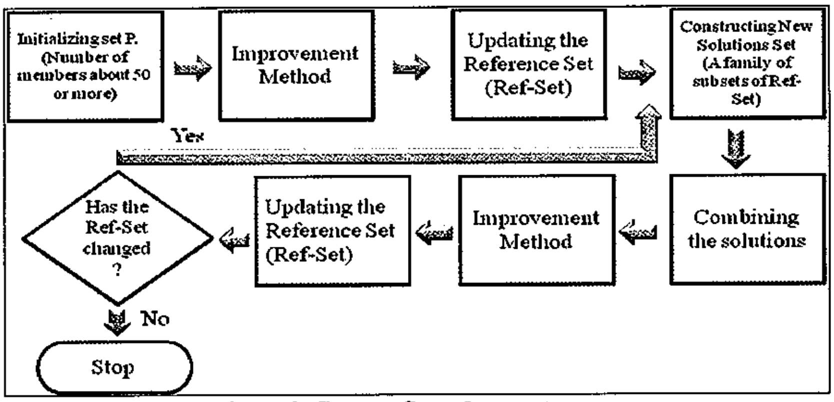

Figure 9: **Scatter Search structure**

3.2. Proposed Scatter Search Algorithm

Before describing the proposed SSA we present an algorithm by wbich we can equalize the discount intervals offered by suppliers to make the SSA work easier. Let $[l_{ik}, u_{ik}]$ represents k^{th} interval offered by supplier i and the total number of suppliers is n and $K = \max_i \{K_i\}$ where K_i is the maximum supply capacity of supplier i.

Algorithm 1. (Equalizing discount intervals)
Step 1. For all i let $l_1 := l_{i1} = 1$
Step 2. $j = 1$;
Step 3. $u_j := \min_i \{u_{ij}\}$
Step 4. $l_{j+1} := u_j + 1$
Step 5. If $(j <= K)$ $j := j+1$, go to 3
Step 6. Stop.

Vector solutions in this problem have the following general format:

$$S = \left(\overbrace{x_{11}, \cdots, x_{1K_1}}^{S_1}, \cdots, \overbrace{x_{n1}, \cdots, x_{nK_n}}^{S_n} \right) \tag{13}$$

Here we set these five methods for our supplier selection problem.

1. *Diversification Generation Method:* In this first step of SSA, 50 trial solutions are built. For i^{th} solution we begin from j^{th} supplier where $(j = i \bmod n$ & $if\ (j = 0)\ then\ j=n$, and n is the total number of suppliers. So a random integer value "x_j" from interval $[1, K_j]$ is assigned to this supplier. Now D is updated as $D = D - x_j$. Hence, $j = j+1$ & $if\ (j = n+1)\ then\ j = 1$. We do the above process until all suppliers are assigned a value or $D = 0$. If all suppliers are assigned a quantity but D is still non-zero, the above process must be repeated until D is zero. This set is called "*set p*".
2. *Improvement Method:* This step is developed to improve the quality of solutions and to obtain more enhanced solutions. This step consists of two phases.
   Phase 1: Let $i = 1$. For $j = i + 1$ to $j = n$ we do tbe following process. Assume that the assigned quantity to supplier i falls in interval k_i and similarly the assigned quantity to supplier j falls in interval k_j . So,
   if $(\alpha_{ik_i}x_{ik_i}+\beta_{ik_i}+\alpha_{jk_j}x_{jk_j}+\beta_{jk_j})-(\alpha_{ik_j}x_{ik_j}+\beta_{ik_j}+\alpha_{jk_i}x_{jk_i}+\beta_{jk_i})>0$ then the assigned quantities to supplier i and j, i.e. x_{ik_i} , x_{jk_j} are exchanged. If x_{ik_i} and x_{jk_j} are zero, then α_{ik_i} , β_{ik_i} , α_{jk_j} , β_{jk_j} will be zero. Now if $i \neq n-1$ then i is updated as $i = i + 1$ and then again we start from the beginning of the process with the updated i.
   Phase 2: In this phase, for each vector solution, those positive quantity variables which are lower than a fixed determined quantity (the lowest acceptable positive quantity) are selected. This fixed quantity can be determined based on organization's policy. We add up these selected variables with each other and then assign the resulted value to the best supplier who has extra capacity more than the above calculated summation quantity. In order to evaluate these suppliers and select the best one we assign the calculated summation quantity to these suppliers and select the supplier that leads to larger decrease in objective function.
3. *Reference Set (Ref-Set) Updating Method:* In SSA, *Ref-Set* originally consists of two subsets. In tbe first subset, b_1 solutions witb better objective values are collected. Members of this subset are sorted with respect to their objective value from higher one to the lower one. The second subset of *Ref-Set* is the set of diverse solutions. Combination of these solutions with otber solutions in *Ref-Set* may lead to solutions with good quality. For updating this subset the remaining of solutions which have not entered the first subset of *Ref-Set* are considered.

We define a “distance index” as follows in order to measure distance of these solutions with solutions in the first subset of *Ref-Set*.

$dist_{ij} = \sqrt{\sum_{r=1}^{n} \sum_{k=1}^{K_r} \left(x_{rk}^{i} - x_{rk}^{j}\right)^2}$ where $dist_{ij}$ is the distance of solution I from solution j. Now the distance index is measured as follows.

$$dist_i^* = \min_j \left\{dist_{ij}\right\}$$

The number of b_2 solutions with highest distance index value is selected. These are sorted with respect to their distance and placed in the second subset.

4. *Subset Generation Method (Constructing new solution sets):* In this step, new subsets are constructed from *Ref-Set*. Let the *Ref-Set* has b_1+b_2 members. Therefore, there are $2^{(b_1+b_2)}-1$ non-empty subsets that can be constructed from *Ref-Set*. In this paper, in order to optimize the computational time, we use only the subsets which have just 2 members.
5. *Solution Combination Method:* Members of the subsets made in the previous step are combined together and consequently new solutions are obtained. In this paper, the convex combination of each couple of solutions is computed. Since the value of λ (parameter of convex combination) is considered to be 0.5, the outputs are feasible.

In the proposed SSA these five steps are utilized in the order shown in Fig 1. The following example illustrates how the problem is formulated and then solved by the proposed SSA.

Example:

Assume that there are four suppliers as alternatives such that n_1 = 2 of them offer all-unit discount and n_2 = 2 of them offer incremental discount. Suppliers 2 and 3 are with famous brand. Table 2 shows these discount intervals. In table 3 rates of defective and late delivered items are presented, more over, the final weight of each supplier is listed in this table. The AHP method is applied to calculate these weights using scores "1" to "9" for computing matrixes of pair wise comparison ratios.

Table 2. Discount intervals of the example

# of supplier	Intervals	Unit prices	# of supplier	Intervals	Unit prices	# of supplier	Intervals	Unit prices
						3	1-80	660
			2	1-50	670		81-140	612
				51-100	610		141-200	550
				101-150	560		201-280	520
1	1-100	623		151-200	510		281-350	450
	101-200	534		201-250	470		351-400	370
	201-300	465		251-300	440		401-500	280
	301-400	383		301-350	400	4	1-75	650
				351-400	360		76-150	620
				401-450	320		151-225	530
				451-500	290		226-300	460
							301-375	390

Table 3. **Data related to each supplier**

Using Eq. (8) and Eq. (9), α_{ik}, β_{ik} cao be computed $\forall i = 1,\ldots,n \quad \forall k = 1,\ldots,K_i$. Applying algorithm 1, equalized lower and upper bounds of discount intervals are computed according to table 4. This model is solved using both LINGO and the proposed SSA.

Table 4. **Objective coefficients and upper and lower bounds of discount intervals**

# of interval	Supplier 1		Supplier 2		Supplier 3		Supplier 4		Lower bound (l_i)	Upper bound (u_i)
	α_{ik}	β_{ik}	α_{ik}	β_{ik}	α_{ik}	β_{ik}	α_{ik}	β_{ik}		
1	3.39	0	3.52	0	3.12	0	3.064	0	1	50
2	3.39	0	3.43	0	3.12	0	3.064	0	51	75
3	3.39	0	3.43	0	3.12	0	3.019	0.022	76	80
4	3.39	0	3.43	0	3.05	0.037	3.019	0.022	81	100
5	3.27	0	3.36	0	3.05	0.037	3.019	0.022	101	140
6	3.27	0	3.36	0	2.95	0.122	3.019	0.022	141	150
7	3.24	0	3.28	0	2.95	0.122	2.885	0.154	151	200
8	3.14	0	3.22	0	2.91	0.181	2.885	0.154	201	225
9	3.14	0	3.22	0	2.91	0.181	2.78	0.308	226	250
10	3.14	0	3.18	0	2.91	0.181	2.78	0.308	251	280
11	3.14	0	3.18	0	2.80	0.373	2.78	0.308	281	300
12	3.02	0	3.12	0	2.80	0.373	2.676	0.514	301	350
13	3.02	0	3.06	0	2.68	0.647	2.676	0.514	351	375
14	3.02	0	3.06	0	2.68	0.647	-	-	376	400
15	-	-	3.00	0	2.55	1	-	-	401	450
16	-	-	2.95	0	2.55	1	-	-	451	500

The exact optimal solution of this problem shows that the best purchasing strategy is to buy the total demand from supplier 3 that is one of suppliers with a popular brand. This optimal decision is because of the impact of branding and other qualitative factors however this supplier offers a high unit prices for its items. In mathematical form it is indicated as $x_{3,16}=500$. This problem is also solved using the SSA then, the same result is obtained.

# of supplier	Defective items' rate (d_i)	Late delivered items' rate (h_i)	Final weight of suppliers (w_i)
1	0.009	0.01	0.2016
2	0.02	0.009	0.3222
3	0.008	0.01	0.2734
4	0.006	0.008	0.2028

4. Performance evaluation of the proposed SSA

In order to evaluate the performance of the proposed SSA in computing the optimal purchasing decision, 24 problems have been solved by both the SSA and LINGO package version 8 on a Pentium 2.8 GHz PC with 1 GB RAM. In table 5 there are 8 groups of problems such that each group has three subgroups and the total number of suppliers in each subgroup is the same. However, the coordinates (n_1,n_2) for these subgroups are not equal where n_1 is the number of suppliers offering all-unit discount and n_2 is the number of suppliers offering incremental discount.

Through comparing the computational time of tbe proposed SSA with LINGO's it is perceived that how fast this algorithm can reach to a desirable solution. In the column titled *"Relative Error"*, the relative errors of outputs of the SSA from exact optimal solutions are presented. The relative error is measured using the following relation:

Relative Error = (Objective function value via SSA - Objective function value via LINGO) / Objective function value via LINGO (14)

Table 5. **Performance evaluation of the proposed SSA**

Total # of suppliers (n)	(n_1, n_2)	*Objective function value via SSA*	*Objective function value via LINGO*	*Relative Error*	*SSA computational time*	*LINGO computational time*
	(4,0)	1280.0	1280.0	0	0.4	0.5

	(0,4)	1281.0	1281.0	0	0.4	0.8
	(2,2)	1281.0	1281.0	0	0.3	0.7
8	(8,0)	692.3	692.3	0	0.2	0.8
	(0,8)	693.1	693.1	0	0.3	1.3
	(4,4)	692.1	692.1	0	0.3	0.9
12	(12,0)	1287.7	1287.7	0	0.4	3
	(0,12)	1288.1	1288.1	0	0.5	2.3
	(6,6)	1288.03	1288.03	0	0.3	2.5
15	(15,0)	1467.0	1467.0	0	0.6	2.4
	(0,15)	1467.87	1467.87	0	0.5	3.5
	(8,7)	1466.06	1466.06	0	0.6	2.9
20	(20,0)	1440.0	1440.0	0	0.4	3.3
	(0,20)	1440.95	1440.67	0.0002	0.5	3.8
	(10,10)	1441.02	1440.72	0.0002	0.5	5.2
25	(25,0)	1471.026	1471.026	0	0.5	4.1
	(0,25)	1472.02	1472.02	0	0.5	3.7
	(15,10)	1472.03	1472.03	0	0.6	5.4
30	(30,0)	1512.68	1500.0	0.0084	0.4	6.2
	(0,30)	1513.40	1500.93	0.0083	0.5	7.6
	(15,15)	1513.60	1500.4	0.0088	0.3	7.1
40	(40,0)	1893.7	1887.53	0.0033	0.6	9.3
	(0,40)	1894.1	1888.38	0.0030	0.5	12.2
	(20,20)	1894.1	1888.50	0.0029	0.5	10.8

5. Conclusion

Supplier selection problem is affected by various qualitative and quantitative conflicting factors. Furthermore, in many practical situations, suppliers may offer different discount schemes according to their selling policies. In addition existence of renowned brands along with sundry ones can affect the purchasing decision from different aspects. Hence, buyers face a complex decision making problem. This paper introduced a linear integer programming model in which qualitative and quantitative factors are considered. We have regarded some qualitative factors including the branding situation in table 1. In addition, an extended cost objective function is modeled as a part of the main model in which suppliers are allowed to offer any of the two discount schemes (all-unit and incremental discount).

Since this problem is NP-hard, we proposed a scatter search algorithm (SSA) by which this problem can be solved. The performance of this SSA is evaluated by comparing its outputs in solving 24 problems with exact optimal solutions. For computing exact optimal solutions LINGO package version 8 is used. Results obtained from this evaluation showed that the proposed SSA can find solutions with high quality but in a short computational time.

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SUPPLIER SELECTION AND DEVELOPMENT BASED ON FUZZY QFD APPROACH

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Abstract

Supplier development is an important concept in logistics which is defined as working with suppliers to help increase efficiency and decrease costs for the benefit of both supplier and buyer. This concept enables buyers to develop suppliers to meet the exact needs. In this paper, a novel decision-making approach to the supplier development has been proposed based on product design. In addition, the House of Quality (HOQ) concept and triangular fuzzy numbers have been composed to deal with vagueness of human thought. The HOQ translates the voice of customer into technical descriptors. Each supplier can be assessed according to the significant criteria. Finally, a case study is conducted to show the simplicity and efficiency of the proposed method. This innovative method can be implemented with spread sheet packages.

Keywords: *Supplier development and selection, Logistics, Fuzzy House of Quality*

I. Introduction

Logistics is about moving materials, information and funds from one business to another business or from a business to the consumer. Logistics is an important part of the business-economic system and is a major global economic activity. In fact, 10-15% of product costs are logistics related (Viswanadham, & Gaonkar, 2003). A structure of logistics and supply chains is composed of potential suppliers, producers, distributors, retailers and customers (Fiala, 2005). Buyers try to manage the suppliers by methods such as supplier development. Krause and Ellram (1997) defined supplier development as any effort of a buying firm with its supplier(s) to increase the performance and/or capabilities of the supplier and meet the buying firm's short- and/or long-term supply needs. Two kinds of supplier development strategies can be distinguished (Krause, 1999; Krause, Scannell, & Calantone, 2000). External supplier development strategies are competitive pressure (using several suppliers for a purchased item), supplier assessment (in-depth evaluations of suppliers' performance and providing feedback), and supplier incentives (promises of future business conditional upon current supplier performance).

Supplier selection and development is a multi criteria decision making problem. Criteria and decision techniques are two important factors in this problem. The earliest review in the context of supplier development and selection is by Moore and Fearon (1973) where they focused on industry applications of computer-assisted models. Weber, Current, & Benton (1991) categorized the literature with regard to the particular criteria mentioned in the article, the purchasing environment and the decision technique used. They reviewed 74 articles and selected price, delivery, quality, facilities and capacity, geographic location, and technology capability as the most important factors in supplier selection. De Boer, Labro, & Morlacchi (2001) did not restrict the review to the final choice models. The authors recognized the prior steps to the ultimate stage including problem formulation, formulation of criteria, qualification and final selection. Recently, Aissaoui, Haouari, & Hassini (2007) have presented a literature review that covers the entire purchasing process. They proposed different classifications of the published models based on single and multiple periods and Items.

Researchers have utilized fuzzy sets theory to solve supplier development problem. They have tried to consider both qualitative and quantitative criteria. Table I shows the summary of the utilized techniques. The majority of papers did not consider product design.

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In this paper, we develop a decisional model for supplier development that based on TQM methods such as House of Quality, adopting an analysis based on fuzzy logic and triangular fuzzy numbers. HOQ enables buyers to focus on product design. To deal with vagueness of human thought, a fuzzy method is suggested to convert the supplier linguistic attributes into fuzzy numbers. The model can be easily implemented with a spreadsheet package.

The organization of this paper follows as section 2, discusses the literature review that includes House of Quality and Fuzzy sets theory. Section 3, presents the proposed model. In section 4, a case study is discussed. Finally, conclusions are presented in section 5.

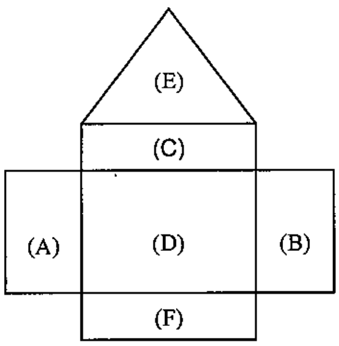
Table 1. Supplier development & selection techniques

Supplier development & selection techniques	Authors
Fuzzy sets theory	Li, Fun, & Hung (1997)
Scoring method and fuzzy expert system	Kwong, Ip, & Chan (2002)
Fuzzy AHP	Kahraman, Cebeci, & Ulukan (2003)
Fuzzy TOPSIS	Bottani & Rizzi (2006)
Fuzzy goal programming	Kumar, Vrat, & Shankar (2004)
Fuzzy-QFD	Bevilacqua, Ciarapica, & Giacchetta (2006)
Fuzzy neural network	Lopez (2007)
Fuzzy simple multi attribute technique	Chou & Chang (2008)

2. Literature review

2.1. House of Quality

Authors have used a QFD technique for supplier development. Quality Function Deployment (QFD) is a planning tool used to fulfill customer expectations. It is a disciplined approach to product design, engineering, and production and provides in-depth evaluation of a product. An organization that correctly implements QFD can improve engineering, productivity, and quality and reduce costs, product development time, and engineering changes. QFD focuses on customer expectations or requirements, often referred to as the voice of customer. It is employed to translate customer expectations, in terms of specific requirements, into directions and actions, in terms of engineering or technical characteristics, that can be deployed through: Product planning, Part development, Process planning, Production planning, Service industries (Besterfield et al., 2003). The structure of QFD can be thought of as a framework of a house, as shown in Figure 1. This is the basic structure for the House of Quality (HOQ). Ansari and Modarress (1994) discussed the roles of suppliers in the various phases of QFD. The Holmen and Kristensen (1998) study illustrated how the HOQ, can be used in the pre-interactive stage of a single product development project, and how the identified correlations and non-correlations between the characteristics of the planned product can be used by a customer as a practical approach for discrimination between the three types of suppliers. Temponi, Yen, & Tiao (1999) developed a fuzzy logic-based extension to HOQ for capturing imprecise requirements to both facilitate communication of team members and have a formal representation of requirements. Recently, Bevilacqua, Ciarapica, & Giacchetta (2006) have suggested a new method that transfers the house of quality approach typical of quality function deployment problems to the supplier selection process. They utilized fuzzy logic for supplier selection. In their method, the weights assigned by decision makers were aggregated using the average operator; however, in practice it is not useful because experience, authority, and the responsibilities of different DMs are not equal.



(A) Customer requirements (voice of the customer), (WHATs)
(B) Prioritized customer requirements
(C) Technical descriptors (HOWs), (voice of the organization)
(D) Relationship between requirements and descriptors
(E) Interrelationship between technical descriptors
(F) Prioritized technical descriptors

Figure 1. House of Quality

2.2. Fuzzy sets theory

To deal with vagueness of human thought, Zadeh (1965) first introduced the fuzzy sets theory, which was oriented to the rationality of uncertainty due to imprecision or vagueness. A major contribution of fuzzy sets theory is its capability of representing vague data. To deal with this type of uncertainty correctly we can resort to fuzzy logic. Fuzzy logic is based on fuzzy sets.

There are various types of fuzzy numbers, each of which may be suitable than others for analyzing a given ambiguous structure, the present analysis uses triangular fuzzy numbers. A triangular fuzzy number $\tilde{A}$= (l, m, u) is shown in Figure 2 (Klir and Yuan, 1995). If we want to use fuzzy sets in applications, we will have to deal with fuzzy numbers operations. Let $\tilde{A}$= (a, b, c), $\tilde{E}$ = (d, e, f) denote fuzzy numbers. Then:

$$\tilde{A} \oplus \tilde{E} = (a+d, b+e, c+f) \tag{1}$$

$$\tilde{A} \otimes \tilde{E} = (a \times d, b \times e, c \times f) \tag{2}$$

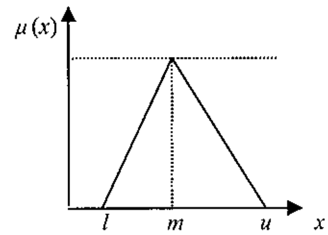


Figure 2. Triangular fuzzy number

3. Proposed model

In this paper, it is supposed that supplier assessment is selected as a supplier development strategy. Assume that a company buys components from some suppliers and we want to assess them according to the significant criteria. In other words, a multi-criteria decision making problem should be solved. In this section, the proposed algorithm is described.

Step 1: List Customer Requirement (product criteria or WHATs).

Step 2: List Technical Descriptors (supplier criteria or HOWs).

Step 3: Determine prioritized customer requirement: Each of decision-makers, determines a weight by linguistic variables. Triangular fuzzy numbers were used to quantify the linguistic variables.

Step 4: Determine a weight of each decision maker: Suppose the weight of DM_i is r_i. This parameter can be calculated by linguistic variables. This step is important because experience, authority, and the responsibilities of different DMs are not equal in practice.

Step 5: Calculate the aggregated weight for WHATs: The weights assigned by decision-makers for customer requirement, should be aggregated. Aggregated weight (w_i), is calculated by the Eq. (3). Where k is the number of WHATs and n the number of decision-makers ($i = 1, \dots, k$).

$$w_i = (r_1 \otimes w_{i1}) \oplus (r_2 \otimes w_{i2}) \oplus \dots \oplus (r_n \otimes w_{in}) \tag{3}$$

Step 6: Determine the relationship between requirements and descriptors: Each decision-maker was asked to express an opinion, using the linguistic variables, on the impact of each HOW on each WHAT. Here again, triangular fuzzy numbers are used to quantify the linguistic variables.

Step 7: Calculate aggregated weight between WHATs and HOWs: Aggregated weight (a_{ij}) is calculated by the Eq. (4):

$$a_{ij} = (r_1 \otimes a_{ij1}) \oplus (r_2 \otimes a_{ij2}) \oplus \dots \oplus (r_n \otimes a_{ijn}) \tag{4}$$

Where k is the number of WHATs, n the number of decision-makers, ($i = 1, \dots, k$), ($j = 1, \dots, m$) and m the number of HOWs.

Step 8: Determine prioritized technical descriptors: now we can complete the HOQ, calculating the weights of the HOWs (f_i), averaging the aggregated weight for WHATs (w_i), with the aggregated weight between WHATs and HOWs (a_{ij}), according to the Eq. (5). Again, these variables are triangular fuzzy numbers.

$$f_j = \frac{1}{k} \otimes [(w_1 \otimes a_{1j}) \oplus \dots \oplus (w_k \otimes a_{kj})] \tag{5}$$

Step 9: Determine the impact of each potential supplier on the attributes considered: It is necessary to assess each supplier vis-à-vis the attribute in question and combine said assessments with the weight of each attribute in order to establish a final ranking. In the same way as before, tbe linguistic variables are used, then the DMs' assessment or SR (SR = Supplier Rating), are aggregated according the following equation:

$$SR_{hj} = (r_1 \otimes sr_{hj1}) \oplus (r_2 \otimes sr_{hj2}) \oplus ... \oplus (r_n \otimes sr_{hjn}) \qquad (6)$$

Where $h = 1,..., p, j = 1,...,m$ and m is the number of attributes. Furthermore, p the number of suppliers and n the number of decision makers.

Step 10: Calculate the FSI index: The FSI index expresses the degree to which each supplier satisfies a given requirement. The FSI index is a triangular fuzzy number obtained from the previously calculated scores by the Eq. (7):

$$FSI_h = \frac{1}{m} \otimes [(SR_{h1} \otimes f_1) \oplus ... \oplus (SR_{hm} \otimes f_m)] \qquad (7)$$

Step 11: Defuzzify the FSI index and rank the suppliers: There are a lot of methods for ranking fuzzy numbers such as α-Cut, Defuzzification, Hamming distance. The simple and popular method, centroid method, is adopted to defuzzify FSI index (Cbou and Chang, 2008). This method is simple and easy to use for practitioners. A defuzzified triangular fuzzy number $\tilde{A} = (l, m, u)$ is calculated in Eq. (8):

$$FSI = \frac{1}{3} \times (L + m + U) \qquad (8)$$

Finally, the final scores can be ranked. Thus, the suppliers are assessed.

4. Case study

A famous company in Iran that manufactures automobile components such as cranks, hubs, rims, and so forth wants to expand its supply chain. The strategy of the company is to focus on product design during supplier development process. Therefore, the company is interested in assessing current suppliers and determine appropriate ranking. Now, the company buys a specific product from 4 suppliers simultaneously. The data were collected by means of interviews with four experts who are eligible to assess the suppliers.

Step 1: Reasonable Cost, Nice Finish, Lightweight, Strength and Durable are five customer requirements.

Step 2: Now that the customer needs and expectations have been expressed in terms of customer requirement, the experts must come up with engineering characteristics or supplier criteria (HOWs). Six supplier criteria are Financial Strength (FS), Technical Support (TS), Management Stability (MS), Quality Systems (QS), Support Resource (SR), Flexibility and Agility (FA).

Step 3: We propose a novel scale to assess suppliers. Let U = {VL, L, ML, M, MH, H, VH} be the linguistic set used to express opinions on the group of attributes (VL = Very Low, L = Low, ML = Medium Low, M = Medium, MH = Medium High, H = High, VH = Very High). The linguistic variables of U can be quantified using triangular fuzzy numbers as follows (Figure 3): VL = (0, 0, 1); L = (0, 1, 3); ML = (1, 3, 5); M = (3, 5, 7); MH = (5, 7, 9); H = (7, 9, 10); VH = (9, 10, 10). Each of the four decision-makers established the level of importance or weight of each of WHATs by means of a linguistic variable. The results are shown in Table 2.

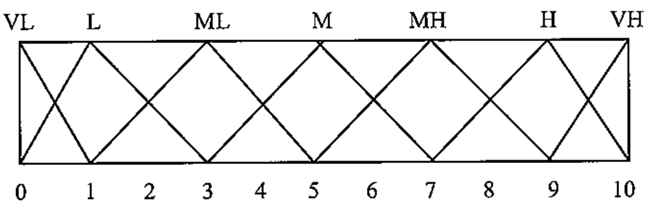


Figure 3. Linguistic scale

Table 2. Customer requirement

WHATs	DM_1	DM_2	DM_3	DM_4
Reasonable Cost	H	M H	MH	M
Nice Finish	ML	M	MH	ML
Lightweight	MH	MH	H	ML
Strength	H	H	MH	VH
Durable	M	VL	L	VL

Step 4: In this case, for determination the weight of each decision maker, experience index has been considered. It is supposed that a DM with more experience is more reliable than others. Experience index can be presented as linguistic variables. (Figure 4): Poor = (0, 0, 10); Normal = (5, 10, 15); Good = (10, 20, 20). In our case, r_1 = (5, 10, 15), r_2 = (5, 10, 15), r_3 = (5, 10, 15), r_4 = (10, 20, 20).

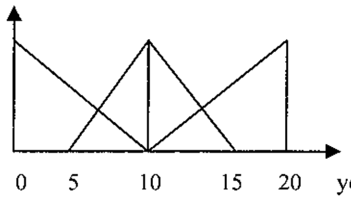


Figure 4. Linguistic scale for experience

Step 5: **By using Eq. (3) the aggregated weights are calculated in Table 3. In our case, $k = 5$, $m = 6$, and $n = 4$.**

Step 6: The opinions expressed by the four decision-makers, on the impact of each HOW on each WHAT are shown in Table 4.

Table 3. **Aggregated weight (w_i)**

WHATs	r_1*w_{i1}	r_2*w_{i2}	r_3*w_{i3}	r_4*w_{i4}	Aggregated weight
Reasonable Cost	(35, 90, 150)	(25, 70, 135)	(25, 70, 135)	(30, 100, 140)	(115, 330, 560)
Nice Finish	(5, 30, 75)	(15, 50, 105)	(25, 70, 135)	(10, 60, 100)	(55, 210, 415)
Lightweight	(25, 70, 135)	(25, 70, 135)	(35, 90, 150)	(10, 60, 100)	(95, 290, 520)
Strength	(35, 90, 150)	(35, 90, 150)	(25, 70, 135)	(90, 200, 200)	(185, 450, 635)
Durable	(15, 50, 105)	(0, 0, 15)	(0, 10, 45)	(0, 0, 20)	(15, 60, 185)

Table 4. **Impact of each HOW on each WHAT**

HOWs	Financial Strength (FS)				Technical Support (TS)				Management Stability (MS)			
WHATs	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4
Reasonable Cost	VH	H	MH	H	H	MH	H	M	H	H	MH	H
Nice Finish	M	M	M	ML	M	ML	M	M	ML	M	L	M
Lightweight	M	MH	ML	M	VH	VH	H	MH	VL	VL	L	ML
Strength	MH	M	MH	MH	M	M	MH	MH	L	L	ML	ML
Durable	M	ML	M	M	MH	MH	MH	VH	ML	M	M	ML
HOWs	Quality Systems (QS)				Support Resource (SR)				Flexibility and Agility (FA)			
WHATs	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4
Reasonable Cost	M	M	ML	ML	H	H	MH	VH	H	MH	H	VH
Nice Finish	VH	H	MH	VH	VL	L	ML	L	M	L	M	ML
Lightweight	H	H	MH	H	L	ML	ML	ML	M	MH	M	M
Strength	VH	VH	H	MH	VL	L	L	ML	L	ML	ML	ML
Durable	MH	MH	MH	H	ML	ML	ML	L	M	M	MH	ML

Step 7: **The aggregated weights between WHATs and HOWs are calculated by Eq. (4). Here again, the a_{ij} elements are triangular fuzzy numbers (Figure 5).**

Step 8: Prioritized technical descriptors are calculated by Eq. (5). The fuzzy values are shown in the matrix F of Figure 5.

	FS	TS	MS	QS	SR	FA	
Cost	(175,440,635)	(125,350,575)	(165,430,635)	(45,190,385)	(185,450,635)	(185,450,635)	(115,330,560)
Nice Finish	(55,210,415)	(65,230,425)	(50,190,365)	(195,460,635)	(5,60,195)	(40,170,355)	(55,210,415)
Lightweight	(75,250,455)	(175,430,630)	(10,70,175)	(165,430,635)	(20,130,295)	(85,270,485)	(95,290,520)
Strength	(115,330,555)	(105,310,525)	(15,110,265)	(175,430,630)	(10,80,205)	(20,135,295)	(185,450,635)
Durable	(65,230,425)	(165,410,605)	(45,190,385)	(145,390,605)	(15,110,285)	(65,230,445)	(15,60,185)
	f_1	f_2	f_3	f_4	f_5	f_6	
	(10505,84820,239095)	(11295,90520,254255)	(5225,52600,167515)	(13225,100180,264260)	(5105,48280,154565)	(7235,66960,204955)	

Figure 5. **The completed fuzzy-HOQ**

Step 9: **In this step, the impact of each potential supplier on the attributes considered. Table 5, shows each decision makers opinions on the various suppliers in relation to each attribute. By using Eq. (6) suppliers rating are calculated.**

Step 10: The FSI index is calculated by using Eq. (7). Table 6 shows the results.

Table 5. The impact of each potential supplier on the attributes

HOWs	Financial Strength (FS)				Technical Support (TS)				Management Stability (MS)			
	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4
Supplier 1	VL	L	ML	L	VH	MH	H	M	H	H	MH	H
Supplier 2	ML	L	M	ML	M	ML	H	M	M	L	M	ML
Supplier 3	M	MH	M	H	VH	H	MH	MH	H	H	MH	H
Supplier 4	M	ML	MH	MH	M	M	MH	MH	L	L	ML	ML
HOWs	Quality Systems (QS)				Support Resource (SR)				Flexibility and Agility (FA)			
	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4	DM_1	DM_2	DM_3	DM_4
Supplier 1	H	MH	MH	VH	M	MH	M	MH	M	L	L	ML
Supplier 2	M	M	ML	ML	MH	H	H	VH	H	MH	H	VH
Supplier 3	H	H	MH	VH	VL	L	ML	L	M	L	VL	L
Supplier 4	H	H	MH	H	L	L	ML	ML	M	H	M	M

Table 6. Calculating the FSI index

Alternative	L	M	U
Supplier 1	955108	21227100	100101921
Supplier 2	527175	16520167	90691733
Supplier 3	1090850	23302767	104464421
Supplier 4	787683	19474633	95771596

Step 11: Triangular fuzzy numbers have defuzzified by using Eq. (8). Now, the scores can be ranked. Ultimate ranking and scores are given in Table 7-a.

Now we can analyze the solutions of our problem. If we devote an equal weight to each DMs then the results would be altered. In the case, we suppose that the weight of each decision maker is $r = (5, 10, 15)$. It means that there is no priority between DMs. The results have been written in Table 7-b. After a glance at the results, we can identify the similarities and differences. Supplier 3 is still the best alternative and supplier 2 placed in the last rank. But the ranking of supplier 1 and 4 has been changed. This case shows that the step of determining a weight of each decision maker has a prominent effect on the answers.

Table 7. Defuzzification

a) Results Non equal weight for decision maker			b) Results Equal weight for decision maker		
Alternative	Score	Ranking	Alternative	Score	Ranking
Supplier 1	40761376	2	Supplier 1	33453675	3
Supplier 2	35913025	4	Supplier 2	32177871	4
Supplier 3	42952679	1	Supplier 3	35446451	1
Supplier 4	38677971	3	Supplier 4	33506044	2

5. Conclusions

One of the most important issues in logistics and Supply Chain Management is supplier development. This concept is a cross functional group decision-making problem. The previous methods do not consider the relationship between customer requirements (WHATs), and technical descriptors (HOWs). Furthermore, expertise, experience, authority, and the responsibilities of different DMs are supposed to be equal; however, these parameters are different in real world. In this paper, we determined the weight of each decision maker by using fuzzy logic. Moreover, a decisional model has been developed for supplier assessment that based on Total Quality Management (TQM) methods such as House of Quality, adopting an analysis to fuzzy logic and triangular fuzzy numbers. Fuzzy logic can overcome the vagueness of decision-making. The HOQ was selected because it pays special attention to product design. It is expected that in the near future, this algorithm will be applied effectively to various issues such as performance assessment, personnel selection, policy making, and business strategies.

The lack of quantitative metrics is one the most important weaknesses in HOQ method. For instance, price is a quantitative criterion which must be evaluated precisely. Therefore, it is worth wile to add another step to take into account quantitative criteria. Besides, after supplier assessment the company should suggest supplier development programs. Another research may focus on supplier development programs. In addition, the majority of papers in the field of supplier selection and development focus on manufacturing environment, and ignore service environment. A future research may be implemented in this area.

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SUPPLIER SEGMENTATION IN IRANIAN AUTOMOTIVE INDUSTRY

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Abstract

New concepts of Supply Chain Management have appeared more than 20 years ago. Variety of customer's requirements, need for fast delivery of product to market and development of Information Technology resulted in movement of organizations toward Supply Chain. In the meantime, automotive industries because of having very competitive market, also variety and lots of components are one of the most developed industries to utilize the Supply Chain Management.

Meanwhile the effective role of suppliers as a first ring of the chain is very important. On the other hand, due to the uncertainty in the effectiveness and efficiency of suppliers and also change in supplier's performance, supplier's relationship management and performance measurement have become very important issues that resulted in improvement of relationship with suppliers in Supply Chain Management.

In recent years, some studies have been concerned with segmentation, evaluation and relationship management of suppliers. Goran Svensson (2004) has presented a strategic model for supplier segmentation base on two factors: eommodity's importance for manufacturer and supplier's commitment to manufacturer. In this paper we will develop Svensson's model based on characteristics of Iranian automotive industries.

Keywords: Supply Chain Management, Supplier Relationship Management, Supplier Segmentation

1. Introduction

Supplier relationship management is one of the most important parts of supply chain management. In fact, effective supplier management and improving qualitative and quantitative level of suppliers could be a competitive advantage of every company. (Cusumano, Takeishi 1991)

Due to focus of Iran's economy on Automotive Industry, quick growth of this industry in Iran, developing competitive market of automotive industry in Iran and entering new products from some famous car manufacturer (BMW, Toyota, Hyundai...) to Iranian market, there is need to study buyer-supplier relationship strategy for promoting supply chain capabilities, reducing supply chain costs and increasing competition power with other manufacturers in the market. Therefore, regard to Iranian automotive industries needs, this research is useful for them as an applicable study.

Our research organized as follow: main concept of Supply Chain Management and Supplier Relationship Management will be explained and also its literature review will be summarized. Next, research method for supplier selection, sampling and statistical analysis will be drawn. Finally, we will have some discussion on results.

2. Supply chain Management

The production, base on Supply Chain Management (SCM) thinking was appeared in 1960s by movement from mass production to lean production. (Huang, Keskar, 2006)

Many factors, such as competitive market place for products and variety of customer's requirements, need for fast delivery of product to market and development of information technology resulted in movement of organizations toward Supply Chain and forced them to outsource their organizational activities to appropriate and certain suppliers

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for sustaining market's profit margin. (Kwai-Saog et al., 2004) ln fact it lets companies to nse their capabilities in an effective way. New concepts of SCM that defined as *"Integration of relevant activities that changes raw material to semi-final product to final product and delivering these outcomes to customers"* were presented from 20 years ago. (Heizer, Render, 2001). Figure I indicates simple structure of supply chain.

Figure 1- Simple structured Supply Chain (Hugas, 2006)

On the other hand SCM is: *" All links for transferring materials, products, money and information from suppliers to manufacturer and vice versa."* (Goffin et al.1997).Figure 2 shows transferring products, Information and money through the supply chain. Considering the structural characteristic of SCM, one of the industries that can specially benefit this philosophy is Automotive Industry.

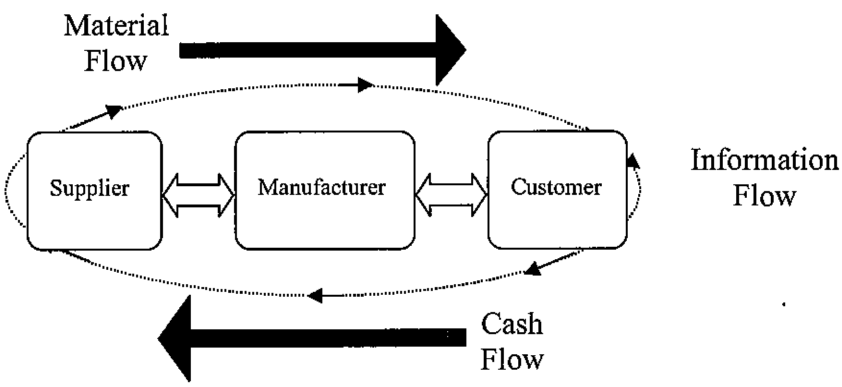

Figure 2- Supply Chain Flows (Sbariati, 2004)

2.1 Supplier Relationship Management: Portfolio Models

There are wide studies related to supplier segmentation and supplier relationship management that based on their structures, named as ***Portfolio Models.*** These models commonly analyze effect of two factors on concept and characteristics of buyer-supplier relationships. For example, for the first time, Kraljic (1983) in his studies classified buyer-supplier relationship based on two factors: Profit Impact and Supply Risk. Table 1 shows Kraljic's model.

Table 3-**Kraljic portfolio model (1983)**

		Supply Risk			
		Low		*High*	
Profit Impact	*Low*	1	Non-Critical	2	Bottleneck
	High	3	Leverage	4	Strategic

ln portfolio models, one of the factors that construct model is related to suppliers and the other factor is related to buyers. On tbe other band, based on the impact of every factor io characteristic of relationship (strength or weakness of factors), we have High and Low impact of every factors. Portfolio models divide buyer-supplier relationship into 4 categories. In cells no.1 and no.4 there is symmetric relationship between buyer and supplier. lt means that in these cells, the relationship is importaot for both buyer aud supplier and both of them tend to iovestment for relationship promotion(cell 4) on non of them tend to investment in relationship(cell 1). On the other hand, in cells no.2 and no.3 there is non-symmetric relationship between buyer and supplier. In non-symmetric relationship, one of buyer or supplier tends to investment and promote in relationship, but the other one tend to maintain current status in relationship.

From 1983 that Kraljic presented the first portfolio model for buyer supplier relationship segmentation and classification till now, many studies focus on these similar models. Krapfel (1990); Olsen, Ellram (1997); Trend, Monczka (1998); Bensaou (1999); Kaufman et al. (2000) and Svensson (2004) have presented portfolio models for supplier segmentation and classification. In table 2 these studies classified based on their factors.

Table 4- **Models and related factors (Rahimi et al, 2008)**

Model	*Factors*	*1=Low 2=Low*	*1=High 2=Low*	*1=Low 2=High*	*1=High 2=High*
Kraljic (1983)	1.Supply Risk 2.Profit Impact	Non Critical	Bottleneck	Leverage	Strategic
Krapfel (1990)	1.Interest commonality 2.Relationship value	Acquaintance	Friend	Rival	Partner
Olsen, Ellram (1997)	1.Strategic Importance of Purchase 2.Difficulty of Managing the Purchase Situation	Non Critical	Leverage	Bottleneck	Strategic
Trend, Monczka (1998)	1.Supply Risk 2.Profit Contribution	Low Value	Supply Assurance	Profit Contribution	Provides Competitive Advantage
Bensaou (1999)	1.Supplier's Investment 2.Buyer's Investment	Market Exchange	Captive Supplier	Captive Buyer	Strategic Partnership
Kaufman et al. (2000)	1.Collaboration 2.Technology	Commodity Supplier	Collaboration Specialist	Technology Specialist	Problem-Solving Suppliers
Svensson (2004)	1.Supplier's Commitment 2.Commodity's Importance	Transactional	Friendly	Business Partner	Family

Ozlap et al. (2006) classified these models into 3 groups: Relationship-focused framework, Factor-based framework and Hybrid framework.
Relationship-focused framework segmented suppliers based on relationship characteristics *(such as trust and commitment)*, Factor-based framework segmented suppliers on more factor-based characteristics *(such as supplier capabilities, characteristics of the product on hand, availability of alternative suppliers)* and Hybrid framework is complex of two other frameworks.

According to all models presented in table 2, common characteristic of every form of relationship could be developed that indicated in table 3.

As indicated in table 2, Svensson (2004) presented a model for supplier segmentation that Ozlap (2006) classified it as hybrid model. Due to having characteristics of both relationship-focused and factor-based frameworks, it was more comprehensive than other frameworks for segmentation of buyer-supplier relationship. One of the other reasons that his model was choose for our research was that like Svensson, our study try to examine supplier segmentation in Iranian automotive industry.

Svensson, in his article, with use of paired questionnaire, studied buyer-supplier relationship in one of Swedish Vehicle Manufacturer (VM) and its suppliers based on two factors: supplier's commitment to VM and commodity's importance to VM. Every questionnaire included 20 questions based on Likert scale. Questions 1-6 for measuring family relationship strategy, questions 7-10 for measuring business partnership strategy, questions 11-14 for measuring friendly relationship strategy, questions 15-18 for measuring transactional relationship strategy, also question 19 for measuring the importance of relationship and finally question 20 for measuring degree of cooperation in the relationship.

We used Svensson model and questionnaire to study perception of relationship between buyer and suppliers in Iranian automotive industry. Regarding to more than 560 suppliers of automotive industries (tier 1 suppliers) 70 questionnaires sent to suppliers and also for buyers. Answers to those questionnaires gathered by mail, telephone and interview. Finally 36 questionnaires that filled by both suppliers and buyers gathered.

Table 5- **Common characteristic of models (Rahimi et al, 2008)**

Transactional , Non critical, Market Exchange	***Friendly, Leverage, Captive Supplier***
1. Short-term relationship *2.* Allocating limited resources to supplier *3.* Simple buy-sell relationship *4.* Change supplier easily *5.* Local suppliers *6.* Standard commodities *7.* No need for innovation *8.* Stability of Demand *9.* Lack of tendency to Investment	*1.* Suppliers depend on buyers *2.* Multi suppliers for every product *3.* High competition between suppliers *4.* Need for high-ranked engineering experiences
Business Partnership, Bottleneck, Captive Buyer	***Familiar, Strategic, Strategic Partnership***
1. Buyers depend on suppliers *2.* Try to increase competition power of suppliers *3.* High level of buying value *4.* High level of supplier's creativity *5.* Supplier's technology ownership *6.* High-ranked supplier's bargaining power *7.* Variety of supplier's product	*1.* Long-term relationship *2.* Buyer's investment on supplier innovation *3.* Powerful joint venture with supplier *4.* Trying to develop supplier's technical skills *4.* High level of buying value *5.* International suppliers *6.* R&D planning for suppliers *7.* Complex commodity's production *8.* High competition power of suppliers *9.* Changing supplier is very costly *10.* Product development planning *11.* Limited number of suppliers

3. Research Method: Supplier selection

This study is based on research in one of Iranian automotive industries. The identity of this automotive industry is autonomous due to the need for confidentiality. For this research, 70 suppliers were selected based on random sampling. Obtaining dyadic perception of relationship between this buyer and its suppliers, questionnaires were sent to them and finally 36 paired questionnaires were collected.

4. Statistical analysis

Distribution normality assumptions of *"Importance of Relationship"* and *"Degree of Cooperation in Relationship"* were assessed by the Kolmogrov-Smirnov test. For comparison of mean of buyer and suppliers answers to question 19 (Importance of Relationship), paired sample t-test was used. For comparison of buyer and suppliers answers to question 20 (Degree of Cooperation in Relationship), Wilcoxon signed-rank test was used. In our discussion, correlation between buyer and suppliers answers was analyzed with Kendall correlation test (table 4). The level of statistical significance was established at $p \leq 0.05$.

5. Results

Table 6-Correlation between buyers and suppliers answers

			Familiar			*Transactional*
Kendall	***Supplier***	*Variables*	(2,3)	(3,4)	(3,5)	(16,18)
		Correlation Coefficient	0.326	0.277	0.388	-0.315
		P-Value	0.020	0.047	0.006	0.026
	Buyer	*Variables*	(1,2)	(3,4)	(5,6)	(16,17)
		Correlation Coefficient	0.554	0.526	0.346	-0.371
		P-Value	0.000	0.000	0.016	0.009

* Other values were not in significant level.

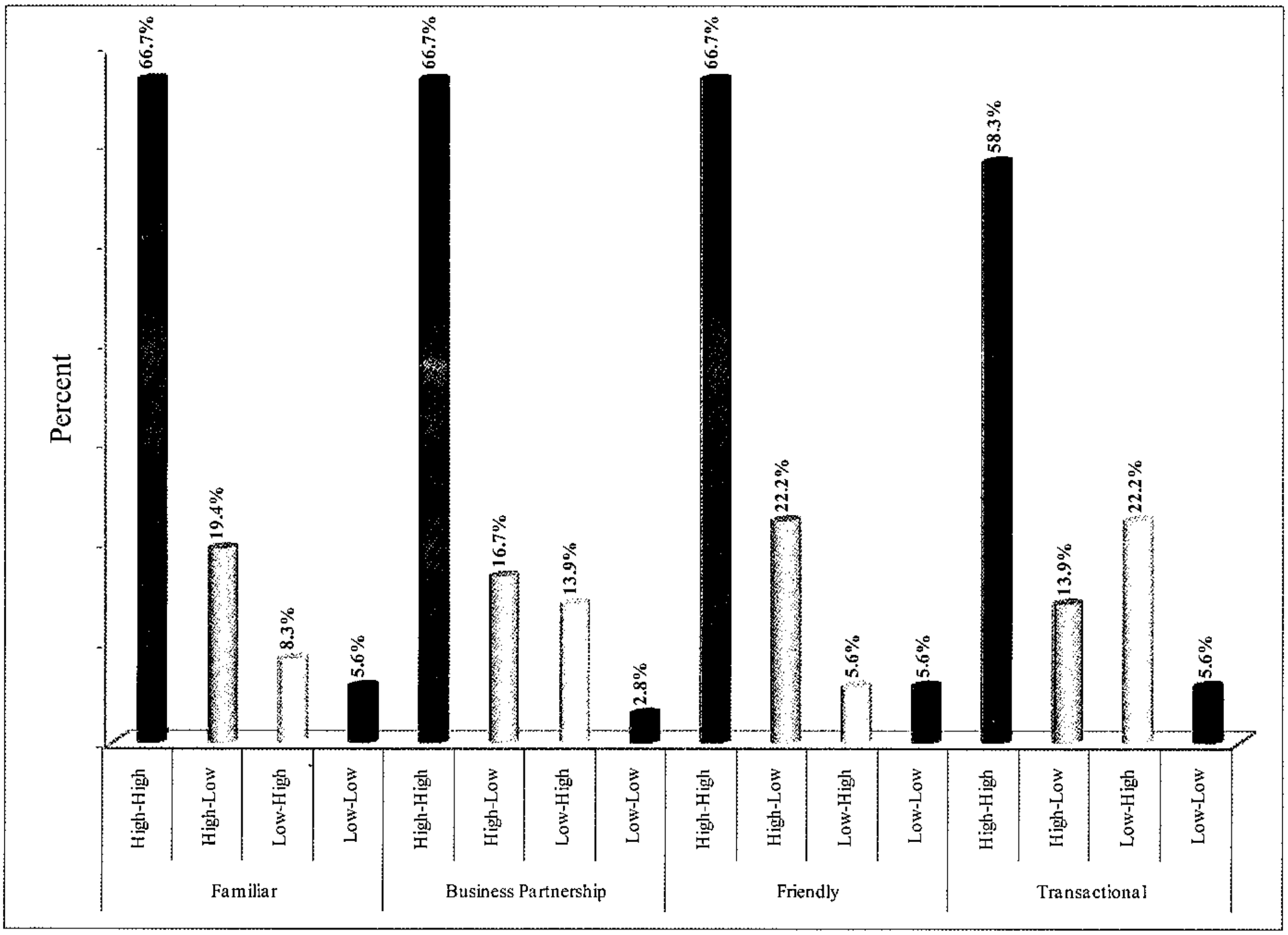

Figure 3 – Buyer's expectancy viewpoint of relationship with suppliers

Questionnaire presented in Svensson's model has designed based on *Expectancy Theory*. It means that our expectation in this questionnaire is observing familiar relationship between buyer and its suppliers. Buyer tries to develop familiar (strategic) relationship for obtaining its long term goals. Therefore, buyer tends to overestimate level of relationship with its suppliers. Figure 3 shows the expectancy viewpoint of buyer and Figure 4 shows the interaction between buyer and its supplier's viewpoint about the level of relationship.

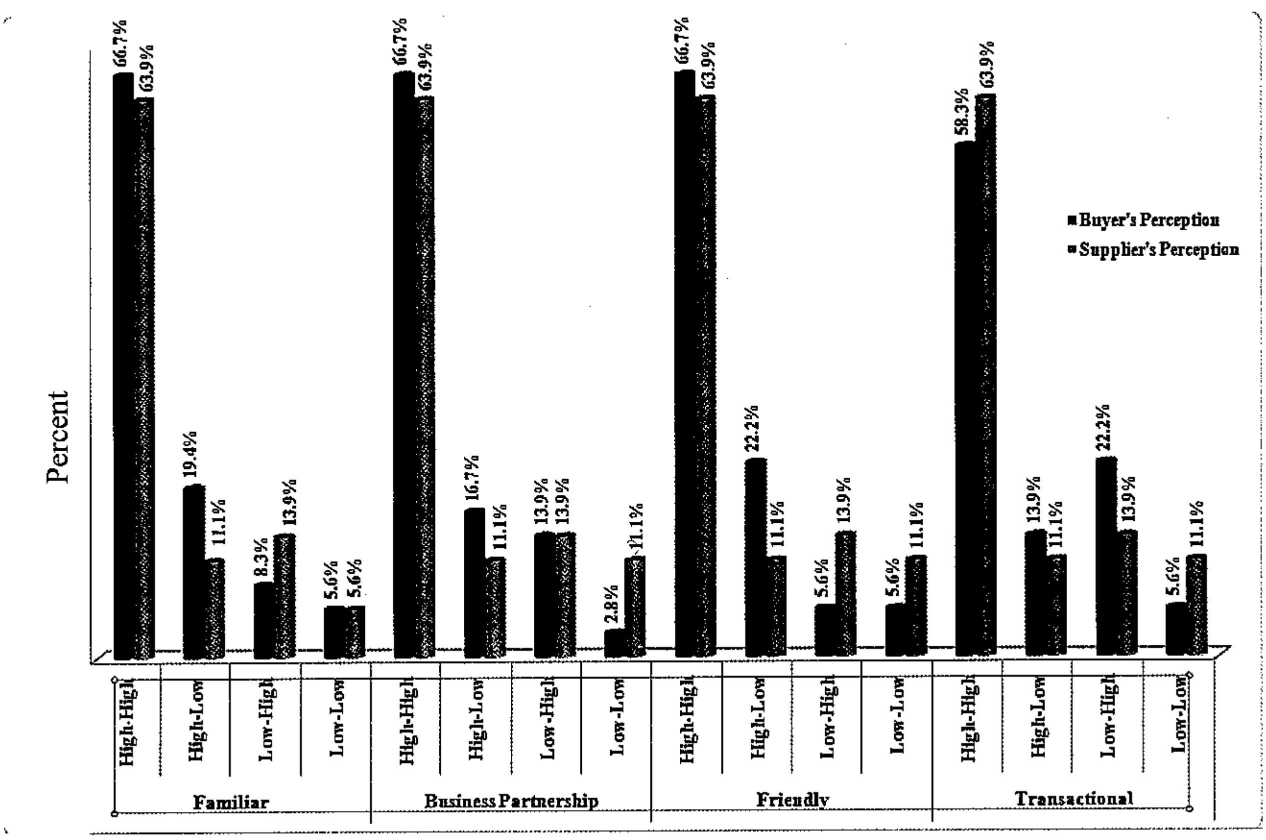

Figure 4 - Interaction between buyer and supplier's viewpoint of relationship based on level of relationship

6. Discussion and Conclusion

As mentioned above, Svensson's model bas based on measuring intensity of strategic relationship between buyer and its suppliers. Statistical analysis of buyer-supplier perception of relationship shows that there is nearness between buyer and supplier's perception about familiar (strategic) relationship in Swedish automotive industry. But, Due to statistical results of our research, there is no strategic relationship between buyer and suppliers. In fact buyer-supplier relationship in our sample was kind of operational relationship. Now, with regard to strategic roadmap of Iranian automotive industry for product quality development, on time delivery, cost leadership and also increasing competitive power in internal and external markets, there is some question: is tbis kind of non-strategic relationship suitable for ensuring strategic roadmap goals? If not, what kind of relationship (mentioned in table 3) is appropriate for every goal? It seems that buyers in Iranian automotive industry need an immigration plan to develop and improve their relationship with suppliers from non-strategic relationship to strategic partnership.

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QUALITY FUNCTION DEPLOYMENT APPLICATION IN SUPPLIER SELECTION

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Abstract

Major developments and changes in the global market economies urge the vitality of the customer focus in all industries. In the competitive world of business, the companies have to evaluate their suppliers for the success of their supply chains. Quality Function Deployment (QFD) is a customer focused methodology depicting the processes in need of improvement. In this research a survey is run to collect data among the companies which have pneumatic valve suppliers in their supply chain. The important factors related to customer selection are identified and QFD methodology is applied. In this research through the help of QFD methodology supplier selection and development is aimed.

Keywords: *Supplier Selection, Supplier Development, Quality Function Deployment, Pneumatic Valve*

1. Introduction

Over the last two decades, globalization has resulted in a highly competitive business environment. The turbulent market condition in the twenty-first century has heightened the need for more competitive enterprise strategies. Speed, quality, flexibility, and responsiveness, which are the key components of agile capabilities, are necessary to meet the unique needs of customers and markets (Baramichai et al., 2007).

Manufacturability and value engineering activities are concerned with improvement of design specifications at the research, development, design and production stages of product development. In addition to immediate, obvious cost reduction, design manufacturability and value engineering may produce other benefits like reduced complexity of the product, additional standardization of components, improvement of the functional aspects of the product, improved job design and job safety, improved maintainability (serviceability) of the product and robust design. Although value engineering focuses on preproduction design improvement, value analysis, a related technique, takes place during the production process, when it is clear that a new product is a success. Value analysis seeks improvements that lead to either a better product or product more economically. The techniques and advantages for value analysis are the same as for value engineering, although minor changes in implementation may be necessary because value analysis is taking place while the product is being produced. (Heizer &Render, 2001, s: 144)

Supplier selection has increasingly been regarded as one of the most important strategies in the globalization era. With the multidimensional nature of the problem, supplier selection involves both tangible and intangible selection criteria. This paper presents a case study on solving the supplier selection problem in the pneumatic valve industry through a decision support system that employs the analytical hierarchy process (AHP) and the quality function deployment (QFD). Since QFD has been used successfully in product design to relate what needs to be achieved with the ways to achieve it, it should provide a means to ensure that the business dynamic/potential changes are embedded in the process of supply chain configuration. In addition, by employing the AHP approach to prioritize the importance of the potential changes and the appropriateness of the change response strategies, the areas that need to be improved can be clearly identified. In our quality function deployment study the pneumatic valve suppliers in Turkey are considered. Among the 6 big pneumatic suppliers in the Turkey Market, only the three of them are considered in the analysis, which have bigger market share in Turkey. In order to understand the customer demands and expectations, questionnaires are replied by the purchasing specialists in the pneumatic valve user companies.

The QFD belongs to the sphere of quality management methods (Bevilacqua, et al., 2006) originated in Japan in the late 1960s (Akao & Mazur, 2003) and has been traditionally employed for developing new products as it provides a method for translating customer requirements into appropriate functional requirements at each stage of product development and production. Recently, a modern QFD that offers a better way to perform an analysis (Zultner, 1995) was developed with the major improvements on the quantitative method used to establish the metrics and prioritize the alternatives. Instead of relying on the ordinal scale, the AHP, which is the simplest prioritization method that provides accurate and reliable results on a ratio scale (Zultner, 2005), is utilized. Using this new approach, the modern QFD has

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been applied successfully for solving problems in several areas including business process redesign and organizational improvement.

Bevilacqua, Ciarapica, Giacchetta (2007) in their article they suggested a new method that transfers the house of quality (HOQ) approach typical of quality function deployment (QFD) problems to the supplier selection process. To test its efficiency, the method is applied to a supplier selection process for a medium-to-large industry that manufactures complete clutch couplings. The study started by identifying the features that the purchased product should have (internal variables 'WHAT') in order to satisfy the company's needs, then it seeks to establish the relevant supplier assessment criteria (external variables 'HOW') in order to come up with a final ranking based on the fuzzy suitability index (FSI). The whole procedure was implemented using fuzzy numbers; the application of a fuzzy algorithm allowed the company to define by means of linguistic variables the relative importance of the 'WHAT', the 'HOW'-'WHAT' correlation scores, the resulting weights of the 'HOW' and the impact of each potential supplier. Special attention is paid to the various subjective assessments in the HOQ process, and symmetrical triangular fuzzy numbers are suggested to capture the vagueness in people's verbal assessments.

Quality Function Deployment (QFD) is also known as the "House of Quality" concept. The House of Quality (HOQ) is the central component in constructing QFD (Hauser & Clausing, 1988). There are many different forms of the "house of quality", but its ability to be adapted to the requirements of a particular problem makes it a very strong and reliable system to use. Its general format is made up of six major components. These include customer requirements, technical requirements, a planning matrix, an interrelationship matrix, a technical correlation matrix, and a technical priorities/benchmarks and targets section.

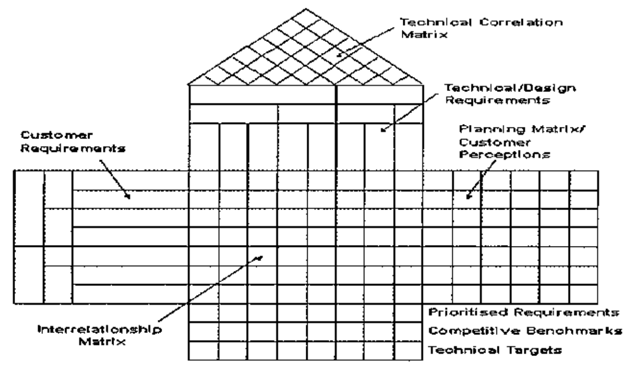


Figure 10. Illustration of main parts of the house of quality

QFD refers to both determining what will satisfy the customer and translating those customer desires into the target design. The idea is to capture a rich understanding of customer wants and to identify alternative process solutions. This information is then integrated into the evolving product design. QFD is used early in design process to help determine what will satisfy the customer and where to deploy quality efforts. One of the tools of Qfd is the house of quality. The house of quality is a graphic technique for defining the relationship between customer desires and product (or service). Only by defining the relationship is rigorous ways can operations managers build products and processes with features desired by customers. Defining this relationship is the first step in building a world-class production system. (Heizer &Render, 2001, s: 139)

To build the house of quality, we perform six basic steps:

1) Identify customer wants (What do prospective customers want in the product?).
2) Identify how the good/ service will satisfy customer wants (Identify specific product characteristics, features, or attributes and show how they will satisfy customer wants).
3) Relate customer wants to product how's.
4) Identify relationships between the firm's how's (How do our how's tie together?).
5) Develop importance ratings.
6) Evaluate competing products (How well do competing products meet customer wants?).

2. Research

Supplier selection is sometimes highly complex, since it incorporates a great variety of uncontrollable and unpredictable factors that affect the decisions involved. The aim of this study was to get a better understanding of the supplier selection process.

2.1. Research material

Main source of our study is composed of the pneumatic valve suppliers in Turkey. In Turkey althougb there are 6 big pneumatic suppliers in the market, only the three of them are considered in tbe analysis. The others are not considered because they have small market share in Turkey. The information about the suppliers is obtained by interviewing with the company professionals. Because of the privacy reasons no company name will be given in the paper. The company in the analysis is a company which has all its plants and production in Europe, and works with a distributor in Turkey. One of its competitors is a German company which has some of its production in China, and the other competitor is a Far East Company. All of them have a bigh market share in Turkey. On the other side, to understand the customer demands and expectations, questionnaires are replied by the purchasing specialists in the pneumatic valve user companies. In the analysis of these questionnaires the criteria of the suppliers' preferences are determined and the importance of them is obtained through AHP method which will be used in the house of quality matrix.

2.2. Identifying customer expectations

In the process of the purchasing pneumatic valves the criteria given below are they taken into consideration. The criteria can be called the customer wants and those wants are shown on the left of the house of quality and are: Price, Quality, and Lead Time, after Sales Service and Company Qualification.

Second, it is determined that how the organization is going to translate the customer wants into product design and process attribute targets. These how are entered to the top portion of the house of quality. These characteristics are Quantity Discount, Sale on Credit Terms, Cash, Material life, Quality Documents, Reputation, Delivery Variety, Delivery Cost, Spare Parts, Insurance, Capacity, Product variety, Training.

Third, customer wants are evaluated against how. Fourth, the relationship between tbe attributes is developed in the "roof" of the house.

Fifth, importance ratings for the design attributes are developed and written on tbe bottom row of the table (9 is assigned for high, 3 for medium, and 1 for low) to each entry in the relationship matrix, and then each of these values are multiplied by the customers' importance ratings. These values in the "our importance ratings" row provide a ranking of how to proceed with product and process design, with the highest values being the most critical to a successful product.

Sixth, the house of quality is also used for the evaluation of competitors. (Heizer &Render, 2001, s: 139) How well the competitors meet customer demand? The two columns on the right indicate how market research thinks competitors (German and Far East Companies) satisfy customer wants. So German Company does a good job on quality, after sales service and it is a qualified company but does a fair job on price (expensive among the other competitors) The far east company does a good job on price but a fair job on lead time , after sales service and quality

1. Price: The price criterion is very important as it is in all purchasing. Without sacrificing from the other criteria the best quality product in the cheapest price is tried to be bought. The availability of a quantity discount, the type of payments, whether they accept cash or credit terms are on the price concern.
2. Quality: The quality criterion is the most important criterion among the others, it has the highest priority number, 0.327. Life if the material, availability of quality documents, and reputation is under the quality concern.
3. Lead Time: In production planning the variability of lead times is very important issue that has to be taken into account. The variety of the delivery terms and the cost of the delivery depend on the type of the delivery, whether it is by train, plain, ship or road transport, is so important for the time factor.
4. After Sales Service: After sales service is important in assuring the customer satisfaction this is why it is considered as the main criterion. The availability and variety of spare parts, the insurance time is in the concern of after sales service.
5. Company Qualification: When company qualification is considered, the capacity of that company, product range of the company, their attitude on training for their customers can be taken into account; tbe expectation of customers for training is increasing day by day.

In Table 1 the priority of criteria obtained from questionnaires and analyzed by AHP technique can bee seen.

Table 7. Customers' Priority

Criteria	Priority
Price	0,151
Quality	0,327
Lead Time	0,179
After sales service	0,150
Company Qualification	0,193
	1,000

The importance percentages of calculated customer's request are placed as the customer's request in QFD matrix. These requirements are then converted into technical specifications. The quality house of pneumatic valve suppliers' selection is shown in Figure 2.

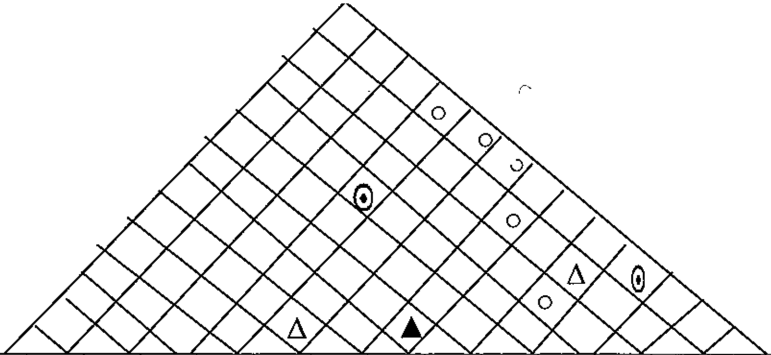
Conclusion

It has been universally accepted that the key success in industry is in understanding and meeting the customer needs. Quality function deployment is a very comprehensive system to transfer this understanding into product, design requirement, part characteristics, process plans, and requirements. It is a powerful tool to evaluate the company and the competitors. The use of QFD is to show how the quality effort will be deployed. By QFD the design characteristics for a new product or the characteristics need to be improved can be easily defined. These design characteristics are the inputs of products and they are satisfied through particular production processes. Once these production processes are defined they become requirements of the quality plan, in that quality plan there is the set of specific tolerances, procedures, methods and sampling techniques that will ensure the production process meets the customer requirements. So the house of quality is the starting point of all the efforts for the improving product.

This study presents the QFD approach in Pneumatic valve supplier evaluation. In the first part of the study, the importance percentages, requested from customers are calculated by using AHP. According to the analysis, "quality" is the most important customers' request (32, 7 %). Lead time, company qualification, price and after sales service criteria follows the quality. In the second part of the analysis, the calculated importance percentages are placed as the customers' request in QFD matrix. These requirements are then converted into technical specifications.

By the analysis of house of quality, the company managers renewed their investment policies and they decided on making investment on the most important criteria more on ``quality``, although they see their company is doing well in quality (10) and although their competitor is not doing well in that issue (7).

In the analysis it is seen that the company can achieve its goals by putting more emphasis on having quality documentation better, by long material life assurance, by having good reputation, having long insurance times, and low delivery costs. The improvement in the technical requirements has to be done by considering the customer importance criteria. When the company is compared with its competitors, it can be seen that the need for improvement in after sales service and company qualification, and a decrease in the lead times is a must, other vice the competitors can easily take the company's place in the near future. By the questions how-what the company's potential is challenged. Visual comparison of the customers wants against the suppliers how's is enabled through the house of quality matrix.



Technical Requirements / Customer Demand	Importance(AHP)	Quantity Discount	Sale on Credit Terms	Cash	Material life	Quality Documents	Reputation	Delivery Variety	Delivery Cost	Spare Parts	Insurance	Capacity	Product variety	Training	Company Today	German Company	Far East Company	Company Goal	Improvement Factor	Sales Point	Importance Rate	Percentage
															Planning Matrix							
Price	0,151	9	3	9	1				9		1				8	7	10	9	1,125	1,5	0,2548	16,669
Quality	0,327				9	9	1				1				10	10	7	10	1	1,5	0,4905	32,088
Lead Time	0,179		3	3				9	3						7	8	6	9	1,286	1,2	0,2762	18,067
After sales service	0,150				1	1	1			9	9			9	7	9	6	9	1,286	1,2	0,2314	15,14
Company Qualification	0,193	1				1	9			1	1	9	9	3	7	9	7	10	1,429	1	0,2757	18,037
Technical quality		168,06	104,21	204,22	320,60	321,96	209,56	162,60	204,22	154,29	203,05	162,33	162,33	190,37	2568							
Percentage of Total		6,545	4,058	7,953	12,485	12,539	8,161	6,332	7,953	6,009	7,908	6,322	6,322	7,414							1,5286	100

Figure 11. The quality house of pneumatic valve suppliers' selection

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SUPPLY CHAIN PROCESSES MAPPING AND INTEGRATION INTO LOGISTICS INFORMATION SYSTEMS

Türkay Yildiz[1]

Abstract

Integrating continuous development plans into company's enterprise resource planning (ERP) system with combined total quality management (TQM) principles and methodologies to fully address all work-in processes is inevitably an essentiol factor to achieve robust design in Supply Chain Management (SCM) and Logistics systems. Keeping under-control of oll business processes, continuously improving, and maintaining the total work flows of all logistics operations, today with highly increased competition in the market, play crucial role while keeping the systems performance level on its optimal values without overloading any system processes. However, to achieve robustness in the design, replacing direct human interaction processes with more abstract process definitions with direct concerns into rules and how-to schemas ploy critical roles.

Keywords: Process development, robustness, work flow, resource management

1. Introduction

Supply Chain and Logistics Systems involve wide variety of business operations and activities ranging from the bottom part of operational activities, in the middle part; mid-level tactical operations to on top level; the strategic operations: The strategic level deals with decisions that have a long-lasting effect on the firm. These include decisions regarding the number, location, and capacity of warehouses and manufacturing plants and the flow of material through the logistics network. The tactical level includes decisions tbat are typically updated anywhere between once every quarter and once every year. These include purchasing and production decisions, inventory policies, and transportation strategies, including the frequency with which customers are visited. The operational level refers to day-to-day decisions such as scheduling, lead time quotations, routing, and truck loading. (Simchi-Levi, David, 2003)

Design chain/supply chain integration is critical to innovation driven companies, ensuring the fast and sustainable launch of new products. Moving from product development to volume production at the target level of quality requires management of processes, assets, products, and information. Design chain/ supply chain integration also ensures that when demand cranks up, the whole supply chain is ready that suppliers can handle your needs, which order-management systems support the new product information, and that sales channels and service people are trained. (Cohen, Shoshanah., 2004) Your supply chain strategy sbould directly support and drive forward your business strategy. ... an effective business strategy begins with a core strategic vision that lays down the boundary conditions for your business: what you are, what you'll do, and just as important, what you are not and what you won't do. (Cohen, Shoshanah., 2004) The members of the chain are required to synchronize efforts, initiate cost and schedule savings through continuous improvement. Once the supply chain of a service commitment is defined, management of what becomes a service chain will result in savings and greater efficiencies (Stevens, G.C., 1989). The service chain will identify linkage and gaps or holes that cause perturbations in terms of unfavorable impacts on operational costs and schedules and efficiencies (Dabbiere A., 1999). Management of the service chain will point out where an organization's time and efforts can be optimized (Roberts, Julie S., 2003). An optimized service chain will search for inefficiencies, assist in decision-making support systems, identify areas negatively impacting costs and schedules and will illustrate relationships between the chain's members and the effects of procurement, logistics and distribution decisions (Roberts, Julie S., 2003, Dougherty D., et. al, 1998).

For many reasons, interest in logistics and supply chain management has grown explosively in the last few years. This interest has led many companies to analyze their supply chains. In most cases, however, this has been done based on experience and intuition; very few analytical models or design tools have been used in this process. Meanwhile, in the last two decades, the academic community has developed various models and tools to assist with management of the supply chain. Unfortunately, the first generation of this technology was not robust or flexible enough to be used effectively by industry. This, however, has changed in the last few years. Analysis and insight have improved, and effective models and decision-support systems have been developed but these may not be familiar to industry. (Simchi-Levi, David, 2003) In many cases the IT that currently supports the components in the supply chain process is diverse and disconnected. It typically has evolved throughout the years based on various local and companywide requirements that were rarely integrated. This issue must be addressed if a company is to position itself to manage its supply cbain effectively. (Simchi-Levi, David, 2003)

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ERP is a business model that involves all levels of the organization - hence the word "enterprise". ERP process disciplines allow organizations to link customers and top-management decisions all the way through to execution in the supply chain and the factory floor. Well-executed ERP not only starts with top management, it is totally dependent on top management (Sheldon, Donald H., 2005). ERP systems are large integrated computer software packages consisting of components, each with a given set of functions. All available functions operate on a shared set of data, thereby achieving integration. The idea of these systems is to support every single aspect of rganizational storage, processing, retrieval, and distribution of data and information (Grant, Gerald., 2003). The total resource planning system concept is the "master plan" designed to address every details of the operational and decision making activities of the business. The systems' parts can be considered independently while focusing on organization's specialized functions. Specialized software systems can be developed to ease the specific functions of the organizations and to retrieve data about the current conditions of that function. However, while taking into the consideration of the enterprise level plans and whole business activities, it is not possible to make specific distinctions between functional bodies of an organization. Consequently, all these functional bodies in an organization work with a harmony and build the enterprise level body. Strategic decisions can only be made at this enterprise level. System plans developed to define overall operations usually do not exist in vendor supplied turnkey ERP structures. On the other hand, businesses run on their own customized and specific functional bodies to produce the necessary output. Figure 1 shows a sample major ERP backbone of a sample supply chain management organization.

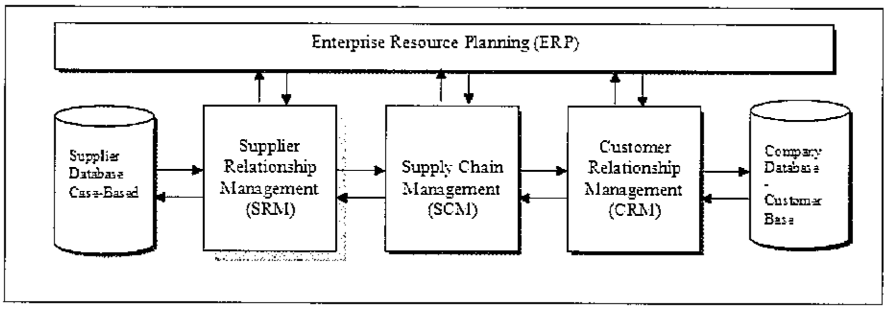

Figure 1. A sample, simplified ERP structure.

Total Quality Management (TQM) is one of the key issues that need to be fully addressed with the enterprise level systems implementations. Fig.2. On quality management systems, systems work flows and process interactions of business operations are all well defined. Systems plans changes and redefinitions of operations are all made on these quality document data. Every detail of functional interactions of one organizational body to another can be found on these document layouts. The system plans feature includes inputs, outputs, and feedbacks. Continuous or discrete data provided on the whole TQM system. However, on many enterprise-level-resource planning systems software, TQM is not well addressed or poorly defined in the mapping methods of the ERP systems structure. Configurable parts of the ERP software modules usually are not as flexible as to match the real time operational functions of the business. Inflexible parts therefore create non-optimal work loads and overloads the systems function.

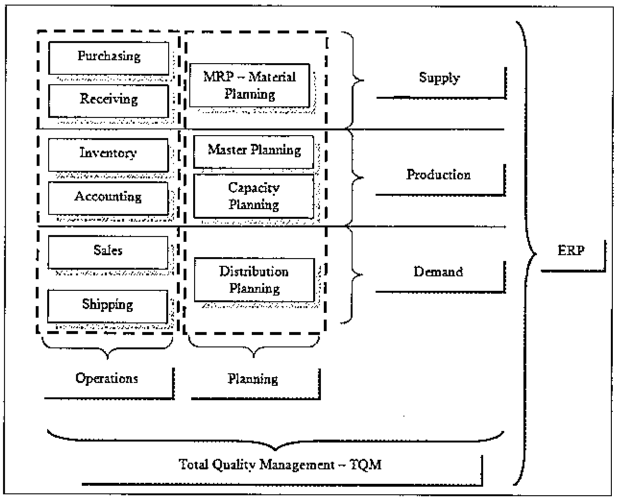

Figure 2. Sample business activities with TQM and ERP coverage

2. Integrating Systems Plans Feature into ERP Structure

Information technology is a critical enabler of effective supply chain management. Indeed, much of the current interest in supply chain management is motivated by the opportunities that appeared due to the abundance of data and the savings that can be achieved by sophisticated analysis of these data. The primary issue in supply chain management is not whether data can be received, but what data should be transferred; i. e., which data are significant for supply chain management and which data can be ignored safely? How should the data be analyzed and used? What is the impact of the Internet? What infrastructure is required both internally and between supply chain partners? (Simchi-Levi, David, 2003)

The availability of information regarding the status of products and material is the basis on which intelligent supply chain decisions can be made. Furthermore, it is not sufficient simply to track products across the supply chain; there is also a need to alert diverse systems to the implications of this movement. If there is a delay in a delivery that will affect production schedules, the appropriate systems need to be notified so that they can make the proper adjustments by either delaying the schedules or seeking alternative sources. (Simchi-Levi, David, 2003)

ERP is the overall business model defining information flow and accountability (Sheldon, Donald H., 2005). IT part of an ERP system is based on client and server computers with the flow of data bidirectional (Fig 3). Client computer side highly involves user interface related part. At the client side user forms and reports are used frequently. The system's response time and the usability of the IT structure at the clients' side are vital parts of the flow of an organizational system.

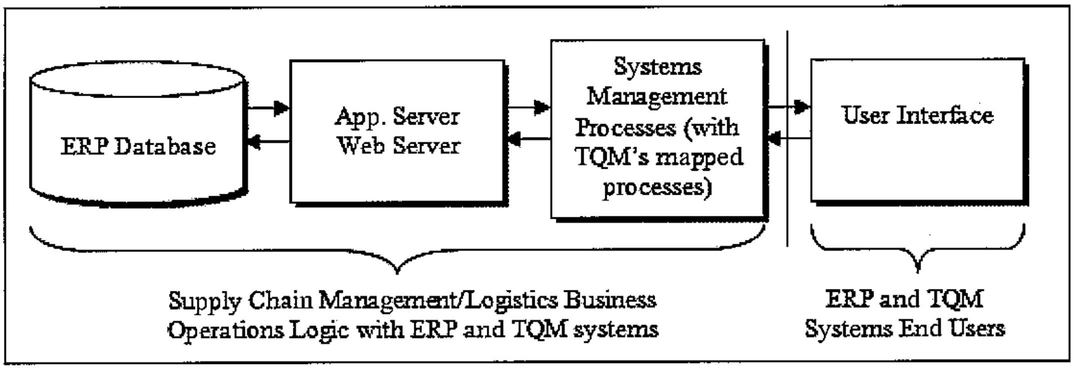

Figure 3. ERP Systems Software - Client/Server interactions with organizational processes.

Each step in the flow of organizational activities needs to be addressed inside the chain management. All flows of activities need to be documented and need to be stored into an information retrieval system. Otherwise, it would become hard to make or develop the needed improvements to the existing system. Documented data play crucial role inside an organization. Based on the documented data of the real time organizational activities, any revisions or add-ons to the documented system needs to be reflected to the operational units of an organization. Fig. 4

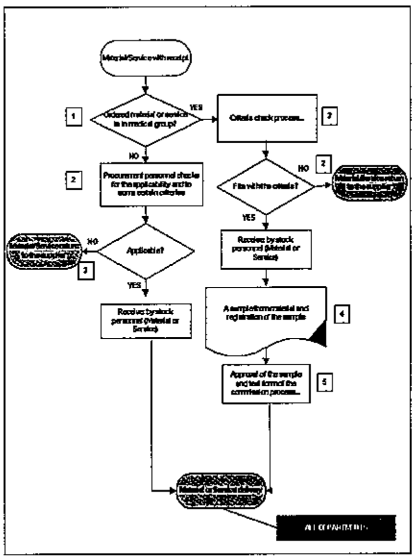

Figure 4. A sample work flow diagrams inside of a TQM. (Eg.: Purchasing Department's work flow diagram)

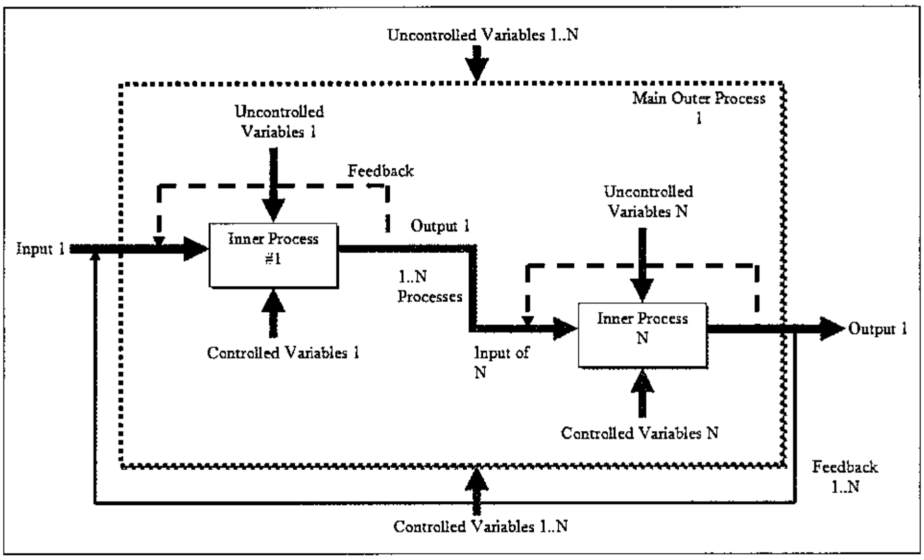

Figure 5. A sample processes layout within an organization.

TQM part of the user interface includes processes (Process 1 through N), input, output, feedback, and the tasks definitions of the current and future organizational activities (Fig. 5). These document data are supplemented by statistical information of the current state of the organizational implementation.

To understand the relationship between ERP and quality, one must understand the essence of quality. Quality is defined as "an organization wide effort to continuously improve products and services delivered to customers by developing supporting organizational culture and implementing statistical and management tools" (Madu, 1998). This definition is entirely accurate when we look at the role of ERP in today's organizations. The essence of ERP is to achieve organizational efficiency through effective management of information in order to deliver high value. ERP is based on the philosophy that the whole is more than its parts, which simply implies that synergistic benefits could be accrued through integration of the different parts of an organization. Knowledge management is the key to competitiveness today and it is the key to achieving high quality. Quality cannot be attained when either customers or employees are dissatisfied, and resources are used inefficiently. Customer satisfaction, employee satisfaction, and employee service quality have been shown through empirical studies to be instrumental in achieving high organizational performance (Madu et al., 1995).

A major phrase in quality management is to "do things right the first time". ERP helps to accomplish this goal by making every part of the organization responsible to the customer by being able to respond in a timely and accurate manner to the needs of the customer without having to re-route customer calls and requests to specialized departments. Of course, there may be cases where this may be inevitable; however, each functional department becomes responsible for providing quality services to the customer and for listening and hearing the needs of the customer. It is no longer a situation where marketing is the only unit responsible for dealing with the customer. Everyone now is responsible in ensuring that the customers' needs are met beyond their expectations. Doing things right the first time means a high level of efficiency and productivity. Customers' needs must be met as the customer expects. With the common policy that ``the customer is always right" now more than ever customers will demand information at will on their transactions or activities or relationship with an organization. The customer is the master and the organization must tailor its roles to meet the needs of the master. ERP helps to get the organization prepared to deal with the demanding needs of the customer. By integrating and coordinating effectively the activities of the different functional units, the organization is able to streamline its operation, reduce waste and redundant activities, and significantly improve productivity and efficiency. By so doing, quality is enhanced and limited resources are conserved. (Seow, Christopher., 2003)

ERP is the acronym for enterprise resource planning. However, this name is a misnomer because ERP actually stands for enterprise management. The aim of ERP is to develop an integrated enterprise - a system whereby all the functional units or departments of an enterprise are integrated onto a single computer system that will serve their different needs. This obviously requires comprehensive software that is able to integrate the functions of the different business units and departments such as finance, operations, accounting, and human resources. Prior to the concept of ERP, these departments or business units operated in isolation, each with its own computer system and ability to achieve its own departmental goals. Thus, the optimization of any one department may be at the expense of the overall organizational goals. ERP, therefore, helps the organization achieve its global optimum goals rather than sub-optimizing them. In this sense, ERP can be viewed as an effective planning tool, since it will help re-align an organization so it can make more efficient use of resources resident in its functional departments or divisions. (Seow, Christopher., 2003) See Fig. 6, 7.

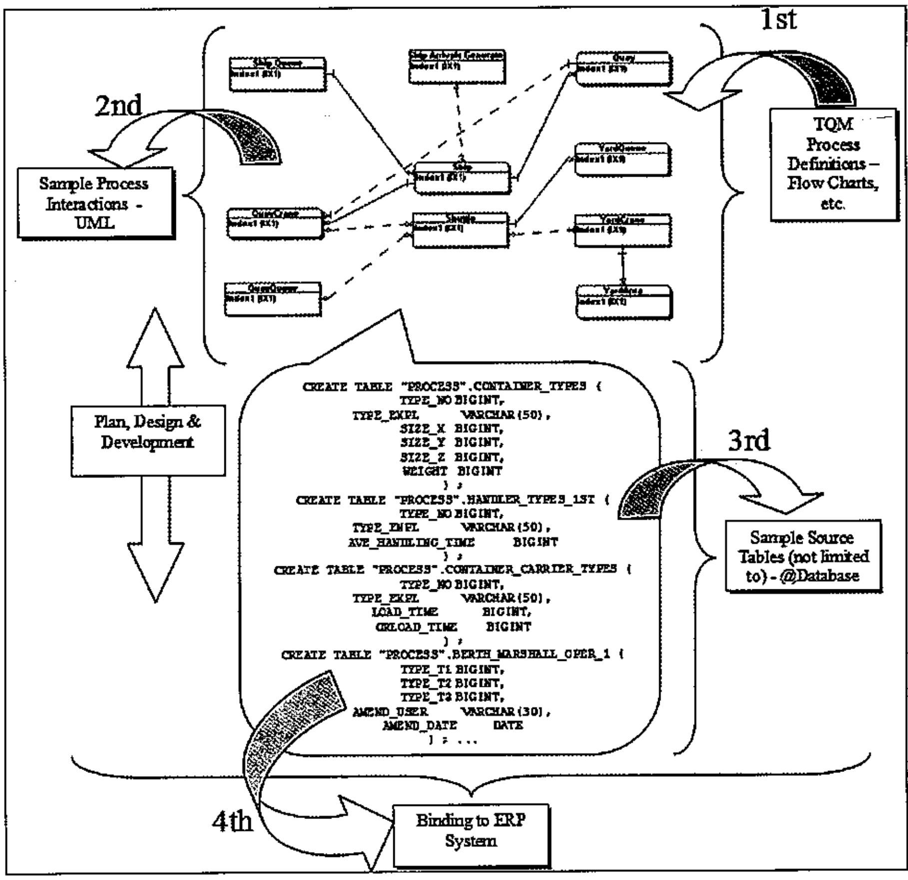

Figure 6. A basic diagram of a TQM system management document access.

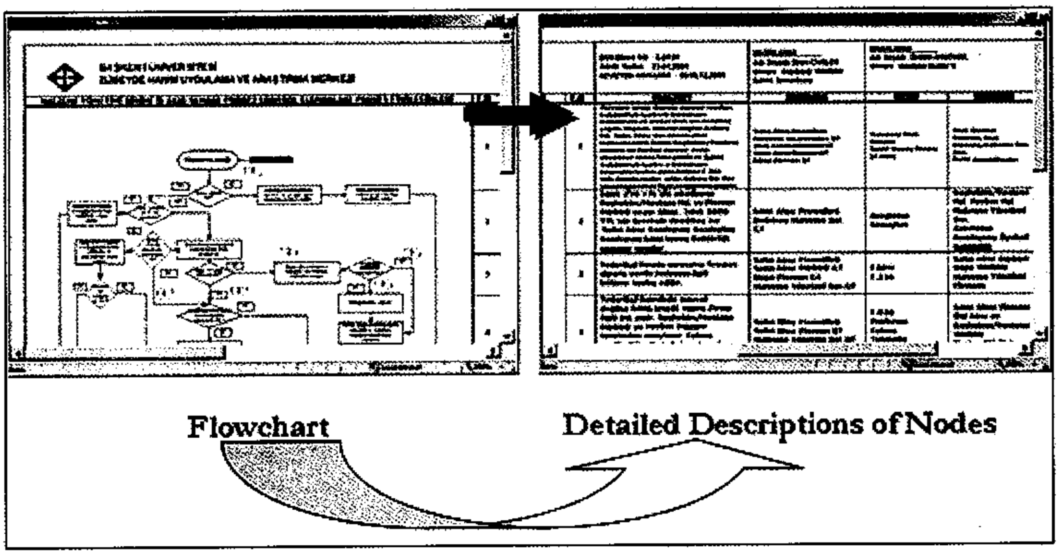

Figure 7. A sample TQM Flow diagrams and detailed node descriptions.

ERP is an effective and efficient use of computer technology to reduce the structural size of an organization by forming a cohesive whole. Fig.6. It deals with resource planning in the sense that it makes organizations more efficient and productive and, therefore, more able to effectively manage and use their limited resources. Resources conserved through ERP such as time, improved quality, and paperless services can be translated into reduced costs to customers. The ability to effectively manage inventory and obtain accurate information translates into significant profit margins for an organization. Keep in mind, however, that ERP is based on automating the business processes of an organization. (Seow, Christopher., 2003)

3. Conclusion

Systems plans built into the ERP parts of the organizational activities to disseminate total quality management (TQM) system all over the organization structure will be highly beneficial to organization's fully dynamic management. Numerous companies and enterprises have already installed ERP systems into their operations. However, with little customizable options of the ERP systems on every functional module, especially on totally vendor supplied ERP systems; system-enablers of the supply chain systems have no option to make use of the every vital detail of the important chain operations on the ERP system. Therefore, the heightened demand of integrating all business processes into the one software (ERP) backbone can only be assured by utilizing more customizable parts of each modules and properly laying out the processes into the ERP modules. On the market, most ERP systems are not designed to cover the TQM principles. Supply Chain System managers who do not wish to limit operational activities to a vendor-provided-turnkey ERP solution; need to consider the customized ERP structures, with an option to fully integrate TQM structure to ERP backbone. Business processes which are clearly defined in the quality documents are not independent parts of business operations. The existing systems that completely rely on ERP data without the TQM part will fail to address further business operations and the system will lose its flexibility to comply with the current and future business activities. The question here is "Should the companies need to force themselves to adapt to an existing turnkey ERP solution? Or should the customized ERP systems solution structures need to address the companies' current operations?" In this article, conceptual approaches, answers, and models are tried to develop to answer and explain the outcomes and benefits from the second question.

One of the best methods to start binding and mapping systems plans and system's value chain members into the organization's Information Technology (IT) infrastructure is the use of TQM's detailed processes, process descriptions, operational level procedures, TQM work flow charts, and all documented data. By defining direct mapping methods for system plans, it will become possible to combine ERP's organizational processes with quality processes cycles inside of an organization.

As a result of systems plans integration into enterprise resource planning (ERP) system, the overall ERP structure will eventually place an emphasis on replacing unplanned total quality processes leaks within the ERP system with carefully timed and delivered whole ERP services based on data retrieved through data-based-systems.

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TRANSPORT NETWORK DESIGNS AND THEIR IMPLICATIONS ON INTERMODAL RAIL FREIGHT TRANSPORT SYSTEM

Hülya Zeybek[1]

Abstract

Globalization has brought about great changes in the European transport market. There is a shift from traditional haulage to logistics/supply chain management. This environment brings changes in transport planning and a network approach rather than single route operations becomes a key notion. Within this planning, one important area is the choice of how to design the transport network to improve the supply chain operations. The aim of this paper is to discuss the recent developments in the transport network designs, freight transport setting and then focus on the implications on the intermodal rail freight transport system, review the recent challenges in Europe and highlight the reflections of these challenges on Turkish transport and logistics system.

Keywords: logistics/supply chain management, transport network design, rail freight, logistics, Europe, Turkey

1.Introduction

Globalisation of production and the corresponding supply chains increase the need for transportation. Today's transport industry is faster, more global and more competitive than ever before. Customers increasingly seek out transport providers who can do more than deliver efficient service at a competitive cost. To compete in this environment, transport sector takes the form of a chain of 'value added' activities that are performed by different actors who utilize the existing infrastructure and offer a reliable service that the user is willing to pay for. One important issue in this context, is the design of tbe transport network. The design of the network will help maximize logistics efficiency while maintaining service responsiveness.

Most textbooks in the field of transport include denotation of network designs. Recently transport network design has been intensively contemplated by a number of scholars (see e.g. Woxenius 1998,2002,2007a,b, Hesse&Rodrigue 2004, Notteboom 2002, Bontekoning 2006, Wiegmans, *et al.* 2007). The terminology, however, is far from unanimous between authors and it often varies depending on the context of geography and traffic mode. With the evolution of the intermodalism, more attention has been recently based on analysing intermodal freight transport network designs and the structure of networks has adapted to fulfill the requirements of an integrated freight transport demand (Woxenius,2007b).

The European Union places considerable emphasis on promoting multi-modal transport chains and ensuring quality of service especially for rail transport (EC,2006). However, present strategies to improve rail transport are often based on infrastructure developments to eliminate the existing bottlenecks of the rail network. This is necessary but insufficient condition to promote a re-equilibrium of the modal split which can be achieved only by improving the overall quality of the rail transport supply taking into account the needs of the shippers, such as frequency and time of transport. As a matter of fact, a potential customer of rail assesses the quality of door-to-door service. Thus, he is indifferent to improvements concerning, for instance, the train speed over a line section, if that will not reduce the total delivery time. Most freight transport models take into account only basic characteristics of the rail supply, such as transport time over railway lines and some estimation of lines and shunting costs. Hence, rail planning methods should be focused not only on long-term strategic decisions about the physical network, such as building of new lines and facilities, doubling of existing sections, etc.,but also on medium-term design of the service network.

The object of this paper is to present the design variables for transport networks focusing on rail intermodal transport which is the core mode for the improvement of sustainable transport.

2. Transport network designs

The term network refers to tbe framework of routes within a system of locations, identified as nodes. A route is a single link between two nodes that are part of a larger network that can refer to tangible routes such as roads and rails, or less tangible routes such as air and sea corridors (Rodrigue, Comtois&Slack, 2006).

Transport networks, like many networks (communication and energy), consist of links and nodes which are closely interlinked with each other. Nodes are locations where goods are stored, transferred or processed. Link is a connection between two nodes on which the transport mode does not change (Walker, *et al*, 2003). One of the features of a network is that any inefficiencies in, or missing links or nodes can affect the overall efficiency of the network.

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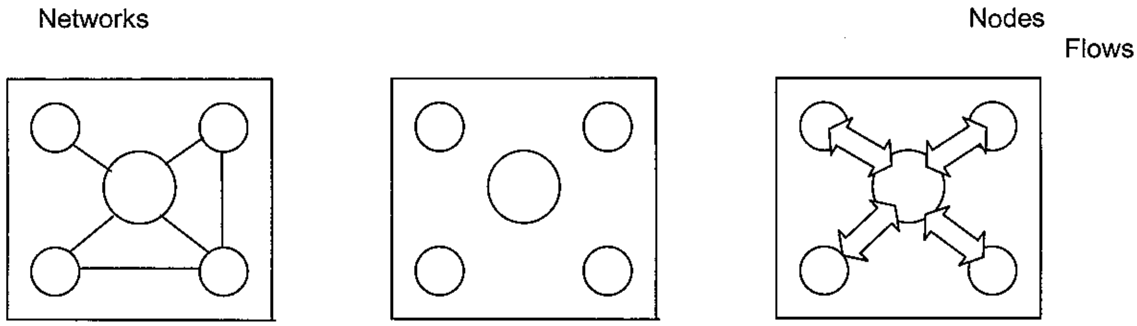

Figure 1: Transport network system

Source: Hesse and Rodrigue,2004

To offer cheap, reliable, fast, flexible and high accessible transport services, transport operators apply different transport network designs. In designing these networks, the geography, supply of infrastructure, character of the transport demand including consignment size, transport distance, transport time demand, product characteristics, availability of other goods along the route and competition with other traffic modes are important parameters (Woxenius,2007a,Ramstedt & Woxenius, 2006). The directness of transport services depends on the economy and practical possibility for consolidation and finding return flows.

Woxenius(2007a) suggested six transport network designs as: direct link, corridor, hub-and-spoke, connected hubs, static routes, and dynamic routes.

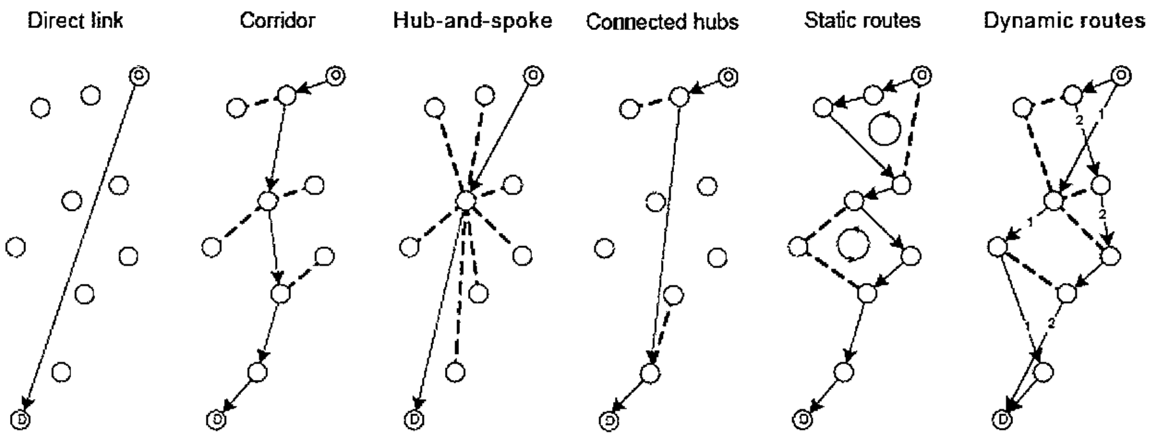

Figure 2: Major transport network designs

Source: Woxenius(2007a)

The terminology is far from unanimous between authors and it often varies depending on the context of geography and traffic mode. Some authors, for example; Hesse and Rodrige(2004) and Bontekoning(2006) use the term 'Point-to-point' instead of 'direct link'.

Direct link or 'Point-to-point' is the simple, flexible and the most efficient design if there is a sufficiently large flow for the required frequency.

Corridor network design often link high density agglomerations with services such as the landbridge where container trains link seaboards. Traffic along the corridor can be loaded or unloaded at local/regional distribution centers.

Hub and spoke network design is like a hub with the spokes of a wheel. The hub acts like a central feeder point to distribution centers that are at strategic locations spread across a particular geographical area. High volume and high-speed shipments take place from the hub to the distribution centers through predetermined short routes called spokes. The major benefit of hub-and-spoke is the ability to connect a large number of origins and destinations with a high frequency, although the flow between each O-D pair is small. (Hesse and Rodrigue, 2004).

The connected hubs design is another hierarchical layout in which local flows are collected at hubs that in turn are connected to other hubs in other regions. It can thus be described as a direct link with regional consolidation(Woxenius, 2007a).

The static routes design is generally applied jointly by several users of more or less publicly available transport services along predefined lines or in routes following strict schedules. The users can then combine different services to connect a very large number of origins and destinations. A classic example of this is urban public transport.

In a dynamic routes design, links are designated depending on actual demand, and the network operator can choose many different routes between O and D. Transport services are planned by heuristics or optimization methods. In an extreme form, routes can be changed during transportation. Timely capture and processing of demand data are obviously crucial for the planning process. Full information in advance is the common assumption for optimization exercises, but a rare experience for transport planners.

3. Implications on the intermodal rail freight transport system

Intermodal transport has been conventionally defined as *movement of unitised goods with at least two different transport modes*.

The term Intermodal freight transport is defined in the "Terminology on Combined Transport" prepared by the UN/ECE, the European Conference of Ministers of Transport (ECMT) and the European Commission (UNECE, 2001) as;

"The movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes. By extension, the term intermodality has been used to describe a system of transport whereby two or more modes of transport are used to transport the same loading unit or truck in an integrated manner, without loading or unloading, in a [door to door] transport chain.."

In order to be classified as intermodal, the transport chain needs the following characteristics:

- The goods sball be transported in unbroken Intermodal Loading Unit (ILU) from origin to destination.
- ISO-containers, swap bodies, semi trailers and specially designed load units of corresponding size are included in the definition of ILUs.
- The ILUs must change between two different transport modes at least once between origin and destination.

Therefore, intermodal transport operates on a large scale, relying on the consolidation of unit loads into trains. It also involves several categories of actors.

In intermodal rail freight transport, point-to-point and bub-and-spoke network models are widely used. The most common model is the point-to-point model (Wiegmans, *et al*, 2007). The trend is to focus on reliable and cost effective point-to-point services for intermodal transport operators and railway companies. Point-to-point services imply that all load units loaded on a train at an origin terminal for the same destination terminal.

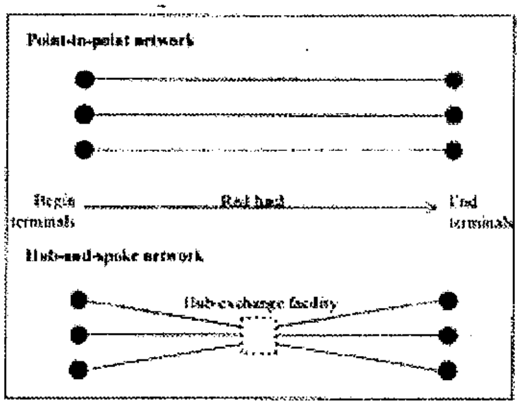

Figure 3: Point-to-point and hub-and-spoke networks in rail transport

Source: Bontekoning,2006

Point-to-point network model is common when specialized and specific one-time orders have to be satisfied, which often creates less-than-full-load as well as empty return problems. The logistical requirements of such a structure are minimal, but at the expense of efficiency.

There are two types of direct or point-to-point trains which are block trains and shuttle trains. In block train arrangement, the number of wagons can be changed according to the demand. On the other band, shuttle trains repeatedly operate between two terminals with a fixed number of wagons (Zeybek,2007).

Hub-and-spoke networks, often found in air freight, have not been favoured by railways in the past. Such a structure could be profitable, however, if there exist concentrated freight flows on some service links. In the hub-and-spoke model, the containers with different destinations are all loaded onto one train at the start terminal. On arriving at the hub, they are redistributed for their various final destinations (Bontekoning, 2006).

The advantages of hub-and-spoke networks compared witb point-to-point networks are (1) a higher frequency of transport services per transport relation; (2) an increase in the number of transport relations (serving small flows); and (3) economies of scale. Instead of increasing the frequency of trains, larger trains may be used, resulting in economies of scale(Wiegmans, *et al.* 2007).

4. Recent challenges in Europe

Traditional markets for intermodal transport in Europe are large flows over long distances e.g.. seaport hinterland flows, flows between production plants and to depots, bulk commodities and dangerous goods (Bontekoning and Priemus, 2004).

The industrial trend in Europe is to simplify rail operations rather than apply the advanced traffic designs investigated and sometimes normatively proposed by researchers. The proportion of transport using single railway wagons is decreasing because of its poor time-quality ratio (Rotter, 2004). Intermodal transport operators and railway companies are engaged in the development of efficient direct train concepts. Direct trains offer simple and cost-efficient operations and a very good service on axes with large flows over long distances. In this regard, intermodal rail transport services focus more and more on ports, and industrial zones. This means that major parts of the freight transport market are left to all-road. In transforming the European transport system in a sustainable direction, there is a need to work up the markets of relatively short distances or small flows (Woxenius 2007b).

Starting with Germany in the 1980s and the Netherlands in the 1990s, European railways have gradually abandoned the wagonload production and the use of direct trains has increased dramatically (Woxenius&Barthel, 2007). There are few European examples in rail freight using hub-and-spoke systems which are Transfracht, BoxXpress and Intercontainer-Interfrigo (Woxenius,2007a).

The intermodal operator Freightliner launched new shuttle trains to increase the number of carried containers. French CNC, with a long history of operating a hub-and-spoke system with Paris as the hub, which now limits its operation of shuttle trains to and from ports under the new company name, NavilandTM. The Swedish intermodal market was one of the last to face the transition as CargoNetTM changed its timetable to include only shuttle trains beginning in January 2006 (Woxenius,2007a).

5. Reflections on Turkish transport and logistics system

Freight transport is of major importance to the Turkish economy. Due to its favourable position between Europe and Asia, Turkey has always been one of the major gateways to the European and Asian hinterlands. Besides the benefits for the Turkish economy, the growth in transport sector, however, has negative consequences as well. The majority of freight is transported by truck. Because of the large number of trucks, the congestion of the road network is constantly growing. Freight transport by truck is one of the major perpetrators of "green house" gases, like CO2. Eurhermore, trucks make a lot of noise, cause a lot of accidents, etc . In future, the transport sector will continue to grow strongly. The policy of Turkish government is to reduce the negative effects of transport by creating alternatives to road transport such as rail freight intermodal transport in consistency with the policy of the EU.

In Turkey, unique railway operator Turkish State Railways (TCDD) operates rail services on 10.991 km of rail network. The network is predominantly single-tracked and is characterised by mountainous terrain, tight curves and steep gradients. For freight transport, TCDD is using point-to-point network model as a block train arrangement. TCDD has abandoned the single wagon operations and started to use block trains since the begining of 2004 (www.tcdd.gov.tr). The number of block trains operating on the network is around 83 train/day, not all intermodal. Since we classified the goods transported in Intermodal Loading Unit (ISO-containers, swap bodies, semi trailers) from origin to destination as intermodal, when we consider only the block container trains, its proportion is 1/3 of total block trains/day, operating in various days of the week (Table 1).

Table I: Intermodal block trains in Turkey on 23 June 2008

From	To	Km	Net tonne	Departure time	Working day
YAHŞİHAN	MERSİN/DÖRTYOL	696	550	00:45	everday
KAYSERİ	MERSİN	343	600	18:00	everyday
HAYDARPAŞA	ALMATİ	2003	500	03:55	sat
HALKALI	SOPRON (KAPIKULE)	276	800	22:07	wed-thu-fri-sat
KÖSEKÖY	KAPIKULE/KÖLN	403	800	19:00	tue-wed-thu-fri
GENK(KAPIKULE)	HALKALI	276	800	00:35	mon
LAMBACH(KAPIKU LE)	HALKALI	276	800	15:50	cts
HALKALI	LAMBACH(KAPIKULE)	276	800	01:10	wed
H.PAŞA/KÖSEKÖY	KEYKUBAT/ BOĞAZKÖPRÜ	940	550	03:55	tue-thu-sat
HALKALI	VİYANA	276	800	16:20	thu-sat
VİYANA	HALKALI	276	800	10:20	thu-fri

KÖLN/KAPIKULE	DERİNCE/KÖSEKÖY	403	800	14:30	mon-fri-sat-sun
SOPRON (KAPIKULE)	HALKALI	276	800	15:50	mon-tue-fri-sat-sun
HALKALI	GENK(KAPIKULE)	276	800	04:48	mon
ÇATALAĞZI	ANKARA	476	600	11:16	wed-thu-sat
KUŞCENNETİ	KEYKUBAT	1054	550	12:00	fri
ALSANCAK	HALKAPINAR	3	272*3	08:45 16:45 19:00	mon-tue-wed-thu-fri-sat
ALSANCAK	HİLAL	3	250	20:30	mon-tue-wed-thu-fri-sat
HALKAPINAR	ALSANCAK	3	783*3	09:45 17:30 20:00	mon-tue-wed-thu-fri-sat
HİLAL	ALSANCAK	3	750	21:15	mon-tue-wed-thu-fri-sat
BİÇEROVA	B.KÖPRÜ/YENİCE	1088	600	00:10	mon-thu-sat

Source: www.tcdd.gov.tr access date: 24.06.2008

Block train is simple, flexible and efficient design for large flows but often creates empty return problems. Shuttle train and hub-and-spoke network systems are not favoured by TCDD. A main problem facing TCDD is to provide an adequate answer to the customer's demand for frequent inland services (in number of departures per week) and in attaining a high volume per haul in order to gain a reasonable profitability. However, it seems that there is a potential for shuttle train operations between seaports and hinterland industrial centers like Kayseri-Mersin port and Haydarpaşa Port- Köseköy.

In Turkey, network approach concept in transport planning is not yet improved. Although there is a trend to shift from traditional transport to logistics/supply chain management in paralel to the universal trend, it is followed with a certain time lag. Therefore, to improve the supply chain operations and to acquire competitive positions by designing the transport network is under development. Considering that any inefficiencies in, or missing links or nodes in a network system affect the overall efficiency of the network, the efforts should concentrate not only on long-term strategic decisions about building of new lines and facilities, doubling of existing sections, etc., but also on medium-term design of the service network. This term defines the set of train services to operate (each service being characterised in terms of origin, destination, route over the physical network, speed, capacity, frequency and other relevant parameters) in order to satisfy the existing demand. Beyond that, intermodal rail transport services should focus more and more on ports, and industrial zones and there is an urgent need to develop efficient shuttle trains to and from ports.

6. Conclusion

This paper has reviewed the recent developments in the network designs in freight transport, the recent challenges in Europe and Turkish transport and logistics system focusing on rail intermodal transport.

It is observed in the European transport market that there is a trend towards simple and cost-efficient intermodal rail freight network designs in order to minimize logistical requirements. Thus, the use of direct trains has increased dramatically.

The evaluation shows that in Turkey, there is a trend to shift from traditional transport to logistics/supply chain management in paralel to the universal trend, although, it is followed with a certain time lag. In parallel with Europe, there is a significant increase in the use of direct trains arranged as block trains. However, ports and industrial zones should be linked by shuttle trains to satisfy the urgent need for efficient train services to and from ports.

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VALUE CREATION THROUGH THE INTEGRATION OF PRODUCT DESIGN AND BRANDING

Ebru Uzunoğlu[1], Sema Misçi[2]

Abstract

Modern marketing approach aims to discover what consumer calls "value", how it can be adapted to product and how efficiently product value is launched. These components involve "identifying value", "implementing value" and "branding".

Identifying value can be determined not only by internal sources such as top managers, product managers, marketing specialists but also directly/indirectly by the customers themselves. Today, actual product value is defined by customer needs and preferences. Implementation of value named by customers involves determining whether this value can be adapted to the product. This adaptation can be realized through developments and innovations in the product design process in many companies. The launch of this process requires assistance of branding, which includes not only naming and logo creation, but also association development, emotional bond creation and relationship management. Marketing communication activities can be considered as the major support of branding which will lead to accomplish the goals in the launch process.

Crucial components of customer appreciation and preference; clarity, consistency and sustainability are achieved by the integration of value identification, implementation, and branding. In this paper we will analyze different products developed by customer value through the integration of product design and branding.

Keywords: Customer Value Creation, Branding, Product Design, Value Delivery System

1. Introduction

Marketing concepts are rapidly changing due to the developments in business environment in the 21st century that is also called as the age of information and technology. Companies are able to increase their production capabilities and consumers meet new products and brands with different qualities, prices, and alternatives by developing technologies. Reaching wide audiences becomes more difficult with media fragmentation. Success of companies is no more directly related with their production capabilities. Gaining customers and creating loyalty, in other words customer oriented working, become more crucial in almost every sector in order to survive in highly competitive markets. However, it is not easy to gain new customers or keep good relations with current customers who are bombarded with millions of new products and messages everyday. While choosing a product or service, current conscious customer wants not only to satisfy his needs, but also to know how the product differentiates itself from the competitors and what kind of benefits it supplies. For that reason, today, marketing specialists try to find out what customer names as *value*, how this *value* can be transferred to product/service, and how well *value-added* product can communicate with customers.

Values of products are determined by the needs and wants of customers. Value is the benefit that customer gets from the product. Since there are too many products and brands that satisfy tbe needs of customers, the preference among these alternatives can be determined according to its benefits. In other words, a product should provide additional benefits named as value. Successful companies of today consider "value" as a strategic concept and manage it with its functional units. Therefore, value management includes, finding the value for customers, providing it and communicating the value as branding strategy. Value management is a cbain with three rings; choosing the value, providing the value and communicating the value. "*Value Delivery System*" forms a model that includes these three main processes (Lanning and Michaels, 2000).

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2. Literature Review

Customer oriented approach requires to determine customer needs from the customers' point of view. Marketing plan that is constituted on understanding customers' essential factors is one of the observed changes in today's marketing world. Customer oriented marketing provides an ability to get beneficial data about customers, to identify efficient segments during new product launches, and to create efficient communication campaigns with high *return-on-investment*. According to modern marketing approach, the aim is to gain customers; get their appreciation with high satisfaction, and create loyalty among those satisfied customers, which will finally bring a long life relation with companies.

Having close relations with customers, a necessity in highly competitive markets, provides an understanding of their needs and wants. This understanding will also guide companies to develop new products and brands those will directly satisfy needs and wants. In other words, companies need to provide values attributed by customers to be preferred among competitors. Value is accepted as "Any principle to which a person or company adheres with some degree of emotion. It is one of the elements that enter into formulating a strategy." (http://pdma.org/library/glossary.html, 2006). Value is defined as the ratio of perceived benefit to perceived cost (Evans, 2002). According to Lanning and Michaels, customers base their buying decisions on two criteria: the benefits of a particular product or service and its price. "The benefits can be reduced to a single number: the most the customer would be willing to pay for that product or service. That number, minus the price, represents the product's value to the customer." (Lanning and Michael, 2000). In other words, "Value is the difference between a brand's benefit and its cost" (Park, 2002). This can be formulated with the following equation:

Value = benefits - costs

Benefits can also be expressed as perception of quality in the minds of customers. The factors which affect customers' quality perception vary from tangible assets to intangibles; such as from product to customer service, relationship and image. In other words, companies try to gain a place both in the minds and hearts' of customers.

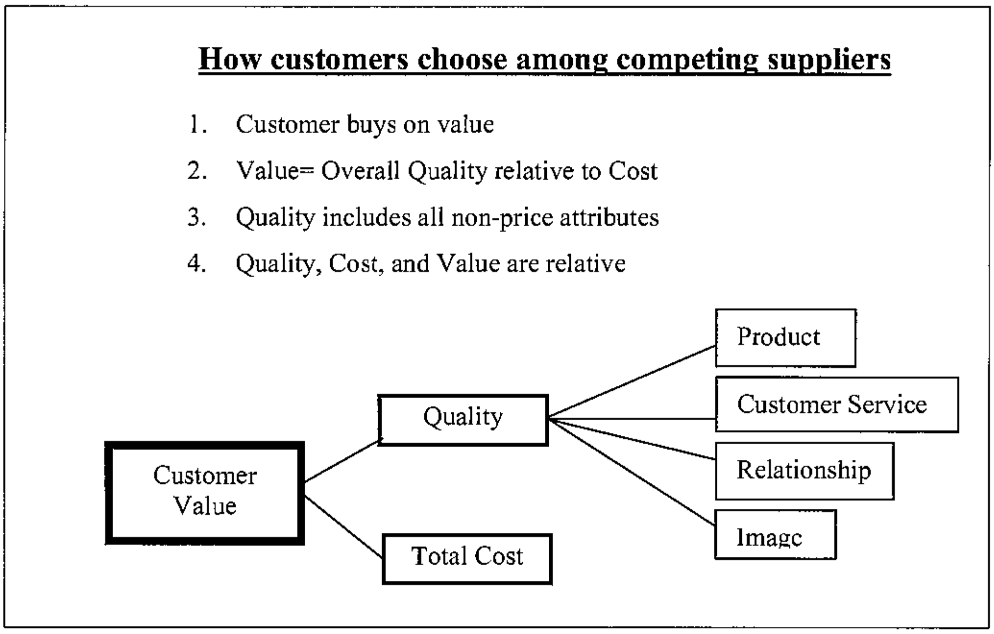

Figure I. Customers' Choice Criteria

Source: Bradley, G. 1997. Measuring and improving customer value, www.cval.com, accessed in 20.06.2008.

Surviving in the market place, and ultimately profitable success in market share, depend heavily on *customer perceived value*. Customer value can be acknowledged through finding ways of getting inside the customer's perception of value (Kippenberger, 1998). So the critical elements are to look after the value that is offered to the customers, and to be able to be ahead of the competitors (Mittal & Sheth, 2001). Customer perceived value is the result of the customer's evaluation of all the benefits and all the costs of an offering to as compared to that customer's perceived alternative. It is the basis on which customers decide to buy things (Belliveau, Griffin, Somemeyer, 2002: 439). The customer perceived value needs to get a deeper understanding, a deeper meaning – a meaning which do not relate only to episodes, but to the expectations of the customer and the responsibility of the company to meet these expectations in a long-term relationship" (Ravald and Grönroos, 1996: 25).

According to DeBonis (2002), value-based marketing is an integrated view of the entire business process that focuses on the value needs and value expectations of the customer. It is the optimized combination of business processes, people, capabilities, resources, and capital that are focused and implemented in five continuous, dynamic steps that help companies create value for themselves and their customers. These steps are (DeBonis, 2002: 17):

Step 1: Discover - Understand the customer.

Step 2: Commit - Commit to the customer.

Step 3: Create - Create customer value.

Step 4: Assess - Obtain customer feedback.

Step 5: Improve - Measure and improve value

Companies will be able to create loyalty that will ensure their existence in the marketplace with the implementation of these steps.

Lanning and Michaels (2000) believe that a *superior value proposition* must stand behind any winning strategy – 'a clear, simple statement of the benefits, both tangible and intangible, that the company will provide, along with the approximate price it will charge each customer segment for those benefits.' Value proposition is a short, clear, and simple statement of how and on what dimensions a product concept will deliver value to prospective customers. The essence of "value" is embedded in the trade-off between the benefits a customer receives from a new product and the price a customer pays for it (Belliveau, Griffin, Somemeyer, 2002: 465).

Value Delivery System (VDS) framework was firstly developed by McKinsey & Company as "The Business System". Then it was widely popularized as "The Value Cbain" by Michael Porter's *Competitive Advantage.* The main question in VDS is "what value proposition (that is, what combination of resulting experiences including price) should organization deliver and how exactly all products, resources and processes should be aligned to profitably deliver it, that is, to provide and communicate each resulting experience?" It is not enough for companies to listen the customers to sustain their competitive advantages; instead they should learn how to *become* customers (Lanning, 2005). From Lanning's perspective, delivery of a specific value proposition is an integrated system that is expressed as Value Delivery System in which a specific value proposition is chosen, provided and communicated.

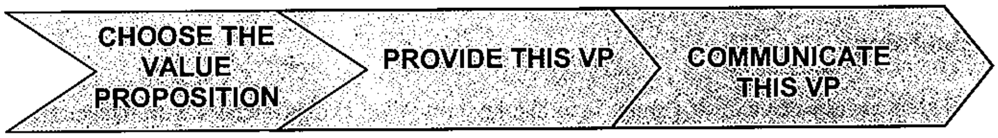

Figure 2. Value Delivery System
Source: Lanning, M. 2005. An introduction to the market-focused philosophy, framework and methodology called delivering profitable value, *White Paper, The DPV Group, LLC*

Choosing the value proposition: The first step of VDS is "choosing the value" according to the customer feedback. This step includes a set of activities undertaken before the product is developed. It starts from customer segmentation for a focused selection of the markets and then developing value positioning (Sharma and Kapoor, 2004). The value suggestion directs the customers to purchase the product. The value of a product depends on its logical benefit for customers. Thus it will not be a mistake to claim that the value is determined by customers. However, customers should be deeply observed in order to find accurate values. Understanding customer preferences involves some quantative market research as well as other diagnostics: systematically listening to customers and distributors about customer preferences, analyzing actual marketplace behavior, and test marketing new benefit or price concepts (Lanning and Michaels, 2000). Consumer insights, their likes and dislikes, needs, preferences, expectations, consumption habits, behaviors, thoughts and feelings are determined through several researches. In the light of this information, performance and benefits expected from products can be adapted as a meaningful value proposition.

Providing the value proposition: When literature and business applications about "providing the value proposition" is reviewed, it is observed that rather than having the greatest appeal proposition, a successful strategy depends on best implementation of the value proposition. Once cbosen, the value proposition must actually *happen* in the life of the intended, target customer. That is, the business must actually *provide* the chosen resulting experiences to the chosen intended customer (Lanning, 2005). Providing the value proposition is a comprehensive process in which the applicability of the value is decided with the capabilities of the company. This process involves adapting the chosen value proposition to a certain product or service that is product development. New-product development is the development of original products, product improvements, product modifications, and new brands through the companies' own research and development efforts (Kotler and Armstrong, 2005: 274). In addition to product development, sourcing, pricing and distribution of value offered product are also managed within this step. The price must fall within the range that provides maximum perceived customer value (Sharma and Kapoor, 2004). Providing the value is not only realized by new product development or product design, but also by image development through marketing communication activities. In order to be relevant with the purpose of this study, it is focused on added value of design in providing the value proposition.

Communicating the value proposition: Chosen and provided value proposition is not an accomplished value unless it is communicated. In order to fulfill the VDS process accurately, it is needed to inform and convince the customers about the value proposition to sell the product. Therefore, value proposition should be transferred to the right target audience with effective, simple and clear messages. This can be achieved by marketing communication activities which drive brand value (Duncan, 2002) with clear, consistent and compelling messages about the products (Kotler et al, 1999). Products are distinguished with their brand names. Many marketers believe brands are important because they shape customer decisions and, ultimately, create economic value (Court, Freeling, Leiter, and Parsons, 1996). Therefore companies invest on branding in order to have a distinct position in the marketplace. Branding is the process of creating a brand with brand attributes and brand identity to build marketplace awareness and acceptance in order to meet aims of the companies. It consists of the creation of brand name, selecting and blending tangible and intangible attributes, packaging, colors, symbols, etc., that helps to differentiate it from its competitors in an attractive, meaningful and compelling way, and helps the customer to develop a relationship with the product (Pickton and Broderick, 2005; Belch and Belch, 2007; Wells, Moriarty, Burnett, Lwin, 2007; Keller, 2008). Successive cases from professional business environment have proven that no matter how well a company chooses and provides a value proposition, it must communicate it to actually win customer preference. Branding means not only naming a product but also conducting emotional bonds and rational reasons which can be achieved through communication.

Brand differentiation and brand management are a part of design management. The designer contributes by creating differences that are perceived by the consumer as benefits and which have an impact on consumer behavior (Mozota, 2003: 82). Customer needs should be expressed in terms of what the product has to do, not in terms of how the product might be implemented. Marketing professionals should ensure that the product is focused on customer needs and that no critical customer need is forgotten (Ulrich and Eppinger, 2003: 68). Adherence to this principle, selecting a product concept and establishing product specifications according to customer needs are crucial for the success of product development through the integration of product design and branding.

3. Methodology

The main objective of this study is to display how VDS brings success with measurable and tangible results if consumer insight is considered as the starting point. Our study is based on qualitative research where descriptive data are analyzed. We have gone through 65 companies those were considered as successful according to the measurable results in marketing communication activities. The reason why we chose these companies is they all conduct pre-tests and post-tests in their projects and they all take customer needs and wants as starting point. Among 65, 12 companies are selected since these companies designed new products in the light of data gathered from customers. Through the analysis, a thematic structure is followed by evaluating the data on the basis of "brand name, category, company, value delivery period, customer perceived value, product design, branding, and success criteria".

4. Research Findings

The results of the analysis of 12 companies confirmed that VDS points out customer-centric and data driven product development process. Our findings support the objective of this study. It is observed that implementing VDS accurately brings measurable and successful results which are displayed in the below table:

1	Coca Cola	Beverages	Coca Cola Company	2001 - 2002	C and D SES group families that can be considered as price-sensitive	Low price products for price sensitive customers	200 ml small bottles are introduced	POP is preferred instead of mass media to announce "cheaper price" message. Rather than individualistic messages, general and positive types of messages are used.	While sector revenue has decreased 14%, Coca Cola's revenue has only decreased 8-9%. Coca Cola's brand image is positively increased according to TNS Piar/Audits and Survey	***
2	Okey	Health Care	Eczacıbaşı Group	2001 - 2002	16-20 year old men for informative messages and 20+ men	Customers do not want to accept condoms as "medicine"	New package design, 4 new products with different ingredients (with varied colors and smell) to address young population	Product variety is launched with the company web site and on product packages, informative messages about new products, outdoor activities, TV advertising	Keeps its market leader position with 50% market share in 2001, two advertising prizes for branding	***
3	Bonus Card	Electronic Card	Garanti Bankası	2001 - 2002	All potential credit card holders who are willing to do free shopping	Credit cards are additional financial tools for the customers during the economical crisis	New payment plan system for customers who have hardship in paying, constant exchange rate for a short period, co-branding with the mostly preferred brands by the customers	Aimed to become firstly preferred credit card among other credit cards in the purse and increase loyalty. "The only credit card that knows saving", "economically sensitive credit card", "we are with you" messages through TV advertising, advertising support for the co-brands, e-mails rather than posts, CRM program	Increasing 6,8% market share in turnover to 17,2%, total turnover has increased 192% whereas the sector has 68%.	***
4	Lily Towel	Tissue Paper	Viking Pulp and Paper	2001 - 2002	20-40 year old A, B, C1 housewives who are responsible for household economics	Towel that lasts for a long time, shorter sheets for small needs, longer sheets for big needs	Selected Sheets Towel: Ordinary sheets are divided into two pieces with narrowed perforation	TV, radio, outdoor advertising, sampling, sponsorship, seminars about hygiene, packaging, POP, sales promotion activities	Lily's market share has increased to 14% from 8%. The market leader has lost 7 points with 28% market share. Total category consumption has also increased with the new product.	****
5	Eti Form	Food	Eti	2002	A, B, C1 SES group 19-35 year old urban women who care their physical appearance and keep diet on their daily agenda	Product variety, taste, trustful brand, care for themselves without avoiding to eat delicious products	New package and logo design, 5 new light products with lemon, chocolate, orange and oat	TV, print, radio and cinema advertising, communication with medical points, sponsorships, free sampling web site	The market has increased 25% with the relaunch of Eti Form in 2003, market share of Eti Form has increased from 41% to 63%, sales volume of Eti Form has increased 37% in 6 months after the relaunch, Eti Form has become generic brand in the category	*
6	Elidor Krem 7/24	Hair Care	Unilever	2003	Women who care their hair	Conditioner which will protect hair against damage, moisturize hair, leave the hair soft and light without any stickiness, enable bair to comb gently	New product which conditions and protects hair at the same time	Packaging, TV, radio, outdoor, print advertising, POP, sampling, merchandising team, sales promotion activities, sponsorships, outdoor activities, B2B communication	A new category called Hair Conditioner and Protector is created and rapidly followed by competitors. Market leader in hair gel market with 25,8 revenue share within 2 months of launch. It has also positive effects on Elidor Shampoo and Cream's total sales. Elidor has become market leader in total hair care category. Awarded with Best Brand Activitation prize among Unilever companies	*
#	**Brand Name**	Category	Company	**Value Delivery Period**	**Target Market**	**Customer Perceived Value**	**Product/Service Design**	**Branding**	**Success Criteria**	**Source**
7	Beko Tablet PC	Home Electronics/ Computers	Koç Group	2003 - 2004	25-35 year old urban people who are interested in using technological products for entertainment, convenience and clouring their lives	Functional, practical, easy, qualified and entertaining technological products	Tablet PC with 180° rotatable and writable monitor with its special pen, long-lasting battery life, wireless connection with other mobile phones and computers, wireless communication and file transfer, digital integrated camera	TV, cinema, print, outdoor, radio, Internet advertising	Beko notebook has achieved 725% sales share increase. Total Beko computer sales has increased 78%. Crystal Apple Award in 2004	*
8	Lay's	Food	Frito Lay	2003 -	B, C1, C2 SES group families who are between 12-45 years	Natural, light, crispy, close to Turkish food	New Lay's with olive and thyme	Thematic communication, news support for the product, POP, sales promotion	32,3% market share in 2003 has increased to 40,3% in 2005 in potato cbips sector, 36,8% household penetration in 2004, 17,8%	*

* *KAZANANLAR / 1. EFFIE Türkiye Reklam Etkinliği Yarışması – 2005.* 2006. İstanbul: RV Yayınları.

** *KAZANANLAR / 2. EFFIE Türkiye Reklam Etkinliği Yarışması – 2007.* 2008. İstanbul: RV Yayınları.

*** Vardar, N. 2003. *Biraz cesaret! Krizde başarılı on markanın öyküsü,* İstanbul: RV Yayınları.

**** Uzunoğlu, E. *2005. Müşteri odaklı pazarlama anlayışı açısından değer zinciri yönetimi ve değer zincirinde iletişimin yeri ve önemi*, Yayınlanmamış Doktora Tezi

Table 1. Evaluation of companies which have implemented customer-centric and data driven product development process successfully

Regarding the findings stated in Table 1, VDS process developed by Lanning and Michael (1998) can be combined with customer centric and data driven point of view. Their process can be adapted as below by integrating design and branding.

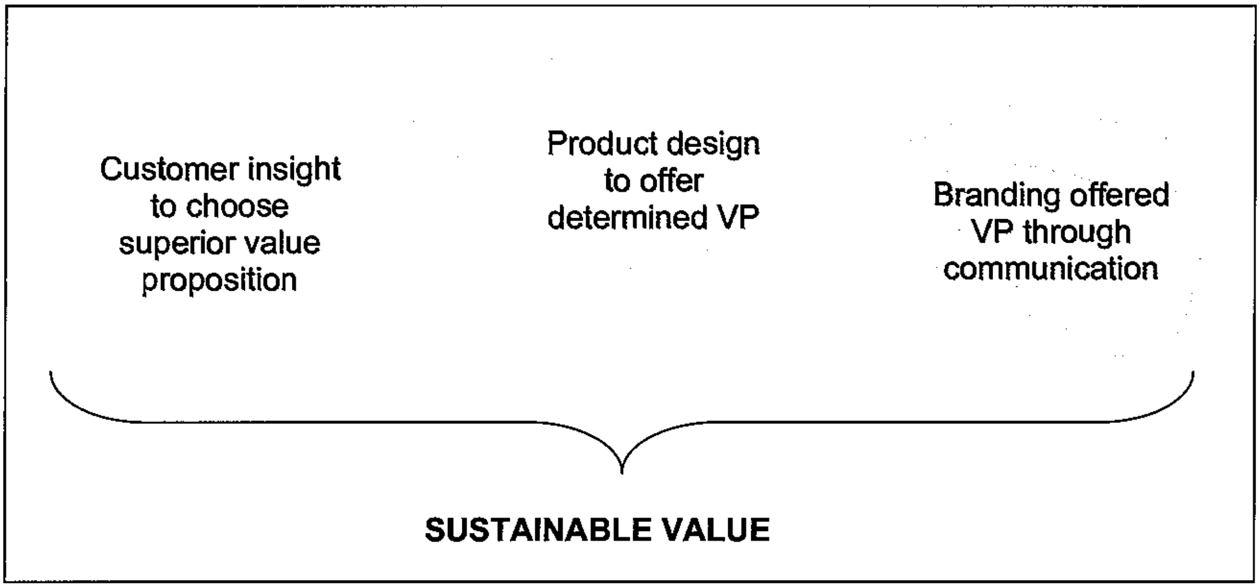

Figure 3. Design and branding integration within VDS process

5. Discussion and Conclusions

Customer-oriented approach is based on traditional notions of needs, wants, requirements. However, in today's highly competitive business environment, listening to customers is not enough as Lanning (2005) stated. "Learning how to become customer" provides competitive advantage for the companies as it can be observed from our findings. Deeper understanding of customers, becoming the customer, requires to explore their experiences. Customer-centric and data driven product development process gives the opportunity of designing value added products where value is named by the customers.

Some of the brands have created a new category with the products that they have launched via VDS. Among analyzed companies, Elidor 7/24 is a successful brand that created a new category. They have developed a new product which protects and shapes the hair at the same time. With the integration of product design and branding, they have also pioneered a new category called hair conditioner and protector.

All of the analyzed companies take consumer insights as the starting point in order to choose the value proposition to be distinguished in the marketplace. Their success is measured not only with sales, market share or revenue but also with brand equity. In other words, provided benefits may bring both tangible and intangible assets. Intangible assets, which create emotional bonds between companies and customers, develop strong relationships that end with loyalty in the long term (Keller, 2008; Pickton and Broderick, 2005, Lane, King and Russel, 2005). For instance, Aygaz has achieved 75% of reliable brand perception among its target audience with its new hologram valve.

According to Keller (2008), it is imperative that companies proactively develop strategies to attract new customers, especially younger ones. They followed customer insights in order to ensure their success in these new target groups. The marketing challenge in acquiring new customers lies in making a brand seem relevant to customers from potentially vastly different generations and cohort groups or lifestyles (Keller, 2008: 574). It is observed that some of the analyzed companies have entered new target segments with their new or redesigned products. Okey expanded its existing market by targeting young generation with 4 new products that have different ingredients (with varied colors and smell). On the other hand, although Ruffles' existing target group was young, it is found out that they took lifestyles of their target group into consideration. As stated in Table 1, their target group was 18-24 year old young men who were chaotic, unplanned, don't have any responsibility and resident life, like to eat out-of-home, travel for freedom, fun and adventure. Therefore, they launched new Ruffles with Turkish sausage (sucuk) aroma, cheddar and grilled meatball aroma.

Some of the companies tend to differentiate their redesigned or newly developed products with their specifications and reach to certain target groups who have distinct properties. In other words, they target special groups. Companies with low shares of the total market can be highly successful and profitable through smart niching (Kotler and Armstrong, 2005: 542). For example, Deren faced a market share problem in February, 2006. In order to overcome this problem, they tended to concentrate on some niche markets in women target group with their Active & Fit, Form, D-Tox, Zen, Specially for Women, Serenity, After Meals, and Form with Flaxseed teas with which they aimed to reach women who had diet and stress problems. While they were in 6th level with 4% market share in Feb 2006, they achieved to 8% market share and reached the 3rd level in the market within three months after the launch of their new products.

It is found out that newly developed products, based on consumer insight, bring customer satisfaction since the provided benefit directly points out customer needs. As the customers are satisfied, they repeat purchase which becomes a competitive advantage in the marketplace. Hence, competitors realize this situation and they become eager to launch similar products like in Lily and Elidor 7/24 cases. However, these companies are considered as followers and their products are called "me, too" products which extend the category. Nevertheless, experiences of many companies show that the first company that introduces the value added product might get the most benefit in the marketplace.

When findings are evaluated, it is observed that all the brands have used 360° communication in which they support all their new products with highly intense communication activities. Using television as the main medium is also another commonality between the brands except Coca Cola, since they did not want to be recognized as cheap product during the economical crisis.

VDS points out customer-centric and data driven product development process. In order to implement VDS accurately, it is suggested that companies should evaluate customers' key buying factors and try to find out essential factors that require the most attention. On the other hand, the design and branding process should also be integrated and be in line with these factors in order to ensure the consistent success and sustainable value.

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GENERAL SYSTEMS THEORY AND THE INTEGRATION OF DISCIPLINES: DESIGN AND MARKETING

Bahar Kurkcu[1] and Jean-Pierre Mathieu

Abstract

Brand management is an important concept of marketing for companies in today's highly competitive market. Although the concept of brand is analyzed from various aspects, the interaction between disciplines of marketing and design is mostly ignored in the literature. Essentially scholars of marketing and design agree on the importance of branding, even though they have different perspectives and accordingly different areas, borders and interrelations. However, in order to achieve success in branding, these disciplines must have an integrated vision of the brand. Therefore, it can be assumed that branding needs to have a holistic approach. As a matter of fact, General Systems Theory, by its holistic view, supports this aspect, since branding refers to the concept of whole as being a multi actor system in which all the actors must work together to accomplish the same objective. In this paper, the need for the integration of disciplines of design and marketing and accordingly the coordination of design management and brand management is discussed through General Systems Theory.

Keywords: General Systems Theory, Branding, Design

1. Branding and the Importance of Brand-Customer Relationships

Brand management is an important concept of marketing for companies in today's highly competitive market. Although branding is not a new concept, it is discussed and enhanced in recent years both by the leaders of academia and industry. Various concepts of branding were developed and the importance of branding was highlighted mostly by Aaker (1991, 1996, 2004), Arnold (1992), Kapferer (1992, 2001), and Keller (2002).

The brand concept has evolved within years from being an approach of a name or a logo to that of an integrated view and within the course of the highly fierce competition, brands have become one of the most valuable assets of the companies.

Brand is not seen as a logo anymore and it is accepted as something intangible in the minds' of consumers (Kapferer, 1992) which generates value (Keller, 2002). However, American Marketing Association still defines the brand from a traditional perspective: "A name, term, design, symbol, or any other feature that identifies one seller's good or service as distinct from those of other sellers"[2].

In contemporary studies, branding has begun to be analyzed with a holistic view. Kapferer (1992) made a great contribution to the literature by explaining brand in holistic terms and he criticized the deconstructionist perspective of the brand as a logo by defining brand as the meaning of the product. Other researchers adopting a holistic view are as follows:

- Lepla and Parker (2002) use the term "integrated branding" and define it as an organizational strategy that is used throughout the company and its products. According to these researchers, all actions and messages must be based on the value the company offers.
- Another holistic approach is presented by the brand definition of de Chernatony and McDonald (2003), "an identifiable product, service, person or place, augmented in such a way that the buyer or user perceives relevant, unique, sustainable added values, which match their needs most closely".
- Schmidt and Ludlow (2003) developed the term "inclusive branding", emphasizing a holistic approach based on the mobilization and optimization of all resources to focus on defining and realizing the brand promise.
- Ambler (2004) also adopts a holistic view and defines brand as the sum of marketing mix elements: product, price, promotion and distribution.

About this holistic approach of branding, it can be articulated that, the changes in the customer requirements and the need for differentiation compelled branding to adopt a broader perspective.

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[2] http://www.marketingpower.com/_layouts/Dictionary.aspx?dLetter=B

Thus far, too many discussions which refer in common to differentiation have been held in the literature of branding. Eventually, differentiation is accepted as a key to brand success (Aaker, 2003). The vital point here is the delivery of the differentiation to be welcomed by the customers. Therefore, "A brand's power lies in its ability to form relationships with its customers", as Kapferer (2001: 221) stated. According to Keeble (1991: 170), "a brand becomes a brand as soon as it comes in contact with a consumer". Additionally, Arnold (1992) explains brand as an expression of the relationship between the customer and the product. Though, this relationship must be personal and unique as the brand itself is.

Communication and feelings play an important role in the success of the brand trying to differentiate through a relationship. In this sense, a relationship built between the brand and the customer can never be copied while the functional attributes of a brand can be copied. Aaker (1996) emphasized the importance of building emotional associations. Consequently, creating a meaningful relationship with the customer is very important and this personal relationship leads to the differentiation and accordingly to the success of the brand.

However, addressing to today's consumer is more complicated then ever because the modern consumer is more individualized, independent and knowledgeable through the availability of information. Today's sophisticated consumers do not just buy the product but are also fond of the experience they can get and they look for satisfaction. Satisfying the customers has always been the core of marketing but in recent years in addition to this core, the focus has shifted from the producer to the customer.

In today's customer centric market, advancements in communication technologies help the brands in building their individualized relationship with the customer. On the other hand, these advancements result in daily 30-100 touch points between a particular brand and the customer (Colasanti, 2004). So many communication trials can cause brain confusion on the customer side.

Since every consumer touch point serves to strengthen the brand values; while building this relationship, coherence and consistency within the brand is essential. Kunde (2002) emphasized this importance about uniqueness and the consistency of being unique. With the intention of the success of the brand, the importance and the need for consistency was highlighted before in the literature also by Ind (1997), McWilliam and Dumas (1997), Hatch and Schultz (2001), LePla and Parker (2002).

Consequently, in order to be accepted in the marketplace, significant brand-customer relationships must be built and it must be realized that what the modern customer seeks is an integrated, coherent and consistent brand.

2. Rivalry Between Design and Marketing

In order to have an integrated, coherent and consistent brand, brand responsibility must be extended throughout the company, rather than remaining just within the marketing department, as Ind (1997), McWilliam and Dumas (1997), Hatch and Schultz (2001), LePla and Parker (2002) stated.

Furthermore, today not only the different departments within the company but also the consultants for design, brand, advertising, law and finance are involved in branding. Therefore, the success of branding should not be delegated to the actors just inside or outside the company. Thus, companies should adopt a holistic model of branding and actors from different disciplines involved in branding should be guided.

At this very point, rivalry between design and marketing emerges as an important debate. In order to figure out the reasons behind this rivalry, Holm and Johansson (2005) analyzed the literature of marketing management and design management and by the help of an inductive contrasting method they highlighted the similarities and the differences in 5 main themes: attitude toward the product; professional identity; attitudes toward corporate identity; relation to value creation; approach to consumer and market research. This analysis can be summarized in short as follows:

1. Attitude toward the product:
Kapferer (1992) claims that the brand is not equal to the product anymore due to the invalidity of the classical brand concept. In contrast, the product is the fundamental discourse of design.

2. Professional identity:
Marketers appreciate general intellectual knowledge while designers appreciate creativity.

3. Attitudes toward corporate identity:
The concept of corporate identity is used both by designers and marketers. Designers consider the concept of corporate identity as the integration of design elements such as product, graphic and environmental design. Marketers consider this concept as the identity the company wants to have.

4. Attitudes toward creating value:
Although brand is a real financial asset, it is difficult to value design. While branding is regarded as an investment, design is regarded as a cost.

5. Approach to the consumer and to market research:
In order to figure out what consumers want, marketers focus on what they say while designers focus on how they behave. In this sense, marketers use marketing research techniques while designers use observation and accordingly their intuition. In other words, marketing is objective, design is subjective.

Consequently, although these two disciplines have similar goals and use a similar rhetoric, since they come from different roots, there are differences in the conceptual understanding, professional performance and work processes.

3. General Systems Theory

In order to have an integrated, coherent and consistent brand, in other words to apply a holistic approach in branding; first and foremost, the problematic dialogue between marketing and design has to be advanced and interdisciplinarity has to be highly considered. The concepts of holism and interdisciplinarity lead us to General Systems Theory (GST).

GST is the science of wholes (Bertalanfy, 1968). In order to understand GST, the concept of system should be defined. To begin with, it should be considered that the concept of system has a subjective nature. "A system is not something presented to the observer; it is something to be recognized by him/her." (Skyttner, 1996: 16).

The following system definitions belong to the leading GST theorists. The multiplicity of the definitions refers to the subjectivity and the widely accepted nature of the concept.

Paul Weiss (1971):
"A system is anything unitary enough to deserve a name."

Bertalanffy (1975):
"A set of elements standing in interrelation among themselves and with the environment"

Churchman (1979):
"A structure that has organized components"

Ackoff (1981):
"A system is a set of two or more elements that satisfies the following three conditions;
1. The behaviour of each element has an effect on the behaviour of the whole.
2. The behaviour of the elements and their effects on the whole are interdependent.
3. However subgroups of the elements are formed, all have an effect on the behaviour of the whole but none has an independent effect on it."

Boulding (1985):
"A system is anything that is not chaos"

Skyttner (1996: 16-17) refers to a commonly used expression "A system is a set of interacting units or elements that form an integrated whole intended to perform some function". He explains the system basically as "any structure that exhibits order, pattern and purpose". Skyttner (1996: 17) also gives an example of definition from management: "a system is the organized collection of men, machines and material required to accomplish a specific purpose and tied together by communication links".

Depending on the definitions above, the following common concerns to be derived about a system are:
- The existence of elements
- The integration of these elements as a whole
- The common purpose to be accomplished by the elements

Subsequent to the definitions of systems, we can set off with explaining GST.

GST is a tool that can be used for "understanding"; accordingly it is qualitative and descriptive by its nature. The major aim of GST is to explain "systemness" (Skyttner, 1996:16).

A biologist, Ludwig von Bertalanffy, is accepted as the founder of GST. Bertalanffy assumed that biology science can be a reference to understanding the key principles of organization. He was not interested in parts of an organism like his colleagues; he focused on the organization of organisms. "Since the fundamental character of the living thing is its organization, the customary investigation of the single parts and processes cannot provide a complete explanation of the vital phenomena. This investigation gives us no information about the coordination of parts and processes", as Bertalanffy (1975: 152) he stated.

He advocated the "organismic" approach which considers the organism as a system or whole (Bertalanffy, 1968: 12). As Bertalanffy (1968: xxi) stated, this theory emerged out of the deficiency of "the analytic, mechanistic, one-way causal paradigm of classical science" in understanding the biological phenomena properly. Although Bertalanffy declared his thoughts about the study of biological organisms as wholes firstly in 1926 and presented GST first in 1937 at the University of Chicago, the first publication about the subject appeared in 1949 (Bertalanffy, 1975).

GST first originated in biology in the 20^{th} century but the discourse about holism is very old. As a matter of fact, GST is based on Aristotle's still relevant statement: "The whole is more than the sum of its parts" (Hammond, 2003). Hegel, Saussure, Smuts are the researchers who studied bolism before Bertalanffy did (Skyttner, 1996). The originality of Bertalanffy's work depends on the presentation of the "organismic" concept and theoretization of holism as systems.

GST arose from biology but it affected many scientific fields such as economy, law, mathematics, sociology, computer sciences...etc. Furthermore, there is a remarkable variation of systems theories developed by other disciplines. And also the essence of the tbeory is advanced by fruitful approaches.

Since GST has grown to be an independent discipline over the years (Ruberti,1984), this paper deals with the fundamental principles which are in the scope of this paper. In this sense, some very important concepts of GST are not revealed in order not to get out of focus. Equilibrium, entropy, feedback, open and closed systems, division of labor are some of the issues not mentioned. After all, the variations of systems theory and the approaches to the theory are based on the fundamental principles considered in this paper.

The fundamental principles of GST summarized due to the scope of this paper are as follows:

1. Adoption of a holistic approach:

According to this principle; parts are not examined separately thus researchers concentrate on the wbole. In this sense, a common purpose of the parts and accordingly integration is highly considered. The main question to be answered is how parts work together.

2. Focusing on the relationsbips:

According to this principle; these relationships take place between the interdependent parts which are in interaction. "Dynamic interaction appears to be a central problem in all fields of reality" (Bertalanffy, 1968: 88).

3. Considering interdisciplinarity:

General Systems Theory, which is a guide for interdisciplinary research, is relevant in various disciplines where similar laws of organization might be applied regardless of their nature. With its interdisciplinary nature, one-sidedness is prevented (Bertalanffy, 1968).

4. Conclusion

Althougb it is difficult to use GST in measurements and predictions, due to its high level of abstraction, it can be used in understanding systems (Skyttner, 1996).Thus, in this paper, General Systems Theory is proposed as a tool to overcome the problematic relationship between design and marketing. The fundamental principles of GST, summarized due to the scope of this paper, keeps up a correspondence with the discussion held throughout this paper and this reveals the convenience of utilizing this theory in dealing with the acknowledged problem.

However, this is an introductory paper and further research is needed about the issues related to implementation. The originality of this paper lies in the articulation of using GST in the integration of design and marketing. As a matter of fact, applications of GST in design and in marketing are accessible in the literature, yet separately. In the marketing literature, the most outstanding GST applications are the research of Reidenbach and Oliva (1981) and Ruekert and Walker (1987). In the design literature, GST is related only with production.

In addition, GST applications in business are wortb to consider in terms of integration in business. Nevertheless Bertalanffy (1967: 69) claimed about this issue "The system components need not even be material, as, for example, in the system analysis of a commercial enterprise where components such as buildings, machines, personnel, money and "good will" of customers enter".

Consequently, in order to be accepted in the marketplace, brands must build significant relationships with the customer and realize that what the modern customer seeks is an integrated, coherent and consistent brand. In order to become sucb a brand, the well-known rivalry between design and marketing has to be overcome by adopting a holistic approach of branding. General Systems Tbeory, by its holistic view, relationship focused structure and interdisciplinarity, can be used by brands in this process.

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A PACKAGING SUPPLIER'S CONTRIBUTION TO BRANDING AND SUSTAINABILITY

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Abstract

In recent years power in the value chain has shifted from manufacturers of branded products to retailers. As the field of retailers has been consolidated, a few very large retailers have emerged, whose influence in the value chain has increased. Retailers set demands for packaging, both in relation to their logistics system, as to sustainability.

Simultaneously, brand owners depend more and more on the expertise of their packaging suppliers, who play an important role in pack development and design. Packaging suppliers find that not only are their customers increasingly bound by third party restrictions, they themselves are well advised to place their efforts in a wider context of the retailer and consumer focused value chain in order to stay competitive.

This paper discusses the need for packaging suppliers to deliver added value besides the physical packaging. This will be illustrated with two cases. The first is a design project for the packaging of a coffee maker, where the on-shelf performance, the unpacking experience and logistical efficiency had to be improved.

Secondly, Retail-Ready-Packaging (RRP) will be discussed. RRP puts the emphasis on in store performance of secondary packaging on top of traditional protective and logistic functions. It will be discussed how the design of RRP influences logistical efficiency, branding and environmental impact, and how packaging suppliers can utilize a good understanding of these developments in generating added value for their customers.

Keywords: logistical efficiency, environmental impact, unpacking experience, retail-ready-packaging, retailer influence.

I. Introduction

Worldwide, several major economical developments have taken place, or are still taking place, that have a major influence on the business performance of Western European packaging suppliers. These developments include, first, globalization with its relocation of production to low-wage countries in Eastern Europe and the Far-East. Second, retail for many product categories is changing in the direction of big-box retailing. Big-box retailing means a twofold change in the scale of retailing, both in the size of individual outlets and in the size of the corporations behind them. These outlets are huge stores which utilize a supermarket-style product presentation of all types of products. This means a self-service environment, with packed products on the shelf, thereby placing different requirements on packaging. Furthermore, due to the size of the corporations behind these stores, their power in the value chain is increasing, in many cases surpassing the power of manufacturers of branded goods.

The first development, the move of production to low-wage countries, places a considerable burden on packaging suppliers in Western Europe, as part of their business moved out. Hence competition is fierce for the remaining business. One strategy in retaining as much business as possible, is building long-lasting relationships with client product manufacturers i.e. striving to become preferred supplier. To achieve this, a packaging supplier needs to supply more than just packaging, they should offer true added value. The second development, the changes in retailing and the increasing power of retailers, is a pointer for what this added value could be.

This paper will explore the possibilities of supplying added value. First the dynamics of value chains will be discussed in section 2. In section 3 and 4, two cases will be studied from a major European cardboard supplier in which they were required to supply more than just the cardboard. The first case will explore a design for an innovative package for a coffeemaker, in which the OEM (Original Equipment Manufacturer) wanted to improve

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the marketing performance of the packaging, both in store (sales performance) as at the consumer's home (unpacking experience). It called on the belp of its suppliers.

The second case study deals with retail ready packaging (RRP); secondary packaging for Fast Moving Consumer Goods (FMCG) designed to be put on the shelf as one unit. RRP defines performance criteria for secondary packaging related to in-store operations on top of logistical functions. As RRP is increasingly used for on-shelf (shelf ready packaging) and off-sbelf (display ready packaging) merchandising, it rapidly becomes a vital marketing element. The case described in this paper deals with a proactive exploration by the cardboard supplier to compare the financial, technical, marketing and environmental performance of its cardboard trays with alternative embodiments.

Both cases deal with requirements from the value chain beyond the direct control of the client (e.g. the manufacturer of the branded product) that orders the packaging from the supplier. Furthermore, in both cases, the requirements deal with 'soft' issues of marketing, whereas the traditional expertise of packaging suppliers is more on 'hard' issues of technical performance.

2. Value Chain Dynamics

OEMs usually do not consider packaging to be part of their core business; rather, they believe their core business is the packed product. Therefore packaging is usually bought from external suppliers. Also the packing and distribution may be outsourced for the same reason. As only very few packaging solutions are patent protected and the number of available suppliers is quite large, OEMs get to choose their suppliers. They do this based on factors such as price, quality, locality and reliability. If a suppliers comes along that outperforms the current supplier on these criteria they may easily change suppliers.

If one looks further down the value chain, one sees a sbift of power. More and more of the control over the chain lies with the stakeholder that has direct contact with the (purcbasing) consumer: the retailer. Besides the advantage of direct consumer contact, this increase in power is a result of the retail concentrating in fewer but larger retail chains (see Figure 1). Retail has become the 'narrowest' part of tbe value chain (i.e. smallest amount of truly significant players), giving each of the remaining retailers increased power over its supply chain. This development can be seen in many different branches of retailing (For a discussion see Spector, 2005, Sampson, 2008), including the ones described in this paper; Fast Moving Consumer Goods (FMCG) and Consumer Electronics (CE) (for the specific retail developments in the CE industry see Wever, Boks & Stevels, 2008). Due to the buying power these retailers represent, OEMs cannot afford to alienate one. The largest retailer, Wal-Mart, operates in most product categories from FMCG to CE products, and from toys to apparel.

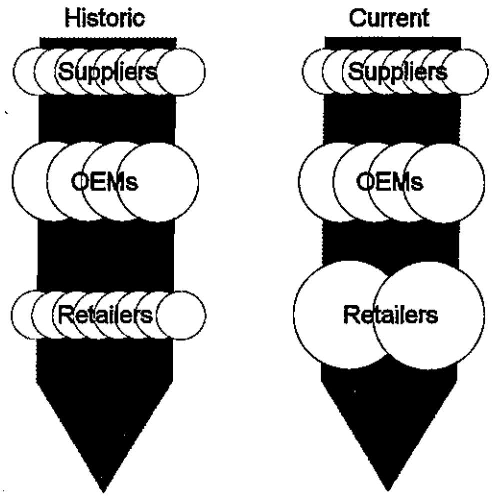


Figure 1: Schematic representation of size and number of players at different pbases of the value chain. On the left the post WWII situation, on the right the current situation.

Retailers strive for continuous reduction of cost, increase of convenience, and thereby increasing sales. They have started to treat manufacturers of branded products in the same way these manufacturers have regarded their suppliers. Tbe retailers set the demands, and if those are not met, one manufacturer is often easily replaced for another. The position of the packaging supplier is hereby reduced to a sub-supplier; a position that is potentially even weaker.

Retailers put a wide variety of demands on the packaging in wbicb products are delivered. This goes both for primary as well as for secondary and tertiary packaging. Demands can cover a wide variety of subjects from dimensions of the primary pack (in order to utilize shelf space optimally), palletization (in order to fit internal distribution systems), openability of secondary packaging (in order to facilitate speedy shelf replenishment) and recently issues of identification (RFID) and sustainability (e.g. Wal-Mart sustainability scorecard). Due to the supermarket-like style of retailing, the demands set for packaging have to do with a mixture of functionalities regarding logistical efficiency, increasing sales and shopping experience. In the end these demands have a strong link to economics, either through reducing costs or through increasing turn-over.

Several retailers have published guidelines regarding packaging to which they expect their suppliers to confirm such as Albert Heijn supermarkets in the Netherlands (Albert Heijn, 2003) which includes modular dimensions for secondary packs and Argos (Argos, 2004) which includes drop test procedures.

Wal-Mart's packaging sustainability scorecard is one of the most far-reaching examples of retailer demands, as it basically defines what sustainability is regarding packaging and simply requires its suppliers to present data on their packaging performance in relation to this definition. The score on the scorecard is subsequently a factor in the purchasing decision by Wal-Mart procurement agents (Mohan, 2008).

Some manufacturers retain some power over large retailers by having something unique to offer, something a retail outlet cannot do without. This can for instance be a very strong brand that consumers simply demand to be on offer. Part of this uniqueness lies in the ability of manufacturers to innovate, something retailers are usually not very good at.

Such a position of essential supplier is something packaging suppliers can also strive for in relation to manufacturers, i.e. obtaining a position of preferred partner where one is not easily exchanged for another supplier. But that requires them to offer more than simple packaging materials. The following two case studies will illustrate that this added value can consist of valued insights in the marketing performance of packaging and the sustainability performance of packaging.

The first case, on the packaging of a durable product, will illustrate aspects to do with the marketing side of the packaging (both increasing sales and experience) as well as sustainability. The RRP case will deal with in-store efficiency and sustainability.

3. Case I: Co-creation of a Durable Product Packaging

This first case describes a case of co-creation of a packaging for an iconic coffee maker from Royal Philips Electronics. First the background of the coffee maker, and the previous product and packaging designs will be described. Also the reasons for a radical new packaging design will explained.

Philips and coffee brand Douwe Egberts (a Sarah Lee company) introduced a co-branded coffee-pod system, suitable for single-serve portions. The system is called Senseo™, and uses special pods of coffee that can only be used in special coffee makers. The Senseo coffee maker has been a considerable success on the Dutch market, as well as abroad. Since its launch in 2001 millions of Senseo appliances have been sold (Santema & Beelaerts van Blokland, 2006).

Philips has a high third party involvement with this product. Not only is it co-branded with Sara Lee/Douwe Egberts, also the packaging was a co-creation with suppliers, as well as sub-assemblies, such as the boiler (Van Echtelt, Wynstra & Van Weele, 2007)

The first series of Senseo coffee makers were made in China. Due to the high quality demands on the product, and the long lead-time for products shipped from China, production was moved to Poland (Hettema, 2005).

At this time the first redesign of the packaging was made, as a switch was made to European packaging suppliers (see Figure 2, on the left). Both the original box and the second generation consisted of a cardboard box, with molded fiber cushions. However, in the new design the cushions were reduced in size, as well the outer box. However, the box increased in complexity and direct cost. Later on, production of the Senseo was resumed in China as well, in partial fulfillment of product demand in the US (Hettema, 2005).

The Senseo became a kind of iconic product, and many stores erected walls of packed Senseo machines in their stores, which was of course a marketing success for Philips. As the packaging has a significant sales function to fulfill, the visual quality of the box has to be very good. Hence, during transport additional transport packaging is applied, with two Senseo packs in one secondary container (Hettema, 2005).

The sales numbers for the Senseo coffee machine in the Netherlands were quite staggering. However, this also presents a problem; how to keep selling machines when most households have one? Part of the solution can be to continuously renew both product and packaging. One example of this is the introduction of a luxury version of the product with an aluminum finish, for which a separate packaging was developed as well. Later, yet another version was launched; the sweet mandarin. This version was available in translucent orange or blue. The package for this model was designed in an unpacking workshop organized by Philips together with its suppliers for the cardboard box and the molded fiber cushions (Hettema, 2005). A radical new design resulted, which utilizes see-through blisters, allowing consumers to see the product while still packed. Hence a supplier of thermoformed plastics was also involved in the project. This also meant that the molded fiber producer was dropped. However, the sweet mandarin was only a limited edition and the normal version continued to be sold in the cardboard/molded fiber combination package.

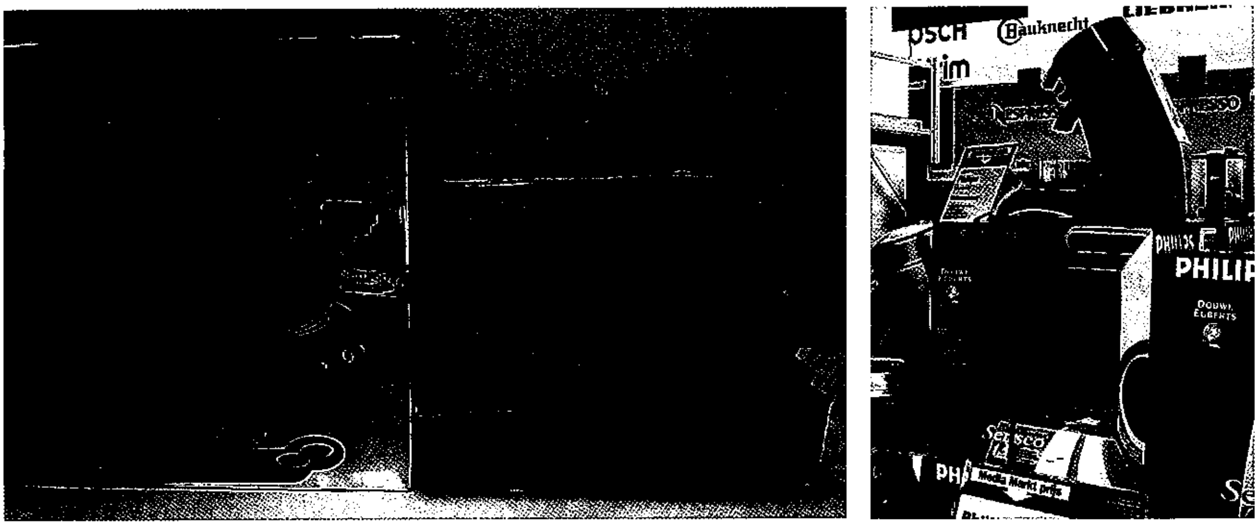


Figure 2: The 2nd generation product with cushions and box (left)
and the sweet mandarin version in a MediaMarkt store (right).
Note the safety strap here. (Hettema, 2005).

Table 1 gives some data on the different product generations and their packaging. The interesting aspect of this project is that the new design resulted in a more elaborate unpacking experience (it opens by flipping open the front side of the package) and improved shelf performance (through being radically different from previous packs, or even other CE packaging in general, and through allowing consumers to see the product), but also improved logistical efficiency by increasing the number of products per pallet from 40 to 42 (Hettema, 2005).

There was however an issue with the retail performance of the packaging. To prevent consumers from opening packaging in the store, MediaMarkt, which is the chain with the largest market share in the Netherlands, applies safety strips around the box. These are red and black (the colors of MediaMarkt) which conflicts with the colors of the packaging, and worse, were applied through the middle of the window in the packaging, thus partly ruining the presentation of the product (see Figure 2, on the right).

Hence, it can be concluded that what happens to a packed product in a retail setting is essential to the success of a packaging design. Proper understanding of retail requirements (of course in combination with creative powers) is essential for product manufacturers, for whom these retail requirements are just as external as for the packaging supplier. Packaging suppliers that are capable of assisting the manufacturer in dealing with these requirements provide true added value.

4. Case II: Retail-Ready Packaging in the FMCG Industry.

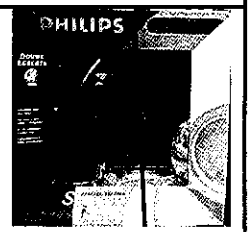
The second case deals with retail ready packaging (RRP). Contrary to the previous case, where the project was initiated by the OEM, this project was initiated by the packaging supplier in a proactive attempt to stay on top of the issue. First RRP will be defined, and the background of the concept described. Then the specific case project will be introduced and discussed.

The purpose of a retailer is to provide consumers with the goods they want (and some times even with goods they did not know they wanted). One of the key factors in running a successful retail outlet is making sure a consumer always finds what she is looking for. A product being available and recognizable is essential. However, making sure that a product crosses the last yards from the back-room to the shelf has presented problems in the past. Retailers currently push two developments that may improve product on-shelf availability, namely Radio Frequency Identification (RFID) and Retail-Ready-Packaging (RRP). A distinction needs to be made between two term used in this latter field, namely Shelf Ready Packaging (SRP) and Retail Ready Packaging (RRP). 'Shelf Ready Packaging is generally the term used to refer to a product that comes ready merchandised and can be put onto the shelf. RRP is a broader definition that encompasses SRP, but also includes further criteria such as easy ID and easy opening' (Institute of Grocery Distribution, 2005).

Currently, one sees two general embodiments of SRP and RRP in store; plastic transparent trays and cardboard trays. Traditionally SRP has been associated with budget oriented supermarkets like the Aldi and Lidl concepts from Germany. Currently though, several large up-market retail chains are pushing for RRP, which can be considered an up-market version of SRP. Aware of questions that might come from their customers as to the performance of cardboard RRP trays in comparison to the alternative transparent (bio)plastic ones, a project was started to gather data and understanding regarding the differences of these embodiments. A current customer utilizing both cardboard and plastic trays was located. This customer participated in the comparative analysis regarding both technical, financial, marketing and sustainability performance.

Considered from the marketing perspective, the transparent plastic trays allow for good visibility of the primary packs, whereas the cardboard trays, while obscuring (part of) the primary packs, provides a bigger, printable area for product identification.

Table 1. The different generations of Senseo coffee makers and their packaging. (Hettema, 2005).

The product	**Senseo crème**	**Senseo blue**	**Senseo VIP**	**Sweet Mandarin**
				
Specifics	1st generation, 2001	2nd generation, 2003	Introduced in 2004	Introduced in 2005
Introduction price (Mossou, 2004)	~ € 70,-	~ € 60,-	~ € 170,-	.
Current price (a)	Not applicable	€ 59.89,-	€ 149,-	€ 79.99
Weight	2668 g	1920 g		1920 g (assumed)
Height x width	325 x 315 mm	323 x 318 mm		323 x 318 mm
Diameter high part	∅133 mm	∅140 mm		∅140 mm
Diameter low part	∅213 mm	∅211 mm		∅211 mm
Changes with the former series (Mossou, 2004)		Dimensions Top handle Cup plateau Pouring nozzle	Dimensions Metal instead of plastic	Semitransparent plastic
The primary box				
Box dimensions h x w x d, mm	400 x 385 x 255	385 x 370 x 265	400 x 395 x 265	383 x 383 x 265
Box volume	39.27 dm^3	37.75 dm^3	41.87 dm^3	38.87 dm^3
Corrugated board	E-flute ~ 550 g/m^2	E-flute 512 g/m^2 **(b)**	E-flute 560 g/m^2	F-flute **(c)** 530 g/m^2
Used board	0.84 m^2	0.96 m^2	0.99 m^2	0.76 m^2
Packed weight	3760 g	2760 g	~	2830 g
F/box weight	456 g	492 g **(d)**	554.5 g	403 g
Buffer weight	640 g	225 g	~	507 g
Transport position	Standing	Standing	Standing	Laying down
# products/pallet	8 x 5 layers = 40	8 x 5 layers = 40	8 x 5 layers = 40	6 x 7 layers = 42
Pallet stack height	2.0 m	2.0 m	~2.1 m	2.1 m

(a) Price at MediaMarkt in the Netherlands, June 2005
(b) 210 g outerliner + 120 g fluting (x1.35) + 140 innerliner
(c) Due to increased folding stress as result of the design the flute was changed
(d) measured at 502 g, which is a 2% difference with reported data

The detailed results of the study are proprietary knowledge, but some of the sustainability results—which are most relevant for this paper—can be shared. First it should be noted that relative to the packed product itself the environmental impact of any secondary packaging is minimal. Hence, from an environmental perspective, improving secondary packaging should not be the first priority. Second, there are differences in the environmental performance between cardboard and plastic embodiments of RRP, but which one is better depends largely on the actual percentage to which both alternatives would be recycled. A quick scan of retailers in the studied country showed that retailers have only two separate waste streams; a paper/cardboard stream and a plastic stream. The plastic stream consists of a mix of different transparent plastics (PS, PE, PET, PP), most of it unmarked. This may prohibit high level recycling. Furthermore, a complication is on the horizon with an increasing amount of bio-based PLA being used, which is considered a contamination within a stream of fossil-fuel based plastics, as its biodegradability would compromise the properties of the recycled plastic.

Although the study did not yield explicit results clearly in favor of either material, it did result in a proper understanding of what the essential parameters are, and how they influence packaging performance in relation to retail operation and sustainability. As the IGD already noted in its study 'RRP solutions can only be delivered in "genuine partnership" with both Branded and Own Label suppliers, and represents a significant challenge for all parties involved.' (Institute of Grocery Distribution, 2005). Thus it can be concluded that a proper anticipation of questions and demands that may arise with regard to retail operations may prove essential added value in retaining current business and securing new customers.

5. Discussion and conclusions

OEMs increasingly face questions and requirements from retailers, which they pass on to their suppliers. Two of the major issues in retailing are guaranteeing product availability (which is currently addressed through both RRP and a push towards RFID) and sustainability issues (e.g. Wal-Mart sustainability packaging scorecard). Packaging suppliers that can respond effectively to these questions and requirements have a considerable competitive advantage over those that cannot.

This paper has illustrated these points through the analysis of two cases. In the case of the Senseo coffee maker the packaging suppliers were involved by the OEM, while the case of Retail Ready Packaging was an example of proactive action by the packaging supplier.

Packaging suppliers need to take a lifecycle perspective to their products, and continuously study the interest of the other stakeholders in the value chain, in particular the most influential one; retailers.

Due to this development packaging suppliers need to develop expertise in other fields than the pure physical performance of their packaging. They should be able to address issues that have to do with marketing and sustainability, both aspects that are harder to quantify objectively. The case analysis shows that a proactive approach can provide a packaging supplier with answers to questions that most of its clients are already asking, or soon will be.

As most packaging suppliers are typically engineering focused, they usually do not have the skills required for dealing with 'soft' issues like branding and sustainability. In building this expertise cooperation with third parties, such as clients, universities and consultancies, may be very helpful.

6. Further research

This paper is part of a wider PhD program focused on improving the sustainability performance of packaging for durable goods, in particular consumer electronic products. Due to the influence of packaging volume on transport efficiency, it takes a focus on design for volume reduction (Wever, Boks & Stevels 2007). Several functional issues of packaging are researched in their relation to sustainability and in particular packaging volume, such as protection from distribution hazards (Wever, Boks, Marinelli & Stevels 2007) sales performance (Wever, De Vries, et al, 2007), and unpacking experience (Wever & Del Castillo, 2006). Future research will focus on how to improve design practice in such a way as to eliminate inefficiency, as well as to find the optimal balance between marketing, logistics and sustainability for a given product.

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SOME INSIGHTS ON SERVICE DESIGN AND BRAND INTEGRATION

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Abstract

According to recent figures, services constitute the largest component of the world economies, while it also is the most rapidly growing industry. This obviously highlights the importance of managing and marketing services, which can also be traced in the tremendous growth of this scholarly field since early 80s. However, the design of services is scarcely studied within this discipline, and up to date only a few works on service design is present in literature. Yet, it is obvious that design in the new millennium is a key contributor to success, and it applies to services as well as physical products. Moreover, the impact of design on branding is recently being documented empirically, which increases the significance of design from a marketing perspective. This paper aims to provide the readers with a better understanding of the recent developments in the services industry, particularly using a framework that integrates service design and branding. The paper also investigates the major gaps in the services industry that mostly pertain to the design of services and offers the researchers with several research directions.

Keywords: Service design, Brand management, Design management

1. Introduction

The service industry has experienced a remarkable growth during the last decades, becoming the largest component of worldwide economies. Statistical data reveals that weighted contribution of services to GDP (Gross Domestic Product) is around 57 percent worldwide, while the figure is as high as 73 percent for developed countries. Services also exhibit an upward trend in economical contribution by more than 25 percent since 1970 (World Research Institute, 2008). This growth eventually reflects itself in scholarly work devoted to services industry since early 80s. Originated particularly in services marketing, literature on service businesses now constitutes an important area of study. While a quarter century of services research has formed remarkable knowledge in the field, the industry still provides the scholars with a vast array of research opportunities. Compared to research in manufacturing industries, the service industry is relatively younger with many literature gaps to be filled. These gaps do not only include the service applications of manufacturing oriented theories, but also cover the development of new approaches that specifically apply to this industry.

The purpose of this paper is to investigate these gaps from a design-branding perspective, as this dyad constitutes one of the hottest topics in business today. Not surprisingly, the image empire we live in ultimately directs the attention to these two issues, how design and branding are incorporated into our product experience and how they form images that guide our consumption behaviors.

The organization of the paper is as follows. It first describes services delineating their differences from goods and explains major service typologies. Oriented around this discussion, it follows by explaining service design and branding, and how these two may be integrated to develop sustainable and profitable services. Next, the paper highlights main gaps in literature pertaining to design and branding of services with a brief discussion of research recommendations.

2. Service Characteristics and Taxonomies

From an economics perspective, a service is non-material equivalent of a good and encompasses the subject area of several industries such as retail trade, accommodation, information, media and telecommunications, finance and insurance, healthcare, consultancy and education. Services are characterized with a number of unique features that differentiate them from goods (Lovelock, 1981; Parasuraman, Zeithaml, and Berry, 1985). Obviously, the primary differentiating feature of services is their intangibility. Services, to a large extent, cannot be seen or touched, nor can be understood by other senses. They are consumed as experiences rather than things, and mostly at the place where it is produced. This context is regarded as the inseparability of services, referring

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to the fact that both the consumer and the producer at the same time must be present in a particular service delivery. In other words, it is not possible to separate the production and consumption stages; rather services are consumed when they are produced. This is a major feature that obviously complicates management of services. For most services, as in the case of education, travel, hospitality, or healthcare industries, consumers witness the production phase of the service, and even they are a part of it, which necessitates an increased level of alertness in delivery. In services, mistakes are less likely to be reversed; an unpleasant service experience cannot be compensated easily as done with a production failure in manufacturing industries. Labor-intensive nature of services industry also adds to this vulnerability, as the delivery of services depend more on humans and less on machines. Not surprisingly, humans have a higher tendency to make mistakes, and even if not, their actions are not easily standardized. Human involvement in services highlights a third differentiating factor, which is usually referred as variability: Service deliveries vary in quality. Every service encounter is more or less different than one another; no matter the same firm or same service personnel provide it. Obviously, such heterogeneity makes the management of service businesses more difficult. And finally, services are perishable, which addresses the impossibility of stocking services. Unused service capacity cannot be inventoried for some future use, and once unused it is lost forever. Service businesses continually strive to cope with such difficulties that arise from the very nature of services, which also fuels a large body of research for the last three decades.

Notably, the extent of these characteristics may vary with the nature of the service, such as the degree of tangible components, contact type or audience. In this context, it is possible to talk about service typologies, which classify the services with regard to several factors. Such classification is important to gain a better understanding of potential tools to manage a particular service business. Notably, previous research has proposed several service typologies. According to Cook et al. (1999), it is possible to find as much as 39 different service taxonomies in literature, while the below discussion involves three most prominent.

Basically, products are theoretically comprehended as laying out on a continuum with entirely tangible and intangible ends (Chase, 1981). Pure tangible products are goods that require no service, such as a packet of salt. On the other hand, the intangible end refers to pure services where no tangible component is present, such as education. In practice, most products lay somewhere in between, involving some degree of tangible and intangible components at the same time. For example, restaurants are hybrid products in this regard, as the consumption involves both a tangible (food) and intangible (dining service) component. Other researchers have proposed taxonomies that rely on customer contact level (e.g. Lovelock, 1983). From this perspective, services can be classified with regard to the proximity between the customer and the service provider. For instance, some services involve face-to-face contact, such as barbershops, others may include one-to-one but indirect contacts, such as call center services, or others may be characterized with no contact, such as the tasks carried by a back-office laboratory technician. Another way to classify services is to differentiate between people-focus versus equipment focus. As proposed by Silvestro, Fitzgerald, and Johnston (1992), in this way it is possible to categorize services into three groups, namely professional services (people-focused with high contact time and customization), service shop (people/equipment-focused with medium contact time and customization), and mass services (equipment focused with low contact time and customization). Consultancy services provided by professionals, such as doctors or lawyers can be given as examples of professional services. Service shops involve businesses with medium customization like hotels or banks. According to the authors, services provided by telecommunications, transportation or entertainment industry exemplify mass services.

In this paper, the aim is to provide some insights for services in two marketing related areas, namely service design and branding. Notably, both these concepts appear to be on the top of the marketing agenda, as they are valuable tools to differentiate products in the fiercely competitive environment of the new millennium. Unsurprisingly, factors that distinguish services from goods play a key role in designing and branding services, while the categorization of services also appear to be important in such decisions. The importance of design and branding is briefly provided below, which is followed by some major gaps in the service literature that may provide the researchers with new areas of study.

3. Design and Branding for Services

Design, in general, refers to the creative process that transforms an idea to a purposeful solution. The impact of design in manufacturing is relatively well documented. A number of design oriented fields, such as product design, industrial design or manufacturing design have put remarkable effort do develop a comprehensive theory of design and relevant applications.

As in manufacturing, design is an essential contributor to success in services, although it is not fully understood in this industry. Service design in brief is the application of design principles and methodology to the service development process and it is concerned with creating a service with such qualities (Holmlid, 2007). In this context, it involves designing the service process to create pleasing experiences. In other words, it can be defined as the purposeful creation of service delivery components that contribute to a quality service experience. Service design is not an exact synonym of service development, which basically refers to the transformation of a market opportunity into a service product available for sale. In this context, service development is more likely to define the new product development process for intangible marketable values, while service design is concerned with intrinsic qualities of the service product from a design perspective.

To better illustrate this argument, the Swedish furniture retailer, IKEA, can be given as an example for successfully designed services. Apart from their products, the retailing service in IKEA is also designed. The service area, wbicb includes the store in its entirety, is intentionally constructed in a way to allow for visiting every section. The consumers enter the store from the showroom area and first view all the products, which are generally placed in a room setting. However, they cannot pick the products directly to buy, but they are required to note product codes that show the warehouse location that they can be found. Upon entrance to tbe showroom, the consumers are offered notepapers and pencils with a description of this procedure that they are expected to carry. Once the consumers note all relevant information and view all the products, tbey are directed to the warehouse floor where they can find the items and carry them to the checkout area. Moreover, the role of the consumer in this service design extends beyond the physical store area to the living room, as assembly of the product is usually the responsibility of the consumer. These processes that show the very nature of the design are depicted in Figure 1. Apparently, the service process here is completely different from a traditional furniture retailer, as it urges the consumer to play a pre-designed role. IKEA's service design generates several benefits for the firm, as it increases customer involvement and retailing efficiency. Moreover, service design process may play a key role in differentiating the particular service from competition, as in the IKEA case.

Figure 1. IKEA Service Design Elements

However, the literature on service design is still in its infancy. This is not surprising given the lack of research on product design particularly from a marketing perspective. Existing theoretical base in several other disciplines, most notably semiotics and industrial design, is mostly ignored by recent marketing effort. As may be anticipated, such deficiencies are eventually reflected in service design researcb as well. Moreover, application of other marketing related constructs to services, such as branding, are scarce, particularly from a design framework. This constitutes a major gap in literature that may be filled with further research.

As noted, another important area for research is branding of services. Branding plays a key role in today's business. A brand is generally defined as "a distinguishing name and/or symbol (such as a logo, trademark, or package design) intended to identify the goods or services of either one seller or a group of seller, and to differentiate those goods or services from those of competitors" (Aaker, 1991). In practice, the context of brand is not limited to tangibles such as logo, symbols, or slogan, but it involves any reference that may be linked to the brand. These eventually include all the values created by the entire marketing mix (DeChenatony and McDonald, 1994; Ambler and Styles, 1996). From such a holistic perspective, service brands are the sum of the meanings attached to a particular service experience. For instance, a service brand may be characterized by being easy, convenient, enjoyable, fun, boring, unmanageable or tiring.

Branding services generate several benefits for the consumers and providers. Similar to tangible product brands, consumers decrease their decision making risks when making a branded service purchase (Aaker, 1991).

Moreover, buying a branded service may provide the consumer with nonmaterial benefits as well, such as psychological pleasures and a feeling of prestige. These in turn increase the loyalty of the consumer for the branded service, generating a number of benefits for the firm. Branded services can enjoy higher profit margins reflected in additional cash flows. The value of the brand also strengthens the financial assets of the business and allows the company to easily extend its brand to new markets. As with tangible products brands, the presence of a loyal customer base acts as a risk reducer for firms, particularly in their strategic decisions.

4. Integrating Service Design and Branding

Design and branding are fully interrelated concepts, although research that focuses on the integration of these two is scarce. This is particularly due to the lack of a common language between two disciplines: Design generally being explored by designers, and branding being investigated by marketers and consumer behaviorists. As the researchers in these two fields usually have different backgrounds they have a lack of interest into each other's field and act on stereotypes (Biemans, 1995). In other words, it is quite common that marketers utilize a managerial approach while designers employ an artistic perspective, which results in a clash between two disciplines.

However, recent research reveals that most of the brand knowledge is in fact cultivated in design (Kaplan, 2007). Design plays a major role in creating brand awareness (Page and Herr, 2002) and reinforcing the brand image through identification (Schmitt and Simonson, 1997) with the strategic messages it carries (Karjalainen, 2004). Notably, research on the interrelation of design and branding is only newly emerging, and following the traditional path of "tangibles-come-first", it currently focuses on goods.

From such a framework, service design may also be proposed to have a significant impact on brand knowledge, a term to coin the set of brand awareness and brand image (Keller, 2003). In other words, the design of a service may lead to instant recognition of the service brand and create several associations, which in time are transferred into brand image. At this point, a few real world examples may be appropriate to support the assertion.

Starting with the previously mentioned IKEA case, it may be suggested that the unique design of furniture retailing service has been profoundly cultivated into the brand of the firm. Such a service design has obvious connections to the do-it-yourself approach, which is a major facet of the IKEA brand in general. Extensive consumer participation in service delivery that urges the consumers to undertake most of the service tasks themselves, such as picking the product from the warehouse, transporting and assembling, is ultimately tied to the brand proposition of inexpensive furniture with attractive design. In Turkey, Garanti Bank constitutes another good example, as it designs the service in a manner to direct the consumers to alternative distribution channels as much as possible, such as call centers, internet banking and automatic teller machines, and enjoying a brand image that produces associations to technology and innovativeness. Design of the servicescape may also generate clear references to the service brand, for instance, the existence of high tables with no chairs will signify an eat-and-go type of fast-food business, while velvet covered armchairs convey the message that Starbucks positions its brand around a theme of a relaxed environment, i.e. "your third place" (after home and work). In the motion picture industry we face a similar situation, the design of the service, i.e. the movie, has apparent references to the brand of the production company. Disney launches family films under Buena Vista name, while movies with thriller or controversial scripts are produced by other divisions of the company, such as Touchstone Pictures, Hollywood Pictures, or Miramax Pictures.

Obviously, the world of business practice endows the scholars with more examples, which may found the basics for undertaking research that integrates service design and branding. The next section provides insights into several research opportunities in the field.

5. Some Implications for Service Research

As previously noted, services constitute a relatively newer area of research as compared to the manufacturing industry. Moreover, the interaction of design and branding is only recently focused by the researchers. In this context, researchers may find several gaps in the service literature. A few of these research opportunities are provided below:

- Service design: Research on service design is very scarce, while most texts available explore the issue from a "service development" perspective. While these two concepts are obviously connected, service design is not the equivalent of service development. Notably, a literature of service design should be established on the existing theoretical base in design research, including but not limited to concepts as service semiotics, design process in services, and service design innovativeness.

- Integration of service design and service brands: Another area for research is obviously the brand-design interconnection in services industry. As discussed afore, most of the brand meanings are enrooted in design, no matter the product is a tangible or an intangible one. In this context, the extent of service design impact on formation of brand knowledge can prove to be a fruitful topic for researchers to explore. Application of this framework to particular service fields to examine potential benefits that may arise from integration of service design and service branding is also another research alternative.

- Application of service design and branding into different categories of services: Application of design and branding models into different service categories may provide interesting results due to two reasons: First, the extent of application success may be limited or extended in line with the nature of the service class, and second, current taxonomies of services are still far from perfection as they share little in theoretical basis, which may be explored and redefined from a design-brand perspective. Within available classifications, for instance, mass services appear to be a major area for future research due to a number of reasons. As Ng et al. (2007) asserts, current definition of mass services is not sufficient and existing criteria do not adequately address some industries contained within. Entertainment industry in particular is a good example: While it provides a mass service, it is not necessarily equipment oriented. Insufficient insights into the mass services also generate several literature gaps with regard to application of existing marketing concepts to the services in this group, including design and branding.

- Service design education: Service design inherently compasses two major fields, marketing and design. In this context, the design of services should be an indispensable part the curricula of both fields. However, a quick look to the contemporary marketing and design curricula makes it clear that service design is literally ignored in education, while most of the theoretical and practical issues covered in these classes are devoted to physical goods. Therefore, a new understanding that embraces service design as an essential component of business and design education is necessary, which can be developed and enriched with the research that investigates how this issue can be best integrated to the mentioned curricula.

This review and recommendations for research are obviously not intended or meant to be complete, but they may provide the researchers with a starting point to carry rigorous academic work into this unexplored area. With such research, more gaps in the service literature may be filled, increasing our understanding into the nature of service businesses which constitutes a remarkable fraction of the global economies.

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DESIGNING FOR IMPROVED LOGISTICS: A NEW GENERATION AUTOMATED WAREHOUSING CAPABILITY

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Abstract

Highly automated warehousing/logistics systems have enjoyed only limited uptake, in part because of their performance capability relative to their cost. Notably, the limited volume retrieval, responsiveness and simultaneous storage capabilities of AS/RS systems are insufficient for many customers' needs.

A novel and highly flexible design solution is described that is built with simple modular elements. Early indications are that it can significantly outperform existing logistics systems. The solution can be scaled in terms of the number of parallel users (retrieval points), the range of different items in store (number of different SKUs), the quantity in store of each SKU and the physical size of the SKUs. The concept, which is being developed to serve the requirements of a leading UK Internet business, is also scalable on response capability and, if chosen, is intrinsically able to deliver items in any selected sequence.

Not only applicable for conventional warehouse/logistics operations, the system's potential capability is such that it might even be employed as the basis of an automated retail supermarket. Its capability in a supermarket scenario is investigated by simulation, where results show that customers can expect delivery of chosen items to an assigned collection location within a minute of payment.

Keywords: Warehousing, Logistics, Automated supermarket.

1. Introduction

Online shopping in the UK is reported to have increased by 33.4% to £10.9bn between 2005 and 2006 and is predicted to rise to more than £28bn, or about 9% of the UK's total retail sales, by 2011 (Verdict/BBC, 2008). Customers prefer the discount prices that can be found online but are also demanding convenient and quick delivery. Retailers require highly efficient distribution centers to be able to satisfy this demand. Improved performance in terms of order throughput volume, mix capability and decreased response time are all highly desirable for such companies, as well as reducing the number of personnel employed. Other advantages can be sought such as reduced pick error, the ability to readily present selected items in sequence ready for dispatch, or the flexibility to accommodate promotions without incurring operational penalty.

Logistics operations of course extend far beyond those focused only on retail shopping, where the logistics sector is acknowledged to be one of the most important in the UK economy. Jackson (2008: p1) writes:

> "The UK economy is the fifth largest in the world and the logistics industry is the fifth largest sector in the UK economy, turning over £75bn a year and employing 2.3 million people, which is eight percent of the total UK workforce."

The rapid growth of online businesses includes retail supermarkets, wbere for example all major UK supermarket cbains provide for Internet ordering and home delivery. Indeed some chains such as US outlet Peapod.com are set up exclusively as online stores. As yet bowever it is not possible both sufficiently quickly and fully automatically to furnish customers witb Internet pre-ordered items should they wish to turn up at a supermarket premises at an unspecified time to collect their items. Equally, extensive automation is not seen for customers who may instead prefer to choose from representative in-store goods, for example by using a scanner. The challenge again is to very rapidly supply customers' chosen goods from a storage area, this time once payment bas been taken.

Whether logistics hub or retail supermarket, there is considerable potential to reduce the bandling inefficiencies of high-staff systems, replacing personnel with automation. The challenge is to do so in a

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financially viable manner whilst at the same time at least matching the capability of any system dominated by high numbers of staff.

1.1 Diverse strategic approaches to automation

There is currently available over 220 million square feet of storage space across the UK, with a trend towards larger, more centralized warehouses (Jordan-Smith, 2008). Mirroring the rapid increase of Internet shopping, it is reported that major suppliers of automated warehousing systems are expanding their revenue, up 23% in 2007 relative to 2006 (Kator, 2008), hence indicating a likely growth in the levels of automation employed in the industry. Operational systems can readily be identified, for example via major system builders' literature. Nevertheless, these systems can still often be seen to employ very substantial levels of personnel (Lyall/BBC, 2007), suggesting, even in such examples, the term 'highly automated' is much more correctly employed than the term 'fully automated'.

The move to automation is not universal. Whereas the University is currently working alongside an industrial partner who is highly committed to automation, prior contact with a major UK third party logistics (3PL) company elicited a polar opposed strategy, namely a deliberate continuing reliance on essentially a fully manual operation.

1.2 Designing for improved logistics

University of Bath researchers have developed a novel warehousing system which has the potential, through modularity, to be deployed in many diverse logistics operations. There are two prongs to the research. First, the ultimate performance of the concept is being evaluated. This is being done by simulating its response in a highly demanding retail supermarket context. Second, the system's applicability in a major logistics operation is being investigated. A paper exercise of building a full system with appropriate modular elements is being undertaken such that the design could be installed in place of the research partner's existing system. Issues of both cost and capability are being assessed with the full involvement of the industrial partner.

In both cases very encouraging initial results are apparent, and are reported later below.

2. A review of warehouse design alternatives

Market competition obliges continuous improvement in the design and operation of distribution networks. Tighter inventory control, shorter response time, expanding product variety and shorter product life cycles are among the challenges for the modern warehouse, which can be prompted in part by the adoption of Just-In-Time practices (Gu et al., 2007) or in response to mass customization (Pine, 1993). At the same time the implementation of new IT capabilities such as bar coding, radio frequency communication and warehouse management systems (WMS) has also presented new opportunities to improve warehouse operations (Gu et al., 2007).

A number of alternative design solutions are apparent in existing automated warehouses. These can include palletizing robots, carton flow order picking systems, automated guided vehicles (AGVs), rotary storage cabinets and automated storage and retrieval systems (AS/RSs). AS/RS designs in particular have been the basis of considerable optimization research.

As well as the variety of available design solutions, there is also clearly considerable variation in the applications for which automated system might be used, ranging from, say, long-term storage of semi-dormant government records through to high volume mail order operations through in turn to a busy multi-user supermarket. Excepting space constraints, the first of these applications would be very lightly taxed, whereas the last exhibits both extreme throughput and response capability demands.

Gu et al. (2007) suggest constructing a theoretical ftamework to address both warehouse design and operational problems. Cormier and Gunn (1992) classify problems associated with warehouse design, whereas Rouwenhorst et al. (2000) have proposed that a typical design process includes a number of consecutive phases which can be situated at strategic, tactical and operational levels.

2.1 Inefficiency: moving the tote, moving the carton and moving the person

There would not seem to be any single current design able satisfactorily to serve all competing potential use situations. Instead different systems designs will be suited to specific applications, or hybrid systems may be proposed. Essentially fully manual working practices might be also be maintained. The authors have particularly researched hybrid systems where AS/RS components have been combined with carton flow order picking systems.

In addition to the academic wisdom outlined above, the designer might also assess warehouse systems with a view to the movement of storage totes, the movement of cartons and the movement of personnel. In particular the movement of personnel, for example when operating pick to light systems, will contribute to operational inefficiency, as will their often necessary employment when enacting the interface between different elements of an overall hybrid design. Equally, automated movement of totes and cartons typically becomes increasingly problematical as a system becomes more complex, wben longer distances are traveled, or wben the tote conveying hardware is independent of (and bence in addition to) the carton conveying hardware. Commercial data shown to the research team indicates that tbe running costs of extensively automated systems can be high, sometimes approaching those of systems wbicb substantially rely instead just on manual labor.

As will be described, a desire to move storage totes to statically located personnel at pick stations underpins the new conceptual design. In this way the number of personnel who need to be employed can be minimized, and there is facility to readily scale the number of staff employed to match the overall demands placed on the system at any given time. It will be shown that, unusually, this goal of static personnel location does not compromise performance in other ways.

2.2 The particular issue of flexibility

Notwithstanding other cballenges of any highly automated system, it will often ideally need to provide high levels of flexibility, to accommodate cbanging product profiles or other expressions of uncertain and variable customer demand. Quantified examples of changeable product mix through time are published, at the same time noting that relatively sbort 3PL contracts, say 5 years or less, can apply (Wincanton, 2007: p10). Operators of highly automated systems face such uncertainty often with knowledge of the considerable likely difficulties of adapting legacy hardware. Many existing system designs are additionally inflexible in that they require a largely fixed staffing level be maintained, irrespective of volume throughput.

3. The new modular automated warehouse concept

The new system concept discussed in this paper was originated by van Esschoten and McIntosh and was first described in a supermarket context in a Dutch trade magazine (te Lindert, 2007). In the intervening period much work has been done by the authors to validate the early capability claims made of the concept. Equally, its application in more general logistics environments has been evaluated and its financial viability investigated. The current paper reports this work.

3.1 A brief description of the storage module

The core element of the automated warehouse is the storage module illustrated by figure I. Items are pre-loaded into totes, at which time the item is matched to a unique identifier of that tote, typically a barcode or an RFID tag (use of an RFID tag and reader is illustrated). The item is henceforth tracked and manipulated through the system within the tote via that tote's unique identifier.

For the purposes of this paper only the concept is described. Design details which permit the concept to be realized are omitted. Key elements for example are described only as 'pushers' or 'conveyors'. In practice a storage module must be space efficient and economic to manufacture. When other design considerations such as reliability, linking multiple modules together and maintenance are also factored in, it can be appreciated that the design problem is non trivial. Nevertheless viable solutions are possible, and a team of 6 students in the University of Bath's Department of Mechanical Engineering recently concluded a major design exercise in conjunction with a mail order business partner. The total system cost was within approximately 10% of the cost of the company's existing system. As a first iteration student exercise there are perceived to be very significant opportunities for both design enhancement and cost reduction.

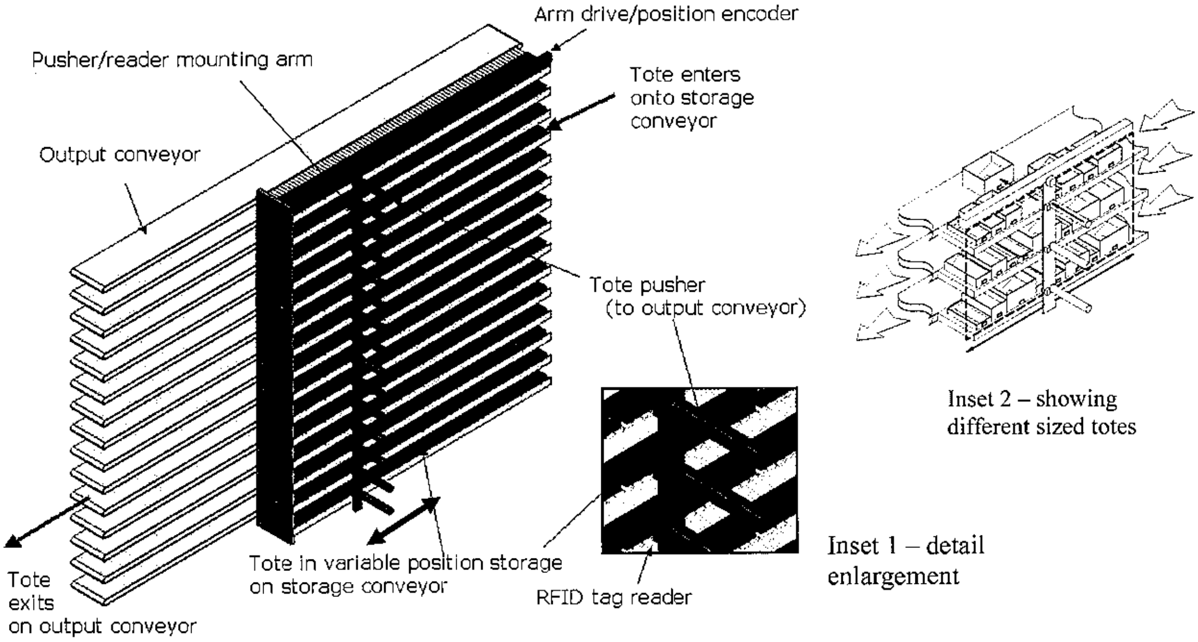


Figure 1. *A module and associated output conveyors.*

3.1.1 Alternative input and output paths

The module comprises two types of conveyor aligned next to one another. These are the storage conveyors and the output conveyors, as shown in figure 1. Figure 2 shows views of a module array. The item enters storage in a tote onto the end of a storage conveyor. When specific items are demanded from store they are transferred onto the output conveyor by a pusher device. The space previously occupied by the tote is then filled, *with all succeeding totes moving forward along the storage row. A tote's position on a storage conveyor is therefore not fixed in time.*

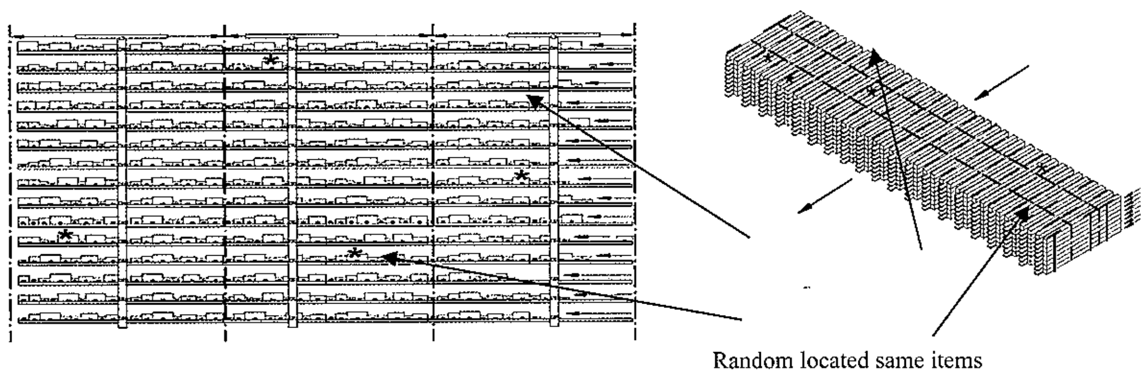


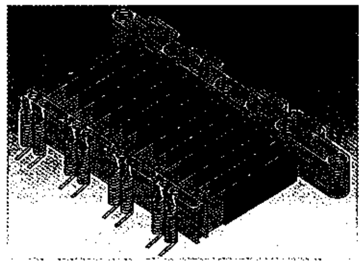
Figure 2. End and isometric views of a three module deep array

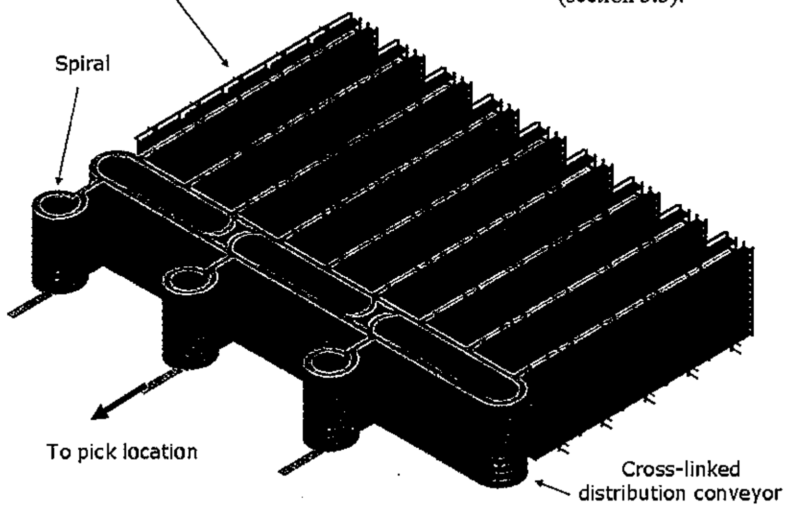
Position knowledge of all totes and hence all stored items on all storage levels is updated each time the pusher arm traverses the module. Readers mounted on the arm identify the tote, and the arm's position along the storage row is determined by use of an encoder. The control system maintains knowledge of where all items are stored throughout the module, or throughout an overall module array if multiple modules are used.

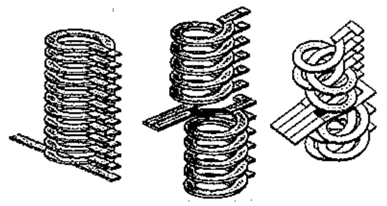
That tote loading and tote removal from storage occur via separate paths permits simultaneous loading and unloading operations, contributing greatly to both responsiveness and volume throughput capability.

Figure 3 shows a module array including a design of conveyors and spirals to distribute totes to pick locations. Other distribution designs are possible. It should be noted that rerouting of totes back from the pick locations is not shown for reasons of illustration simplicity, although this has been considered by the research team for both a high volume mail order warebouse and a supermarket application. Details are available upon request from the authors.

Inset 1 – showing a module array feeding to 8 pick locations and also including an input conveyor system (section 3.3).







Inset 2 – showing different spiral configurations, respectively TYPE A, TYPE B and TYPE C (section 4.1)

Figure 3. Adding further elements to the overall system

3.1.2 Scalability: tuning system capability to match specific customer demands

Notably through its modular design, the concept is scalable. It can be adapted to specific customer demands when built, for example a customer's peak or mean throughput rates, numbers of collection stations or response time. Single modules can be of different sizes, and linked arrays of modules can be configured in many different ways.

Flexibility is inherent in the new storage concept, and the problems described earlier in the paper concerning flexibility are either totally eliminated or can be much more readily managed. If necessary the capability of an overall system can be changed by adding (or removing) module elements.

The concept permits large numbers of parallel events to occur at any given time: it is possible for very many simultaneous load, pick and distribution events to occur within a module array and within the system as a whole.

3.1.3 Random item location and item selection optimization

Figure 2 shows that if there are a number of the same SKU in store, then these same items are ideally distributed either randomly or semi-randomly.

Distributing same items throughout the storage space either randomly or semi-randomly represents a further way to enhance the response capability of the system. Distributed items significantly raise the likelibood of both a chosen SKU being nearer to a desired pick location and the likelihood of there being a module arm wbicb is both available to be moved along the module (because pushing is not at that time occurring from it) and reasonably adjacent to a chosen SKU. Also, same items in different locations can readily be selected simultaneously if need be.

Item selection optimization in a fixed mecbanical system has been considered in the simulation reported in section 4, although just two different and comparatively simple selection strategies have been investigated.

As well as optimization through enhanced selection logic, there are also of course many opportunities to change the physical system, for example using different sized modules, or configuring modules together in a different way.

3.2 Matching capability distribution from the modules

It is critical that the capability of the modular core of the system is matcbed by a similar capability to distribute selected totes to staffed pick locations (or in the case of supermarkets, customer pick locations).

Figure 3 shows the design of the distribution system modeled by the simulation. It comprises a series of looped and cross-linked conveyors. These conveyors, along with the spirals which connect to them, can also act as buffers at a number of positions along the overall delivery path. One potentially highly attractive corresponding capability is that selected items can be sequenced during their delivery phase – rather than necessarily employing the more limiting option of sequencing the selection of items from the modules. Items can be routed in looped buffer paths, and subsequently be mixed into sequential position as required prior to arriving at their assigned pick location.

Other distribution system designs can be envisaged. Some of these will be both more compact and cheaper, but may not have the ultimate capability of the design described by figure 3.

The distribution system design as elsewhere is such that multi-parallel activity can occur and, furthermore, that short potential routes between storage and destination locations are statistically likely. The multiplicity of parallel available routes ensures that no substantive congestion problems arise.

3.3 Matching capability replenishment

Just as the distribution capability must match the multiple selection capability within the storage module array, the system also requires a matched replenishment capability. Within the modular storage area the design enables substantially independent tote replenish and select activities to occur. As with other aspects of the design, scalable multi-parallel activity is sought, wherein, also, no single sub-element is critical in the event of breakdown to the system's overall functionality. A viable solution to supply replacement totes into the storage array (although one which has not yet been simulated) is to repeat – in reversed format – the output conveyor design. This is shown in an inset in figure 3. Variations in the design are also likely to be possible because mean supply rates rather than peak demand rates typically have to be satisfied.

To greatly simplify the simulation model, the results presented below assume that selection occurs independently of item supply. In effect therefore replenishment of items is suspended over the duration of the simulation. In practice the surplus capacity of the system is so high that parallel select and replenishment is likely to have minimal impact upon ultimate delivery capability. In this way the design is once again superior to AS/RS designs.

3.4 Output from the distribution system to manual pick stations

The design of pick stations at staffed logistics warehouses will in all likelihood be substantially different to pick (or more accurately, collection) locations in a fully automated supermarket. In the former case employed staff are involved, whereas in the latter it will be members of the general public who are looking for guaranteed and foolproof collection of their selected supermarket items.

Novel designs have been developed for each situation but are outside the scope of the current paper. Readers are invited to contact the authors for further details.

4. Capability testing: supermarket scenario simulation

The initial capability claims in te Lindert's article (2007) were based on simulation work by a final year MSc. student at the University of Bath (Hamzah, 2007). The levels of performance this original simulation work hinted at were exceptional. It was also however apparent that substantial numbers of variables impinged on the performance. These variables included physical attributes such as the way that modules are arranged relative to one another. Myriad potential tote pick and routing optimization algorithms might also be used within a fixed physical system. Extensive investigation has elsewhere been completed to date on optimizing AS/RS performance and it would seem that further very comprehensive parallel research opportunities similarly exist (Powell et al., 2007).

Following from Hamzah's work, additional early simulation by Li (2008) using the Witness software investigates just three potential variables. The results of Li's work are summarized by this paper.

It was chosen to simulate a supermarket situation as it is perhaps the most demanding application that the new concept may face. For the purposes of this simulation a mid-sized supermarket was assumed to have approximately 1,000,000 items across 20,000 separate product lines (SKUs). Customers make their choices, perhaps using a scanner, from representative items arranged in the public access area of the shop. Each of 24 customers was assumed to choose 100 items and simultaneously download their orders once complete at in-store pay terminals. The warehouse is thus required to correctly deliver 2,400 items as quickly as possible to 24 collection points.

To ease the simulation task just one eighth of a total supermarket was modeled, in which therefore there are 3 collection points and 3 customers. Each of these 3 customers still orders 100 items simultaneously and there are still 20,000 SKUs in the modeled storage space. Figure 4 presents these details and also describes the module configuration. All totes are assumed for the purposes of the simulation to have an equal footprint of 150 x 250mm.

4.1 Investigating variation of three parameters

In contrast to the load demands placed on it, conservative assumptions regarding the physical operation of the system are applied throughout. For example pusher arm traverse speeds are set at 1 m/s and pusher action cycle times are set at 4 seconds. The simulation is detailed in full in an internal University of Bath report by Li (2008).

The simulation tested variation in three parameters:

1 – **Conveyor speed.** Comparatively modest blanket conveyor speeds of 0.4 m/s and 0.6 m/s were simulated.

2 – **Sequencing strategy.** In the nearest neighbor (NN) strategy selection sequencing occurs according to the minimum travel time between a storage location and a selection arm. In the shortest leg (SL) strategy sequencing occurs according to the minimum travel time from the storage location to the collection point.

3 – **Spiral device to customer collection point.** Figure 3 shows three different spiral configurations that were tested. First, one spiral linking all 35 levels fed a collection point (where items are picked out of totes) at the base of the storage area. Second, to reduce expected tote travel distance, two separate spirals feed a mid-level collection point. Third, four interleaved spirals are used, again feeding a mid-level collection point.

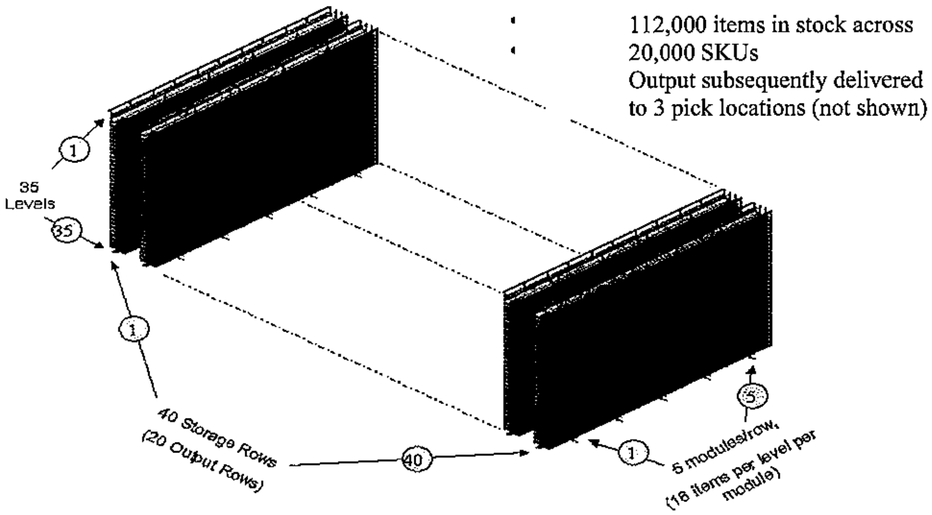


Figure 4. Detailing the module array for the supermarket simulation

4.2 Simulation results

Table 1 shows the impact of the three variables noted above. Both the time of delivery of the first item and the time of delivery of the last item are recorded. Figure 5 is a graph of item delivery rates to the three customer pick locations in 10 second time windows for the best performing model. Item delivery sequencing (for example heavy supermarket items first such as 1 liter bottles of water) has not been applied in any experiment.

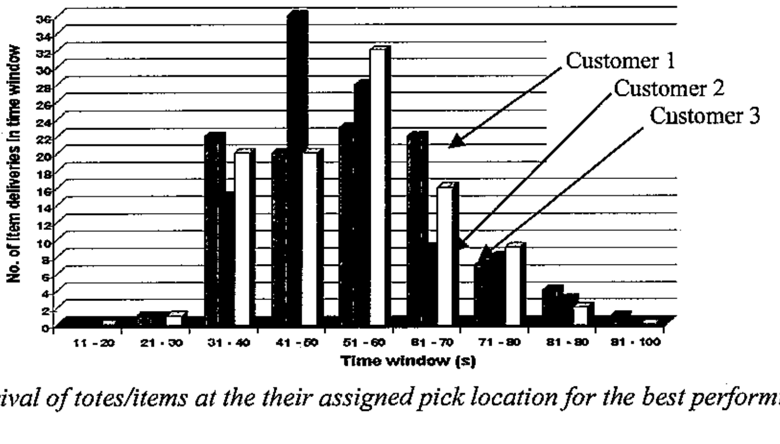


Figure 5. The arrival of totes/items at the their assigned pick location for the best performing model

Table 1. The impact of the three variables under investigation

	Variables			Time for first item out (s)	Time for last item out (s)
	Conveyor Speed (m/s)	Sequencing	Output spiral conveyor		
Experiment 1	0.4	NN	Type A	50	367
Experiment 2	0.4	NN	Type B	43	243
Experiment 3	0.4	NN	Type C	43	174
Experiment 4	0.4	SL	Type A	34	239
Experiment 5	0.4	SL	Type B	35	176
Experiment 6	0.4	SL	Type C	35	128
Experiment 7	0.6	NN	Type A	35	247
Experiment 8	0.6	NN	Type B	30	164
Experiment 9	0.6	NN	Type C	30	118
Experiment 10	0.6	SL	Type A	25	167
Experiment 11	0.6	SL	Type B	25	125
Experiment 12	0.6	SL	Type C	25	91

4.3 Enhancement: Internet selection of items and subsequent collection at an unspecified later time

Excellent system performance is described, with all in-store customers being able to collect chosen items in a very swift timeframe. Random storage location of Internet chosen items is no longer necessary however once these items become allocated to customers, where such items can immediately be moved closer to a likely collection location (via a non-illustrated recirculatory loop between the output and infeed conveyors). An even faster response then becomes likely, where items might be made available in the very short time between customers identifying themselves upon arriving at the store and subsequently arriving at their nominated collection point. As items remain within the storage space they are still available to alternative customers in the event of a no-show.

5. Ongoing research

There are many potential applications for the concept as described, not least arising from its ability to be scaled or otherwise adapted to meet the specific demands of the application in question, including adapting its capability after initial installation. Research is continuing into alternative logistics applications.

Significant design progress is also being made concerning how the concept can be integrated with transnational inter-warehouse transportation. The objective is for there to be minimal penalty to multiple road truck usage via a simple automated sequence for toted items of: unload from a truck, deposit into a warehouse, reselect subsequently from the warehouse, and reload into another truck. A maximum 5 minute truck turnaround target has been set.

6 Discussion: adding value

The concept provides for near-live stock taking (certainly when there is just one item per tote) and provides very rapid access for selection to each and every item in total storage. A multiplicity of simultaneous events – load, select, distribute, pick – can occur throughout the system. Although not explored in the current simulation, delivery of items to any selected pick location can also be sequenced. All this can happen at a seemingly faster rate than is currently possible, with greater throughput and with fewer staff. In addition (but not necessarily apparent in the illustrative figures presented) storage occurs in a space efficient manner. Research to date suggests that substantial cost can be taken out of the logistics operation at the same time that performance is being improved.

The concept, especially if including transport integration, opens up many possibilities.

Mail order distribution has been a main focus of the research so far. With significantly lower staffing levels the research partner now has opportunities for example to sort prior to dispatch, extend 'last order' time and much better match mail packaging media (such as padded bags, cartons or polythene envelopes) to the items being posted.

The concept's impact can be greater still if integrated with transportation in the way described. Beneficiaries might include major companies such as Schneider National or UPS. Minimal penalty multiple deposit, store, sort and reload would mean routing could occur such that all facilities are employed at much higher utilization levels. For example, with current environmental concerns, trucks could potentially depart on average significantly more fully loaded, in which case proportionately fewer trucks could be used. Warehouse volume utilization could similarly be optimized, both short term and longer term, in a way that currently is difficult.

For supermarkets similarly far-reaching opportunities are potentially available, albeit possibly with less likelihood of being fulfilled in the short term as they represent such a considerable step change from current practice. Notwithstanding this, the advantages automated shopping as described offer are highly attractive in many ways, both to the shopper and the store operator. Supermarket staff are largely employed for manual handling purposes, and dramatic staff reductions are likely. Equally, some interactive shopping techniques which are being trialed and which use existing technology (Firth, 2006) are now much more feasibly implemented. RFID tagging of sold items will be eliminated, eliminating their associated cost and issues of civil liberty infringement (Albrecht and McIntyre, 2006). Many other possibilities for revised operational practices similarly exist and are being investigated.

Finally, new opportunities are created for brand enhancement or brand exploitation, founded on the new levels of performance suggested by this paper. Thus for example a supermarket chain has the potential to position itself apart from its competitors if it offers Internet shopping in the way outlined above. Or, for in-store customers, there could be a wholly refreshed and highly interactive shopping area with no trolleys and without any expectation of check-out delay. Likewise mail order companies could see measurable performance advantages over of their rivals in the eyes of their customers. Many additional brand promotion opportunities are likely to be available.

7. Conclusions

A novel concept is presented which early work suggests can offer superior performance to existing warehousing/logistics solutions. Advantages are apparent for example in staffing levels, response rates and volume throughput capability. Advantages also extend to the concept's inherent flexibility to accommodate variation in operational circumstances, and its inbuilt ability to continue to function largely unimpaired in the event of the breakdown of a system element. The cost of a proposed large scale installation for a mail order distribution company appears closely comparable to that of an existing installation of significantly lesser capability.

Work is continuing at the University of Bath to develop and integrate the concept with transportation. At present multiple occurrence single item deposition and sort is problematic and constrains how items can be routed to their final delivery point. Highly significant opportunities arise if these constraints can be substantially overcome.

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MODELING AN INTERMODAL TRANSPORT SYSTEM IN MARMARA REGION

Ömer Faruk Görçün[1] and Özhan Görçün[2]

Abstract

Integration of transportation modes play key role on Intermodal transportation effectiveness. Especially optimization and modeling for integration of rail, road and maritime transportation can be provide to cost effectiveness, right using of sources and productivity. This study will offer to propositions and model for integration of transportation modes in Marmara Region. The model is applied to the rail/road transportation system in the Marmara Region. Two planning scenarios are considered. It is shown that modal shares are very sensitive to the cost of rail, maritime and to that of track gauge changes at the Turkish border. On the contrary, the location of the terminals has little or no impact on the market shares of the combined traffic, but location changes in the region generate consequences on the entire European transportation system. In this study, major consumption and production places and transport facilities will be consider in Marmara region.

Keywords: Integration of Transportation Modes, Marmara Region, Modeling, Optimization

1. Introduction

This study will focus on the problem of optimally locating rail, road, air and maritime terminals for freight transport and Intermodal Transportation. A linear 0-1 program is formulated and solved by a beuristic approach. The model is applied to the rail, road, maritime and air transportation system in the Marmara Region. Five planning scenarios are considered. It is shown that modal shares are very sensitive to the cost of rail and to that of track gauge changes at the Turkey's northwest border. On the contrary, the location of the terminals and logistic village has little or no impact on the market shares of the combined traffic, but location changes in the Marmara region generate consequences on the entire European transportation system.

Passenger and freight transport demand in Marmara Region has been growing by more that 300% during the last decade. Number of road vehicles has growth from 62.5 million to 175 million in Turkey. Consequently demand of roadway will increase approximately %50 in 2010 according to expeditions.(DPT: 2007:14) However environmental pollution, traffic accidents, high transportation cost economically and under its social aspects will be rise dramatically.

Simultaneously, the modal sbare of road has significantly increased. Its development is mainly favored by the current spatial distribution of human activities (linked to the land-use policies) and by the progressive stock cuts in the productions processes. The reputedly "preeminence" of the road (wbich is still expected to increase in the future) generates important negative externalities in terms of environmental, economic and social costs (congestion, pollution, infrastructure damages, road accidents), and greatly increases the use and over-use of the roadway networks (Nijkamp, P., 1994: 261-271)

Negative impact to society and environment will be reduced and combined and integrated transport chains will be improved by innovative strategies and technologies. For effective using of multimodal and combined transportation, share of road transportation should be reduced by policy makers. These kinds of applications will be absorbed to demands of roadway by other transportation alternatives.

Multimodal and Combined transportation is defined as transportation of goods by at least two different modes of transport in the same loading unit (an Intermodal Transport Unit or ITU) without unloading and loading to trailer or container when changing modes. Railway or maritime transportation is major part of intermodal and combined transportation. Road transportation is providing integration of these transportation modes. Share of road transportation in intermodal and combined transportation system should be as short as possible. If share of road transportation increased total transportation cost would be increase in intermodal transportation system. (Bryan, D., O_Kelly, M., 1999:275-295)

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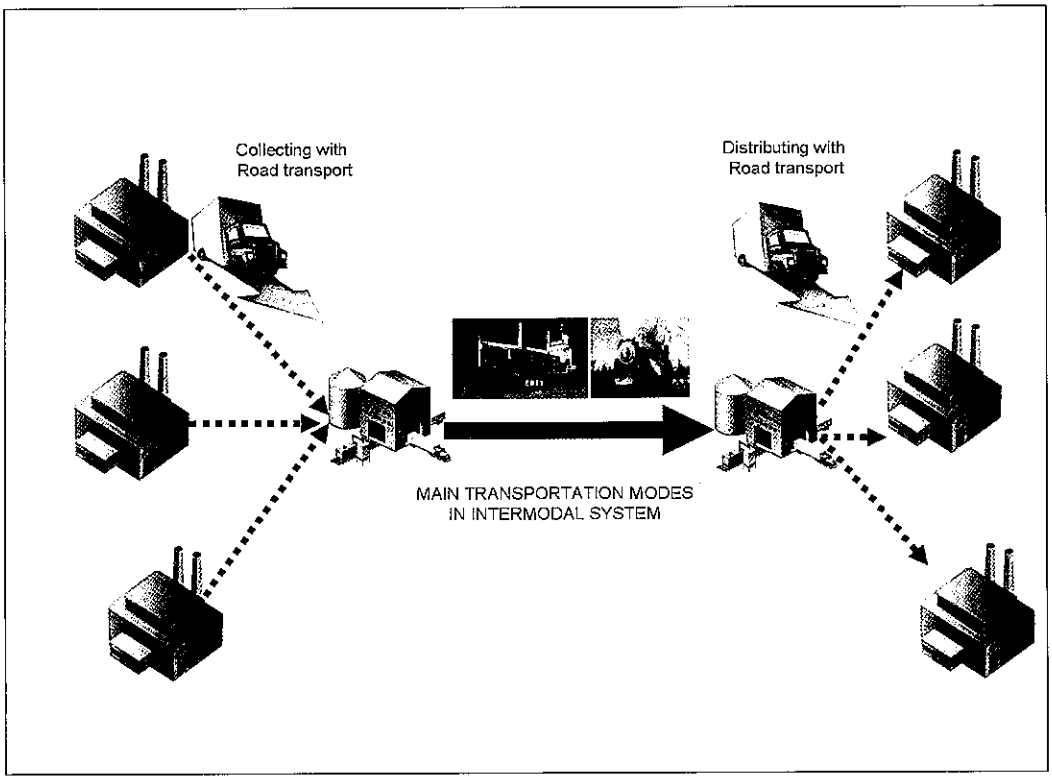

Figure: 1 Intermodal and Combined Transportation Chain

In this study, intermodal transportation is described by the combination of the advantages of rail, maritime and road, railway and maritime transportation for long distances and large quantities, road for collecting and distributing over short or medium distances (Nierat, P., 1997:109-127)

At the same time this study focuses on the problem of optimally locating multimodal and combined terminals for freight transportation. It suggests a model and illustrates it's operationally for rail, maritime and road terminals in the Marmara Region. The principal aim of this implementation is to demonstrate the impact of changes in the supply of transport on the modal shares within the Marmara region and goods flow between Turkey and Europe.

Even if the environmental and social benefits of intermodal transport systems are known, still economic competitiveness is determining factor in the choice of road haulers. Most important factor with the complementary nature and the competitiveness of the various modes of transportation are choice of transportation modes, route and speed. Therefore, transporters and consumers don't consider to external social and environmental impact of their choice so social and environmental costs don't clear for transporters and consumers. Such costs don't appear in the short term.

Determining location is very important factor for transportation problems. Before all else, network design problem should solve for determining location of transportation terminals. Consequence, transportation networks, nodes of transportation, hubs and terminal location play key role for success of integrated intermodal transportation.

2. Transportation Networks in Marmara Region

In the Marmara region, transportation networks are interconnected. Especially 0-2, 0-3 and 0-4 motorways are into European Transport Networks. These motorways are take place in fourth corridors. Distance of 0-2, 0-3 and 0-4 highway is 377 km from Edirne Kapikule to Adapazari. According to statistical data of General Directorate of Highways of Turkey, most heavy traffic has seemed on Fatih Sultan Mehmet Bridge. Approximately 208.000 road vehicles pass to this bridge everyday. Secondary, heavy traffics has seemed Boğaziçi Bridge and between Avcilar / Istanbul and Mahmetbey / Istanbul. Heavy traffic has increased thorough center of Marmara Region.

Table-1: Average Traffic Data per a day for 2006

KESİM - ADI	UZUNLUK KM	HAFİF TAŞIT Taşıt/Gün	AĞIR TAŞIT Taşıt/Gün	TOPLAM Y.O.G.T. Taşıt/Gün
EDİRNE - HAVSA	19,9	1.940	1.732	3.672
HAVSA - BABAESKİ	27,2	2.127	1.854	3.981
BABAESKİ - LÜLEBURGAZ	24,4	2.966	2.266	5.232
LÜLEBURGAZ - SARAY	26,8	3.862	2.712	6.574
SARAY - ÇORLU	20,2	4.480	3.296	7.776
ÇORLU - ÇERKEZKÖY	18,5	5.682	4.275	9.957
ÇERKEZKÖY - KINALI	12,3	9.012	6.200	15.212
KINALI - SİLİVRİ	6,8	15.049	8.681	23.730
SİLİVRİ - SELİMPAŞA	12,1	16.499	9.023	25.522
SELİMPAŞA - KUMBURGAZ	7,5	19.943	10.168	30.111
KUMBURGAZ - ÇATALCA	7,2	21.368	10.249	31.617
ÇATALCA - HADIMKÖY	12,1	25.711	11.904	37.615
HADIMKÖY - AVCILAR	6,0	41.611	16.645	58.256
AVCILAR - MAHMUTBEY	14,1	86.657	24.563	111.220
F. S. MEHMET KÖPRÜSÜ	1,0	163.463	45.260	208.722
BOĞAZİÇİ KÖPRÜSÜ	1,0	163.743	9.329	173.072
ÇAMLICA - SAMANDIRA	7,9	77.033	26.456	103.489
SAMANDIRA - KURTKÖY	12,1	53.581	24.966	78.567
KURTKÖY - ŞEKERPINARI	9,4	42.382	24.065	66.467
ŞEKERPINARI - GEBZE	10,2	29.247	16.357	47.604
GEBZE - DİL OVASI	6,2	33.045	20.659	53.704
DİL OVASI - BATI HEREKE	6,1	32.497	20.508	53.005
BATI HEREKE - DOĞU HEREKE	2,4	32.305	19.732	52.037
DOĞU HEREKE - KÖRFEZ	13,4	32.678	20.588	53.266
KÖRFEZ - BATI İZMİT	7,2	31.239	20.628	51.867
BATI İZMİT - KANDIRA	11,7	24.867	17.691	42.558
KANDIRA - DOĞU İZMİT	7,4	22.693	15.339	38.032
DOĞU İZMİT - SAPANCA	19,4	23.070	14.657	37.727
SAPANCA - ADAPAZARI	13,5	22.526	14.562	37.088

Source: 2006 Trafik Ve Ulaşım Bilgileri Strateji Geliştirme Daire Başkanlığı Ulaşım Ve Maliyet Etütleri Şubesi Müdürlüğü Temmuz-2007 s: 13

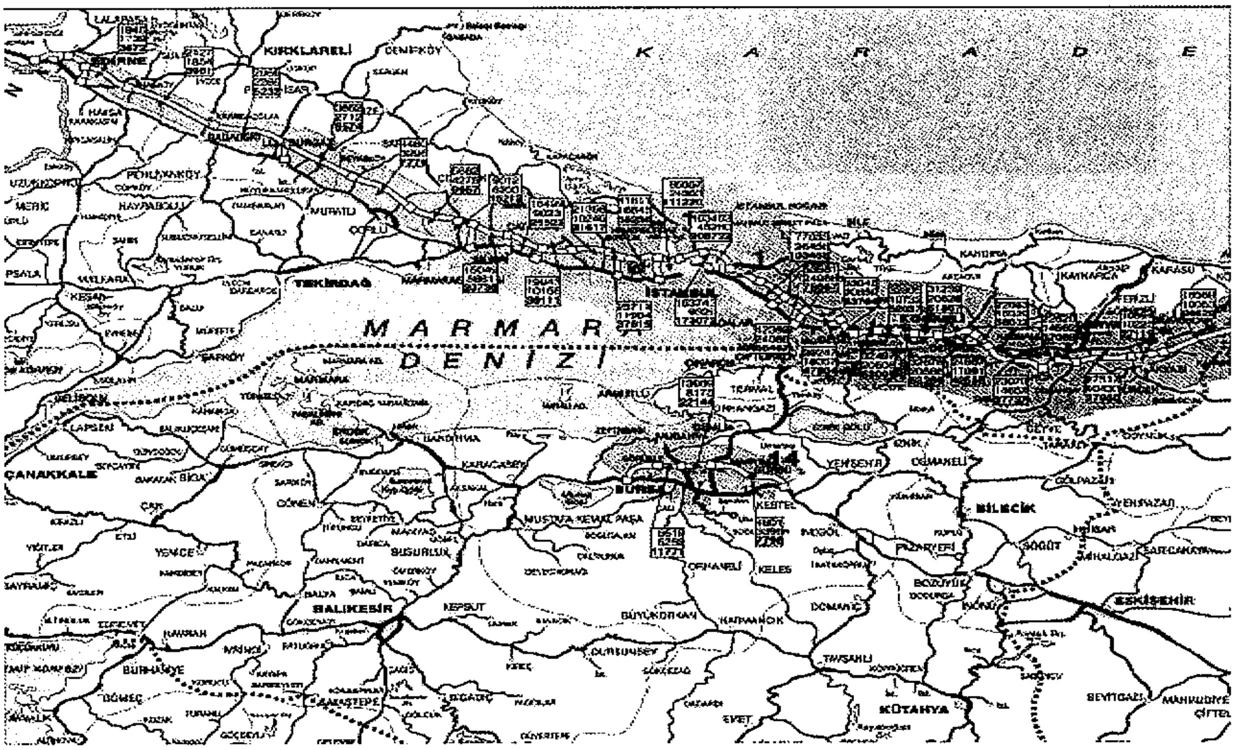

Figure: 2 Motorway and Traffic Values in Marmara Region, Source: 2006 Trafik Ve Ulaşım Bilgileri Strateji Geliştirme Daire Başkanlığı Ulaşım Ve Maliyet Etütleri Şubesi Müdürlüğü Temmuz-2007 s: 13

In addition that, D-100, D-110, D-555, D-200, D-575, D-130 and D-575 national highway are exist in Marmara region. All of the road crossed and connected in Istanbul. When we consider to critical points at national highways we can see tree important route for heavy traffic. Firstly Silivri- Küçükçekmece secondly Küçükçekmece –Topkapi other Kadiköy- Maltepe. Approximately, 24.000 vehicles pass between Silivri and Küçükçekmece per day. Averagely, 19.964 automobile, 2972 heavy and light vehicle pass from this route. According to statistical data of General Directorate of Highways of Turkey, per day when 63.207 vehicles pass from Kadiköy- Maltepe route. 10.138 of this figure are heavy and light vehicle.

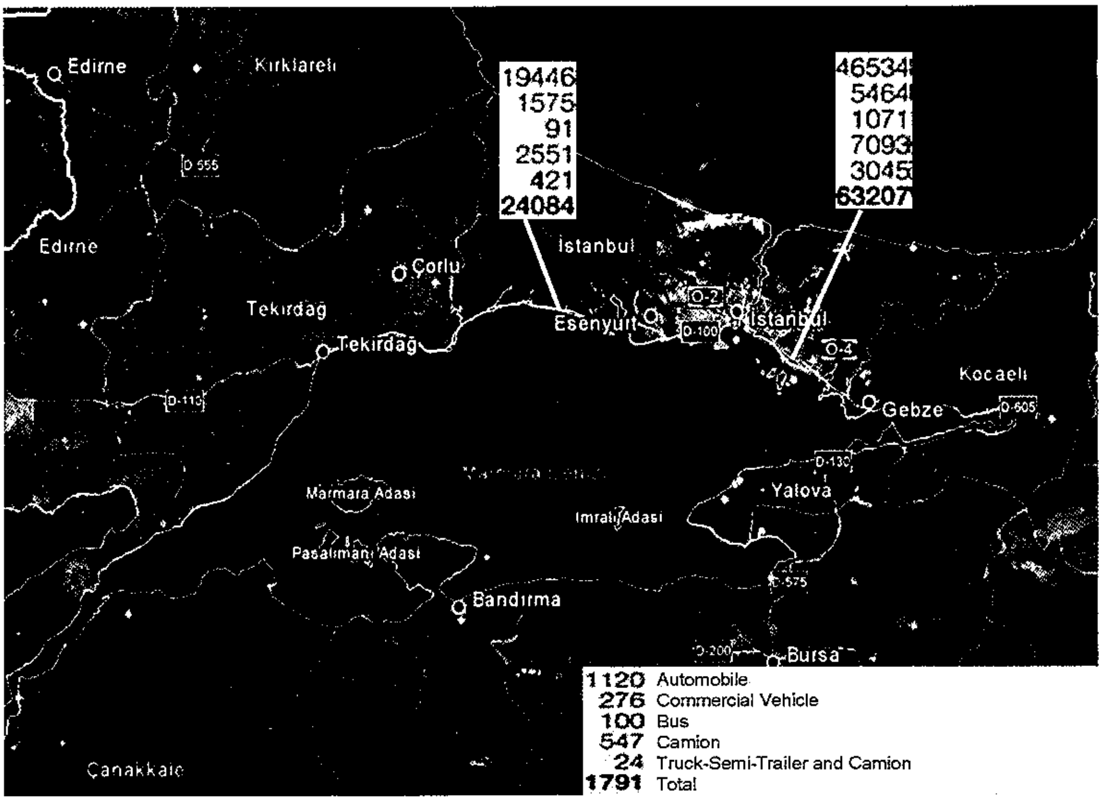

Figure: 3 According to statistical data of General Directorate of Highways of Turkey, heavy traffic is better than average in between Maltepe and Silivri.

2. Transportation Nodes in Marmara Region

Firstly, very important nodes of transportation and logistic system are industrial zones. Especially İkitelli Industrial Zone has importance for intermodal transportation and regional logistic system. This industrial zone has 700 hectare and 37 cooperative enterprises take place in İkitelli Industrial Zone. In addition that per day vehicles between 2000 and 3500 gives service to this industrial zone. Other important industrial zone is Dudullu Industrial Zone. Dudullu Industrial zone has formed from joining four Industrial zones as Factories Zone, Metal ware Industrial Zone of Istanbul (IMES), Ironworkers Industrial Zone (DES), Kadıköy Automotive Industrial Zone (KADOSAN). Averagely, between 800-1200 vehicles carriages goods in Dudullu Industrial Zones. Other important industrial zones are Tuzla Industrial Zone, Tuzla Leather Industrial Zone, Tuzla Paint Industrial Zone, Beylikdüzü Industrial Zone and Tuzla Marble Industrial Zone.

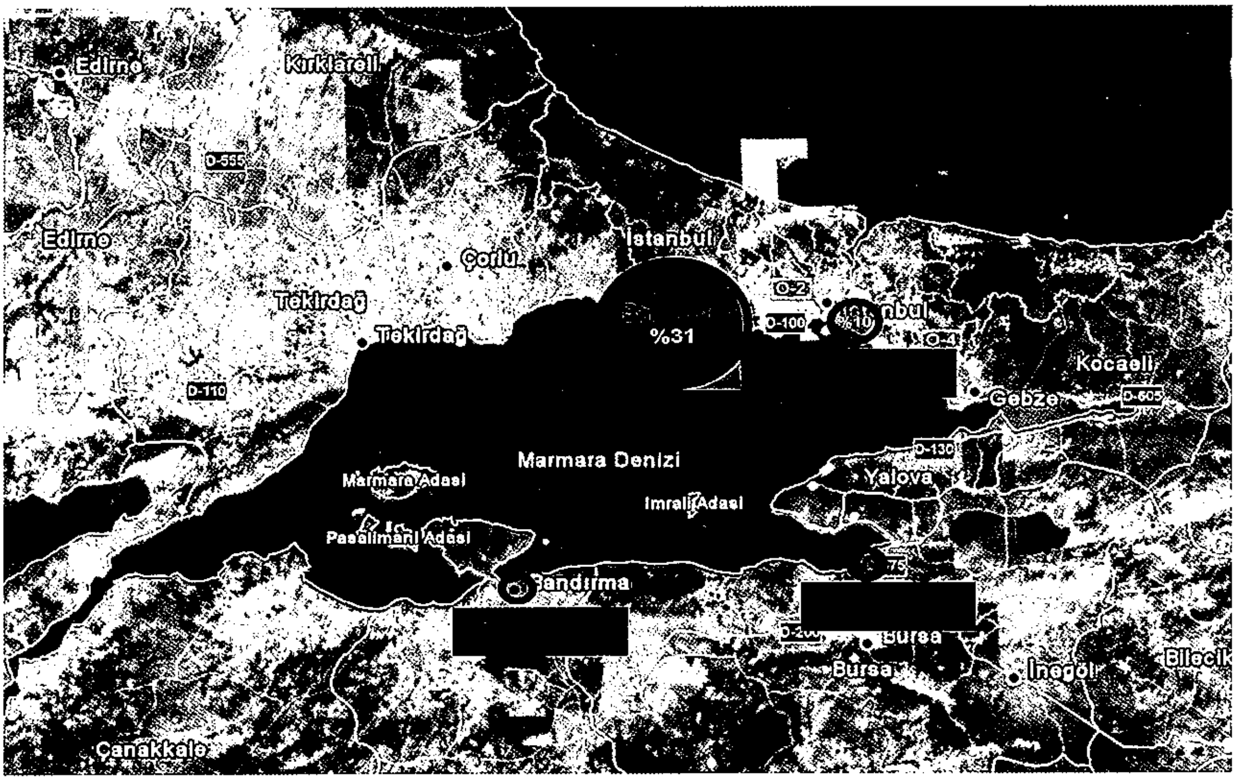

Figure: 4 Ports Marmara Region and Their shares on the Purpose of Total Handling

Other important nodes are Ports of Marmara region. Most important ports are Port of Haydarpaşa, Port of Ambarli, Port of Gemlik, Port of Bandırma. While Port of Haydarpaşa is public investment, other important ports are operated by private sector. 3.328.936 tones bulk cargoes and 316,982 TEU containers have been handled in Port of Haydarpaşa. At the same time, share of Port of Haydarpaşa is %10 (DPT: 2006:32) between other ports for the purposes of total handling. Share of Port of Ambarlı is %31 (DPT: 2006:33) on the compared with other ports. In the Port of Ambarlı, 945.840 container and 4.635.632 tones bulk cargoes have been handled. Port of Gemlik has %7 (DPT: 2006:36) on the purpose of total handling.

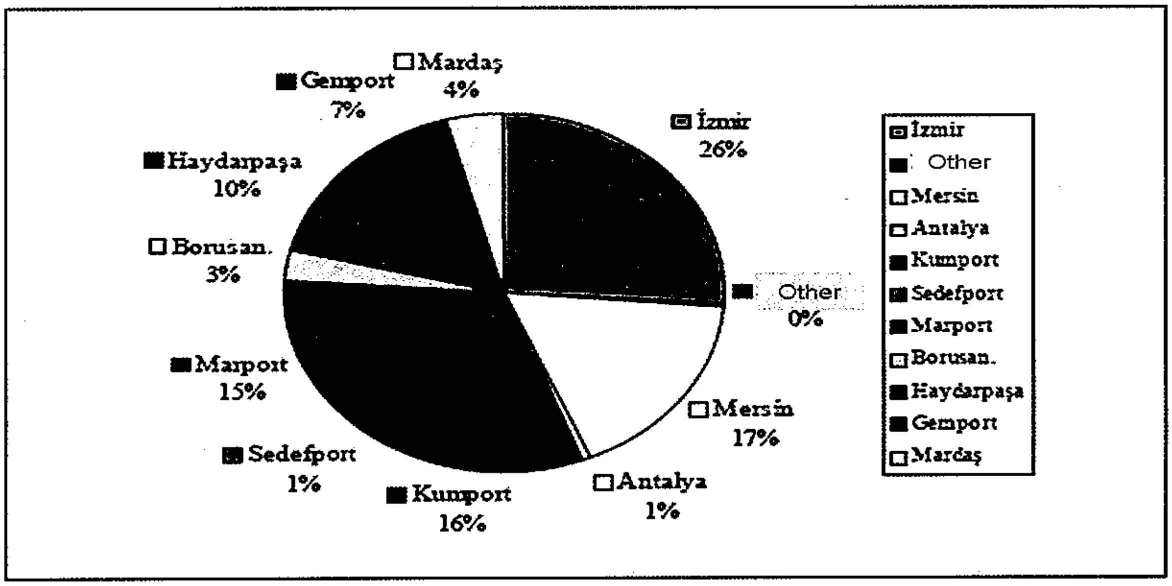

Figure: 4 Share of Ports of Marmara on the Purpose of Total Handling Source: 9th five-year development Plan, Report of Maritime specialized Commission, State Planning Organization p:33-36

Furthermore, while three airport show activity in Istanbul as Atatürk airport, Sabiha Gökçen airport and Çorlu airport, one airport is take place in Dardanelles. In addition that very important railway stations are exist in region as Halkali, Haydarpaşa, Bandırma railway stations. Food terminal as Rami, Erenköy and Mega Center with together 16 Customs and 424 customs warehouses are transportation nodes and they are take place in Marmara region.

3. Effective and Productive Using of Railways in Marmara Region.

Freight flows should be switch to railway transportation. Especially on the purpose of this, Marmaray Project will be play important role. After pm 12:00, freight transport will be done with Ro-La operations on this route. According to expectations, 20.000 road vehicles will transport on the open wagon from this route. However Gebze, Haydapaşa and Halkalı railway stations will play key role for success intermodal transport operations. Thanks to this, betterment on traffic of Istanbul can be providing approximately %6 at the same time, per road vehicles cause to 130 gram CO_2 emissions per kilometers (http://www.musiad.org.tr/abbulteni/musiad_turkiye_ab_bulteni_19.pdf) under the best conditions. Furthermore between Gebze and Halkali is 67 kilometer. Total CO_2 emission will reduce approximately 174.200 kilogram. Consequently, external negative impact of road transportation will be reducing with this project.

Before all else, Logistic and Freight villages should be built in Gebze, Halkalı and Haydapaşa. These logistic villages should be connected with Industrial Zones. Routine distributions should be done after pm 12:00 as foods, retails, and other materials.

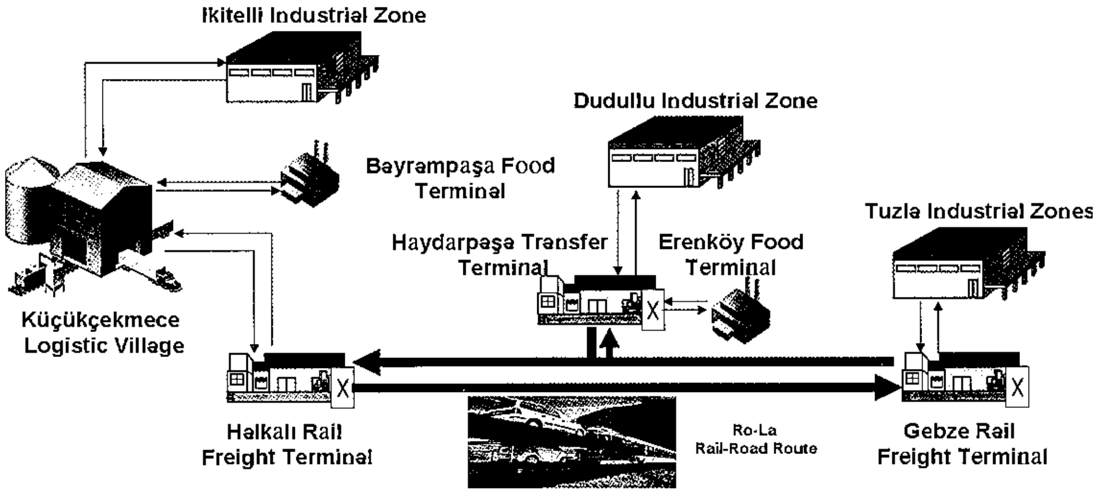

Figure: 5 Intermodal Transport Chain and Nodes of Transportation in Marmara Region

At the same time, in spite of that large quantitative of goods can be transported by railway, transportation cost can be reduced by transportation operators. Directly railway provides low transportation costs, indirectly environmental and social costs can be reduced with railway.

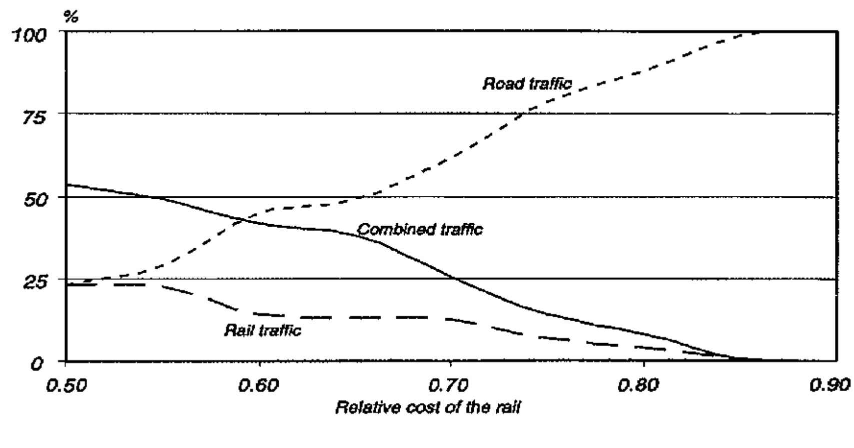

Figure: 6 Variation of the model share of the national traffic Source: Pierre Arnold, Dominique Peeters, Isabelle Thomas, "Modeling a rail/road intermodal transportation system" Transportation Research Part E 40 (2004) 255–270

Variation in the market shares of the different modes or combination of modes, the increase in the relative cost of rail also has a major impact on traffic distribution on the networks. Figure 6 presented the important changes in road traffic distribution when the relative cost increased by 10%. Besides a considerable increase in cross-border traffic and in the traffic converging on Istanbul, induced effects are observed on the entire Marmara Region network.

3. Using to Maritime Potentials of Marmara Region: Ro-Ro Lines

Per Diem, 350 heavy vehicles are carriage with Ro-Ro Lines from Ambarlı to Bandırma ports. Besides, eighty vehicles can be transported with Ro-Ro lines between Bandırma and Tekirdağ ports. Every day averagely, one thousand vehicles are transported between Eskihisar-Topçular by Istanbul Fast Ferries Co. (IDO). Under these conditions, Ro-Ro potentials of Marmara region don't use sufficiently. Present Ro-Ro lines should be developing and new Ro-Ro lines should be created by private and public sectors. Especially parallel lines to shore should be constituted between Mudanya, Ambarlı, Yalova, Haydarpaşa, Gemlik and Bandırma ports and these lines should circuit as can be seen below Figure: 7

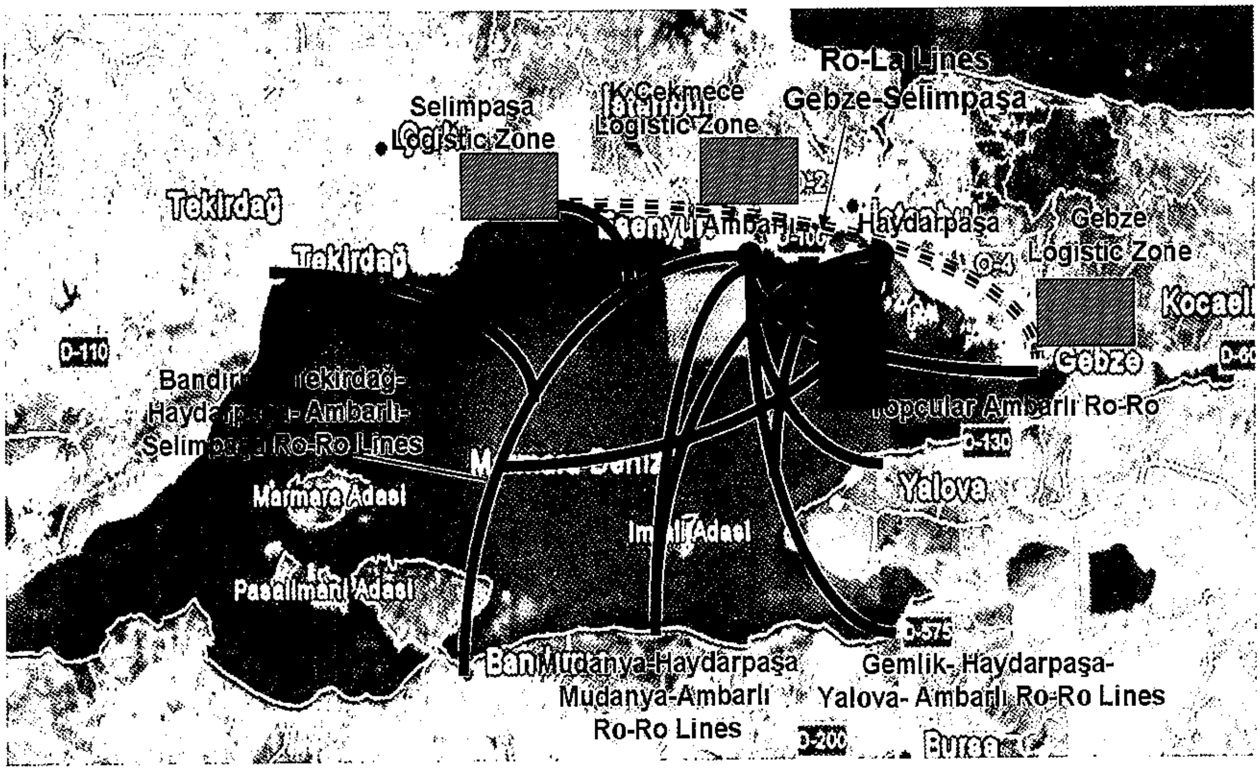

Figure: 7 Present and Propose Ro-Ro Lines

Thanks to these Ro-Ro lines, traffic may be reduced and transportation cost will be under the control. With the road transportation especially fuel cost are changed despite of differential traffic congestion. Thence transportation costs are fixed by Ro-Ro transportation to so traffic congestion doesn't discussed in Ro-Ro transportation. On the other hand related with environment and social negative external costs of road transportation are reduced by this transportation modes.

Ro-Ro lines should be planned and organized by authorized public administration. At the same time these lines should be scheduled. At least two direct lines should be constituted and eight circuit lines should be shown to activity between ports of Marmara. At the same time Ro-Ro system should connect with Logistic and freight villages.

4. Conclusion

Multimodal and combined transportation is should be alternative transportation modes to unimodal transportation especially road transportation mode. Therefore transportation terminals, freight villages and transportation nodes are important for effectiveness and productiveness of multimodal transportation modes. One of the most important problems are determining to location of transportation terminals and freight villages. On the other hand, problems of particular urgency are constitution Ro-Ro and Ro-La lines and their planning. If these problems solve optimally, economic competitiveness will provide however, multimodal transportation can be choice by transportation user. Put it differently, multimodal transportation will be advantageous as compared with road transportation.

At the same time, negative external impacts of road transportation will be reduced with the effective using of multimodal transportation system. With the effective Ro-Ro and Ro-La operations, traffic will be reduced between %10 and %25 approximately. On the other hand transportation speed will be increased with these strategies. Authors of this study proposed that, existent Ro-Ro lines should be reorganized and new lines should be adding this transportation process. Ro-La transportation network should be review by public authority and its transportation capacity should be increased. At least, three logistic and freight village should construct in Istanbul as Gebze, Küçükçekmece and Selimpaşa logistic zones. These each logistic village has 1200 hectare at least and Warehouses, depots, Custom, Handling area, Parking zones, offices of transportation firms and living quarters should take place in these logistic zones.

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DESIGN TO SUPPLY CHAIN: CENTRAL VERSUS DECENTRAL DECISION TAKING

Patricia Hurschler[1] and Roman Boutellier[2]

Abstract

An increasing number af campanies source and sell globally to recover their innovation investments faster and to reduce cost. In many cases, adaptations are necessary, either in the product or in the supply chain; sometimes both have to be redesigned.

This paper describes a basis for decision-making that helps managers ta deal with typical "going-global" challenges, in which redesign of their products and supply chains shauld be cansidered. A case study based classification of product design adaptation triggers versus management approaches is introduced. The integration af suppliers inta the design process helps to adapt the product to lacal pracurement and sales markets; but in many cases lacal decisians with suppliers boost cost and time needs. Product design adaptations for changed supply chains need to be considered as early as passible in the R&D process in order to excel a global purchasing and merchandising strategy.

Keywords: Supply Chain Redesign, Local Design Adaptations, Purchasing in Low Cost Countries, Classification

1. Introduction

Many product design adaptations originate from global sourcing and entrance to emerging markets. Literature on global sourcing provides the theoretical background of this paper. The value chain and transaction cost theories underlie as basis. This paper aims to classify product design adaptations and to discuss central versus decentral decision taking for such design adaptations. Product criteria are the basis for sourcing decisions; But by changing the sales or the procurement market, adaptations of the product criteria might occur. Therefore it is important that a company observes adaptations of the product and in the supply chain.

1.1 Low Cost Sourcing and Emerging Sales Markets

How to source globally has become a critical strategic decision for companies competing on a global basis. In today's market, globalization increases the number of competitors and forces companies to concentrate on their core competencies and contract non-core business from external providers (Dachs, et al., 2006). Outsourcing of components and parts is steadily increasing (Arnold, 2000; Lau and Zhang, 2006). Material costs often exceed direct labour costs; strategic purchasing becomes more important (Arnold, 1999). The expenses of direct and auxiliary material, bought products and external work of Georg Fischer for example, a leading industry company in the areas of automotive, piping systems and precision machinery, amounted to 48 percent in 2005, compared to 42 percent in 1999 (Boutellier and Hurschler, 2007: Chapter 12).

Today, companies sell their products worldwide and purchase globally, often in low cost countries. Especially the Far East and Eastern Europe play a major role in low cost sourcing for Western European companies, even though salaries are increasing: Between 2004 and 2007 by 30% in Bulgaria and Czech Republic and by 35% in China (Bloomberg, 2008). In March 2008 the average earnings of a Chinese amounted to 310 USD per month. Similar to the regional inhomogeneity in China, the Eastern European countries also differ in infrastructure, development, educational level, political stability and salaries: Average earnings in Czech Republic amounts to 430 USD per month in 2007 while in Bulgaria it amounts to 316 USD per month, which is quite similar to the salary in China (Bloomberg, 2008).

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The decision where to source which parts seems to be a critical question as companies aim to reduce costs. At the same time, quality and delivery time have to be considered, especially when sourcing in low cost countries. Therefore, the product has to be structured and designed suitable for globalization and on the basis of the company's technological core competence (Grosse-Heitmeyer, 2006).

Only few products are truly global products and even if its core remains the same, packaging or label are different: Products have to be adapted to the local market. And herewith companies try to find local suppliers for the local market. If protection of know-how is critical, core parts will have to be imported. To make a decision about the sourcing location for each part, a structured criteria based process is needed.

1.2 Theoretical Background

Michael Porter developed the concept of the value chain, which includes all high level strategic activities of a company (Porter, 1985). These activities are focused on the creation of competitive advantages (Porter, 1988). The supply chain is part of the value chain. Meixell and Gargeya conclude that "global supply chain models need to address the composite supply chain design problem by extending models to include both internal manufacturing and external supplier locations" (Meixell and Gargeya, 2005). Based on the customer needs, the decision and integration effort in supply chain design should be driven by the manufactured product, specifically, product characteristics and product life cycle (Wang, et al., 2004).

There are numerous publications on global sourcing (Matthyssens, et al., 2006). Some address the sourcing process (Matthyssens, et al., 2003; Quintens, et al., 2006; Zeng, 2003), some address the strategic buyer-supplier relationships (Oberoi and Khamba, 2005), and still others address specific sourcing activities (Ireton, 2007; Nassimbeni and Sartor, 2007; Salmi, 2006). In this paper, we adopt Trent and Monczka's definition: "Global sourcing involves proactively integrating and coordinating common items and materials, processes, designs, technologies, and suppliers across worldwide purchasing, engineering and operating locations" (Trent and Monczka, 2003)

In literature, few approaches about global versus local sourcing decisions are found (Woo-Tsong, et al., 2006). Global footprint design is a resultant term which considers the positioning of the value chain steps in a worldwide network (Schuh, et al., 2007); Own production plants in low cost countries are a central issue: Location management is becoming an important issue for globalized companies (Abele, et al., 2007; Wildemann and Baumgärtner, 2007). It has a big impact on taxes, delivery times, customer acceptance, and last but not least on complexity. There should be an alignment of the product design, the processes as well as the choice of location (Grauer, et al., 2007; Reinsch, et al., 2007).

Gelderman (Gelderman and Semeijn, 2006) uses Kraljic's purchasing portfolio approach, which classifies the purchasing items by supply risk and profit impact (leverage, non-critical, strategic and bottleneck items) for developing effective purchasing strategies and for managing a global supply base: The criteria are the number of suppliers and the purchasing volume.

Issues behind global sourcing may be accessed through the resource-based view and also the transaction cost view of the firm (Ettlie and Sethuraman, 2002). The transaction cost theory sees the economic organization as a contract problem and shows that global sourcing drives cost and time (Williamson and Williamson, 1985). Decision taking with suppliers, especially with foreign suppliers, always bears transaction costs which have to be considered in the total cost calculation (Ellram, 1995). Savings are a tradeoff between production and transaction costs. Hannon states that "dealing with overseas suppliers sometimes means adjusting metrics and digging a bit deeper into the reasons behind missed metrics" (Hannon, 2006).

1.3 Objectives and Methodology

The objective of this study was to classify design adaptations and to develop a concept on how to manage design and supply chain adaptations. The paper describes a basis for decision-making that helps managers to plan and deal with typical "going-global" challenges, in which redesign of their products and supply chains should be considered. It also shows which product criteria serve as a basis for sourcing decisions.

This paper introduces a case study based classification of product design adaptations and their management approach. The case study method was chosen for a number of reasons (Eisenhardt and Graebner, 2007; Siggelkow, 2007; Stake, 2006): Primary, because there was no research article found addressing this issue, but also because case study research is preferable when the research questions focus mainly on 'how' and 'why' questions. The questions in our research deal with exploratory issues, rather than quantitative and standardized issues.

Some examples, especially the tools in section 2.2, were gathered from presentations (Boutellier and Hurschler, 2007); To find criteria for sourcing decision and to deduce the classification, ten interviews with engineers and sourcing people were conducted. A detailed case analysis with one of our project partners[1] delivered extensive process insights and allowed to verify the triggers and management approaches within the classification.

The paper is structured as follows: First, product attributes and tools which are helpful for sourcing decision are presented in section two. Triggers of design adaptations are then discussed in section three. Section four highlights the management of design adaptations. The results of the analysis of the case studies are presented in a classification in section five, and finally section six provides a discussion and conclusions.

2. Important Product Attributes and Tools for Sourcing Decision

To make reasonable sourcing decisions, a company has to develop criteria and procedures. The analysis of different company decisions has shown that there are general and industry-specific product criteria which serve as a basis for sourcing decision. Some company examples even provide tools and explicit steps, which will be presented in the following sub-sections. The cases show that the product design and its criteria provide the basis for sourcing decisions. By changing the sales or the procurement market the product design and also decision-making will change. There is a loop between product criteria as basis for sourcing decision and product criteria adaptation according to changed sales or procurement market.

2.1 Product Criteria as a Basis

The design of a product, together with its purchasing volume, the complexity of its components and the supply chain of a product (lead time, customization) determine where a product can be sourced. Such criteria are similar in all industries. There are also some special parameters for specific industries, such as sewing minutes in the textile industry. Table 1 shows criteria which are decisive to whether a product can be sourced globally or should rather be sourced locally. Depending on the product and the industry, parameters and their values may differ.

Table 1: General and industry-specific product criteria for sourcing decision

General	*Industry-specific*
volume / lot size (critical no. of items)	raw materials (quality, location)
complexity (no. of product variants, bill of materials)	level of technology (process and product)
lead time / transport time	skills needed
level of customization	intellectual property
level of automation	quality (including reputation)
value added versus total costs	sewing minutes
	etc.

There are criteria which should be considered in combination with each other. If the product has medium complexity and high-volume for example, suppliers in Eastern Europe should rather be included in the evaluation process. Volume, lead time and number of variants, which correlates with level of customization, play a combined role for offshoring versus nearshoring (Figure 1).

[1] This study is part of the „Design Chain – Supply Chain – Management“ project financed by the CTI (Swiss Commission for Technology and Innovation) and carried out in collaboration with seven Swiss industry partners (www.dcscm.ethz.ch).

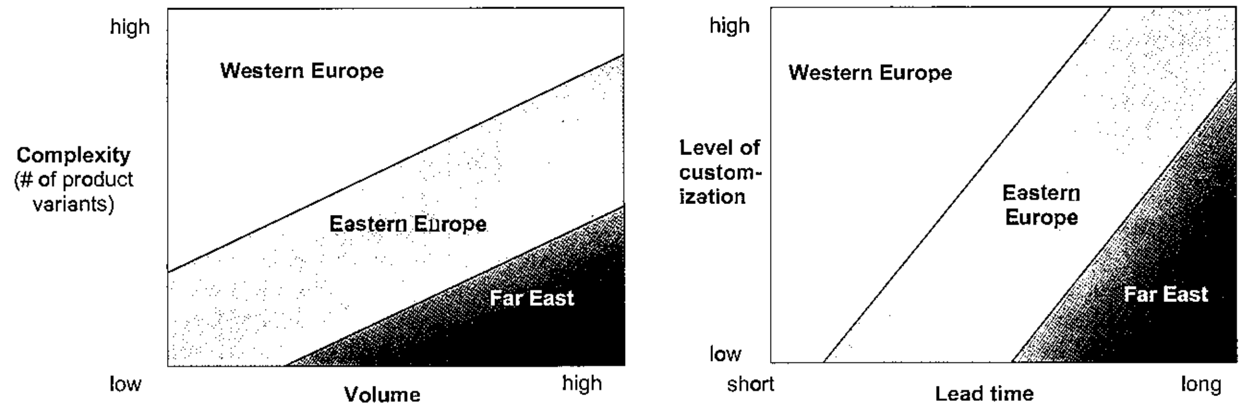

Figure 1: General decision criteria for offshoring versus nearshoring (used by several Western European OEMs).

Before evaluating suppliers and considering sourcing countries, the product and its markets have to be analyzed. Variants, strategic components and the purchasing volume are recorded in a purchasing portfolio. The analysis of this portfolio acts as the starting point for sourcing decisions. Helpful dimensions are volume, complexity, customization and lead time (Figure 1). Afterwards, tools and predefined procedures help to find the right sourcing location.

2.2 Tools and Steps

There are different ways to consider attributes of a product for the decision where to source components of this product. The various case studies contributed some pragmatic tools (Boutellier and Hurschler, 2007). The presented tools and steps point the importance up to start with a product analysis and foresee adaptations: Customer requirements, product criteria such as volume and basic production conditions may change as well as relocation of processes and supply chain modifications may become possible. The following four examples might be used as tools in different phases of sourcing decisions.

Product portfolio analysis

A product portfolio analysis provides a basis for sourcing decisions. The customer requirements decide what has to be made to order or can be made on stock. As the delivery time is set by customers and competition, companies must decide if the time needed for production and transportation is within the given time limit. For sourcing offshore, minimal volumes are required: In many cases this means one production location for the total volume. Some case studies recommend to start with simple and people-intensive products. Later, the complexity can be upgraded as far as the suppliers are skilled enough. The suppliers should be developed carefully. Disruptions or late deliveries can destroy reputation quickly. Technology and herewith protection of the company specific know-how should also be considered in the product portfolio analysis.

Strategic work-sharing

Cedes, a Swiss company for opto-electronic sensors with strong expansion and high degree of company-internal added value, has setup a subsidiary in China in 2001. By analyzing the technologies and product parts, especially material and labour costs and volume, Cedes splits the work between China and Switzerland: Products with high direct labour costs and high volume are suitable for production in China. To protect some of its products, it buys some company specific components in China, assembles in Switzerland and exports back to China.

Globalization of the value chain in four steps

Bosch Rexroth AG, a big German drive and control company, organizes the value chain globally. The applications are adapted locally. With a global value chain, the company benefits from local cost advantages. **The globalization of the value chain takes place in four** steps:

1. Export of finished products and sale through local distribution and service companies. These products serve standard customer requirements.
2. Setup of local Customizing-Functions: The products are adapted to local customer requirements.
3. Increase of the new business segment, localization of production and procurement.

4. Development of a global production- and R&D-network: Production plants work for their local markets and for export to other regions as well. Together they form a network with internal deliveries. Bosch Rexroth follows five principles in this global network:
   a. The plants are used at full capacity.
   b. All sub-suppliers deliver the same quality level worldwide. Every sub-supplier provides components, which can be used globally in Rexroth-products.
   c. From each plant a global supply is possible.
   d. Local solutions for local customers are the rule.
   e. All products are offered in all countries. Every product is supervised by a control plant. This plant is responsible for all engineering changes and upgrades.

Technology, automation, product- & process development

Some Western companies even think about relocation of processes back to their home country as soon as high volume, full-automated production becomes possible. Schurter AG, a Swiss family enterprise in the electronic industry, operating worldwide, develops the three scenarios "Technology", "Automation", and "Upgrades of Products and Processes" when a product is relocated back to its plant in Switzerland. As decision-basis for relocation, the company developed a so-called relocation-potential-matrix, which shows whether a product is easy, critical or impossible to relocate dependent on the technology phase, the possibility of automation and of the product and process development. As a second decision-basis, Schurter makes a cost-benefit analysis which evaluates twelve criteria, such as "market", "know-how", "expansion possibility" and "political risk" in a grading system.

3. Triggers for Design Adaptation

After having analyzed basic product criteria, design adaptations should further be considered for sourcing-decisions. There are global products, which can be sold worldwide without any modifications. In these cases, packaging will be adapted to local habits and languages. Pocket calculators, disks and textiles are such products. But often local markets ask for different specifications of a product. Either customer needs are different from a cultural point of view or local materials or producers entail diverse adaptations. It is important to first understand local markets and their requirements and suppliers and then adapt the product design. Procurement people should consider the skills of their suppliers and discuss adaptations in advance. Triggers for design adaptations change product criteria; Design adaptations entail different management approaches and therefore design adaptations should be considered in the sourcing decision process.

3.1 Sales Market

Products often differ from region to region, from market to market because the customers have different requirements and preferences: For example in the food industry tastes have to be adapted to local needs and to cultural habits. Design adaptations considering shape, color, materials, function, size, usability, and layout arise from the cultural education (Lay, 2001)

Product adaptations can be technical or design specific. Technical adaptations become necessary if regulations and standards differ, but also if the customer's needs request it in terms of functionality or cost. Different building technologies, electronic applications and regulations require technical adaptations. Similar with packaging: Some products are identical, but the packaging has to be different depending on the country it is sold in. Labels and instructions are in different languages, and even the product-name or brand may be different. For example, if a product is launched in China, the name of the product has to be adapted to the Chinese language: Chinese character trademarks focus on phonetic naming preferably with Chinese sound and should have a positive meaning, both in Mandarin and Cantonese dialect (Bauer, 2007).

Qualitative adaptations refer to materials, shapes and production processes which influence the life cycle of the product. Asian customers do not ask for the same quality level as European customers. Companies often divide their products in the three segments high, middle and low. High-end products are produced in Europe and then exported in small units to low-cost countries. Low-end products have to be produced locally, often by local companies, because foreign companies are too expensive. They are sold in bigger volumes. Middle-ranged products are generally produced locally by foreign companies with some parts still coming from the home country: Sometimes European companies are able to compete on this technology and price level.

3.2 Procurement Market

When comparing products in different regions of the world, some adaptations can be observed, whereas others are imperceptible. Some adaptations don't catch anybody's eye because they are made inside the product. This is the case if components are adapted because the raw material is not available or because some processes are not used in the local production: Semi-automation replaces full automation. For example in the electronics industry, processes in Europe are designed for full automation whereas in China a lot more hand soldered connections are in place. Suppliers in low cost countries use different processes and have different commitment to quality and therefore local suppliers adapt the product marginally. Big companies have their own subsidiaries in low cost countries and often transfer products. At the beginning of the transfer, difficult parts are still produced at home and later these parts are transferred stepwise, eventually with adaptations. In these cases, the trigger for design adaptation is not the sales market but the procurement market. In the early nineties, Leica had to adapt its telescopes because some glasses were not available in China.

Often companies work with worldwide platforms and adapt components locally. Design adaptations should be considered in the early stage of a platform design, so that the interfaces are robust enough to survive these component adjustments. Procurement managers are crucial in the early stage of design processes because they know what the local suppliers will be able to deliver.

4. Management of Design Adaptations

The management approach for any design adaptation depends on its trigger. If the sales market triggers a product adaptation, the specification sheet of a product will be changed by engineers with the input from local sales people. In contrast, if processes and products have to be changed to suit the suppliers' skills, an adaptation often arises from the suppliers' side in agreement with the own company's engineers. The difference in these two approaches is that in the first case engineers work together with internal sales people. In the other case, engineers work closely with a supplier's employee. Dependent on the nature of adaptation central decision-taking is possible or local decisions are required.

For some design adaptations, close collaboration with local experts and therefore decentral decision-taking is necessary. It is difficult to integrate cultural aspects into a product, centrally from the home country. Therefore such design adaptations have to be managed in cooperation with suppliers or the subsidiaries in the countries. Production processes influence the design of the product. If the supplier does not master a technology, the product design has to be adapted to the production process of the supplier. Such adaptations are managed locally together because product and process have to be adjusted.

In contrast, if the adaptations are made by the supplier because he substitutes a material or optimizes it, then the supplier himself proposes a solution for adaptation. A company can agree such adaptations centrally from another country. Also, for adaptations of standards and norms, local specifications are clear and can be understood and managed centrally from home. A more delicate question arises when expensive standards exist on paper only and are not enforced by authorities.

To correctly manage design adaptations, it is important to understand the trigger and to know whom to involve. Some adaptations demand a clear process which should be managed centrally. Some adaptations, however, demand decentralized decision taking and the development department has to involve market-specific know-how.

5. Classification

The triggers for design adaptation and the corresponding management approaches result in a classification: Four generic approaches to an educated decision for adaptations.

Management Approach		
Decentralized Decisions	Process Adaptations Product Redesign ***Conformation***	Cultural Adaptations ***Segmentation***
Centralized Decisions	"Optimization" by Supplier ***Selection***	Standards, Norms, Packaging ***Localization***
	Procurement Market	Sales Market

Trigger for Product Design Adaptation

Figure 3: Classification of design adaptations: Management of different situations.

Localization

Standards, norms, language and instruction manuals have to be adapted to the countries in which the products are sold. If possible, country-specific configurations are applied as late as possible in the supply cbain.

In the "Localization" process, packaging plays an important role. For example, Toblerone, a Swiss chocolate manufacturer, produces all its cbocolate in Switzerland and for the worldwide sales market the chocolate is packaged in different boxes. Gillette Mach 3 is a global product, as is milk. In both cases packaging differs widely from country to country.

These local adaptations are easy to manage, centralized decisions are possible. The requirements are well known and documented. Therefore hardly any collaboration with local experts is necessary. The localization of the product design can be managed centrally from the country in which the product has been developed.

Segmentation

If the adaptation for the sales market is not only driven by country-specific norms and standards, but because behaviour and requirements of customers are different, then the sales market needs an additional segment. The product usually sold in Europe will be adapted to Asian-specific requirements. For example, the taste preference of Asian people differs, therefore Hiestand, a Swiss vendor of refrigerated baked goods, sells sweet croissants in Japan.

When products are transferred to other sales markets, a segmentation of the technology level can often be observed, especially in Asian markets. These customers want the same product but a different technological level. For lower technology, some core parts are not produced in the low cost country, because of the intellectual property protection. AgieCharmilles, for example, developed a technologically mid-ranged spark-erosion machine for the Asian market[1]: Some parts are produced locally on a lower technological level; the proprietary software is still produced in Switzerland.

To understand the cultural differences and the country-specific requirements, local engineers and sales men should be involved in tbe product development process. Sometimes integration of customers in the design process might give useful design ideas. Therefore, the adaptation of the product has to be managed in cooperation with locals and decentralized decisions are preferable.

Selection

If the product is procured in another country, suppliers often selectively adapt some parts or details of the product. The adaptations are necessary because the supplier uses different production processes and machines. His technological level is different and he is not able to fulfill the specifications. The adaptations from the supplier's side have to be approved by the original producer.

Such adaptations are necessary if the product is procured in a low cost country. Often the end user does not notice the adaptation. From the supplier's point of view, the design is optimized to its skills and production process. The supplier makes a selection of the parts and processes he needs to adapt. After the proposal of the supplier, the development department accepts or refuses the adaptation. For example, nickel plating is a difficult process, especially in terms of cleanliness. Therefore, a Chinese supplier added a copper layer, with the consequence that the surface became too soft and by tightening the screw's surface was damaged. The company accepted the copper layer but on condition of a maximum thickness so that the surface will be strong enough. Such adaptations can be managed from the central development department; the collaboration is marginal because the suppliers propose the adaptations and the development department approves the adaptations, provided the specifications are clearly wrote down on blue prints. But even a perfect blue print does not contain all specifications. There always is tacit knowledge involved. This results in a drawback that too many companies start with selective adaptations and only become aware of the differences after failures occur.

Conformation

Some products are intentionally designed for the production in a low cost country. Processes are adapted to the local process advantages, such as manual work in low cost countries. Or the design of a product is changed in favour of lower cost. The product design conforms to the procurement market. These process and product adaptations are made in cooperation of the development department with the local supplier or development department of the subsidiary. Often such conformations are not an adaptation of an existing product design but rather a redesign of an existing product. To integrate advantages and possibilities of procurement markets into the design of a product, local development people have to be involved in the early stage of the development process. Therefore, local presence is necessary and such process adaptations and product changes should be decided decentral. For example, products which are transferred have to be redesigned in collaboration with the development engineers at home and engineers of the subsidiary in the low cost country.

[1] http://www.agie-charmilles.com/Actspark.1665..html

6. Discussion and Conclusion

If a company is expanding into new markets, either for sales or for purchasing, the supply chain changes, and design adaptations become necessary. Depending on the trigger for the design adaptation and on the intended impact, the adaptation process can either be managed centrally or decentral with local experts. The presented classification of design adaptations helps companies to be aware of different situations and thus to manage adaptations efficiently. Decentral decisions require collaborative projects and are more time consuming than central managed processes, according to the transaction cost theory.

On the procurement side it is important to know whether the supplier proposes adaptations by himself or if processes and product specification adaptations have to be considered in advance. Referring to this classification, suppliers are selected and treated differently: Competences should be exchanged with the supplier in case of collaboration, on the other hand, a company has to be careful to protect its know-how from piracy.

For product and process adaptations which occur because of different cultural reasons, close collaboration with the supplier or the engineers from the subsidiary is necessary as only local people know the details of their shop floor and which features of a product are crucial for the local market. Some product adaptations require decentral teamwork.

More and more companies evaluate the possibility of sourcing in low cost countries. Product criteria allow a first rough decision about the sourcing location, especially the decision to source offshore or nearshore. Some criteria, such as lead time or low volumes make it unreasonable to source in Far East. For sourcing decisions it is important to analyze the product and its supply chain. The design of a product is the starting point for sourcing decision and at the same time an element to be considered permanently; adaptations should be foreseen.

For West European companies Eastern Europe also offers low cost sourcing partners. The main difference to the countries in Far East is the distance – geographically as well as culturally. If lead time is crucial, suppliers in Eastern Europe are often preferred to Asian suppliers.

Whereas big international companies build up a global network with own distribution companies and subsidiaries in many countries, small and medium sized enterprises have to get information from outside. Big companies manage "Localization" and "Selection"-adaptations either central or from their subsidiaries in foreign countries, while smaller companies do not have an own subsidiary and manage these kind of adaptations rather centrally from their home base. "Segmentation" and "Conformation" require decentralized decisions. Big companies often get their decisions decentral together with their subsidiaries while for smaller companies "Segmentation" and "Conformation" is quite difficult to manage except if the company has a very well established supplier-relationship so that it can closely collaborate together with the local supplier. However, local presence is needed and therefore without subsidiary in the country, it is time-consuming. The relationship with the supplier has to be built up before it becomes a closer partner. Hilb (Hilb, 2008) introduced the concept of „Glocal“: Multi-cultural similarities are emphasized as well as multi-cultural differences have to be respected. Design within the supply chain is critical as it is important that all supply chain participants understand their role within the design process. Sometimes, decisions can be achieved centrally; sometimes decentral decisions have to be made with all their acceptance problems in our ethnocentric R&D-cultures.

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DIFFICULTIES OF DESIGN TRANSFER IN CULTURAL CONTEXT AS A CASE OF MANAGEMENT OF GLOBAL VALUE CHAIN THROUGH INTEGRATION

Arif Özver Ergin[1]

Abstract

Cultural &Socio-Economical potentials of different countries allow challenging opportunities especially through globalization in marketing, design, production and service industries. The design transfer is the contemporary way of integrating these potentials. However in the particular domain of new product development, cultural features, user expectations &needs keep their dominancy. When the innovation &evaluation and design &quality cycles neglected, ultimate course of the design transfer would be disappointing.

Keywords: Design Transfer, Management of Global Value Chain through Integration

1. Introduction

Recently the new product development has been divided into various stages through cultural &socio-economical context. For example, the theoretical studies are being done in the country A, market research is being done in the country B, product is being designed in the country D, produced in the country C and marketed in the country F. This is mainly because different countries, lets say different cultural and socio-economic structures, have rewarding potentials for each single product development stage. The design transfer is the way of allocating and integrating various potentials from product development to market launch stages. Nevertheless there are also some risks of the design transfer in cultural and socio-economic contexts for a successful product development.

In this paper, new product development and design transfer background will be reviewed first. Then the case of a design transfer through new product development will be examined. Lastly the present material will be summarized and main elements for a successful design transfer will be advised.

2. Conceptual Framework

2.1. New Product Development

An invention generally aims to satisfy a certain need and/or in order to solve a particular problem. However the initial stage of invention is far from satisfying its ultimate expectations. Therefore cyclic innovations and user &customer interactions play an important role for the new product development.

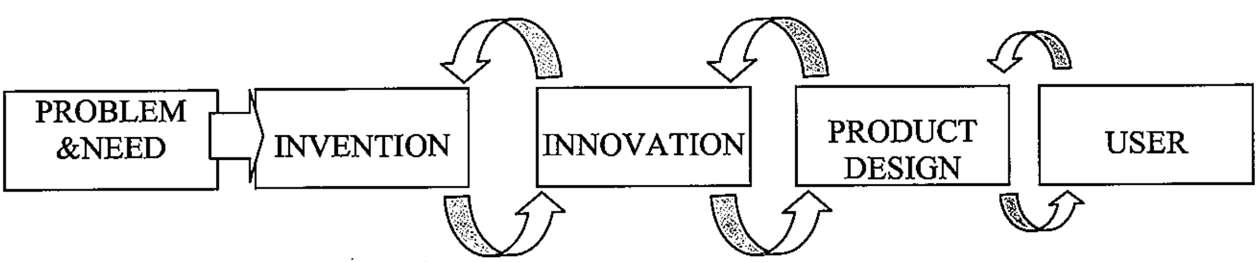

Figure 1. New Product Development Stages

The emergence of the prototype is the first step of new product development. The prototype aims to visualize and materialize the invention and validate proposition in terms of user satisfaction and completion of the need, (Er &Ergin, 2001):

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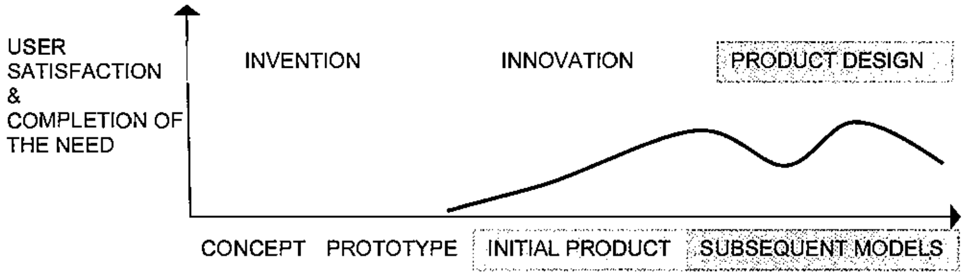


Figure 2. New Product Development Stages versus user satisfaction &need completion.

Cyclic progress of innovation &evaluation takes place in the core of new product development. Unforeseen problems of the invention determined through prototype evaluation.

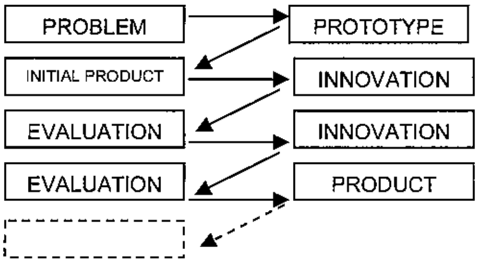


Figure 3. New Product Development Cycles

2.2. Design Transfer

Through the globalization; products, goods, raw materials, human, know-how, knowledge, money, technology, etc have been flowing through cultural and socio-economic boundaries. In the Wikipedia the Design Transfer defined as the process in which the New Product Design is translated into Quality, Production, Distribution and Installation specifications. Zenner, underlined that design transfer is an integral process in the early life of a product. It must be well executed, especially for complex devices, (Zenner, 2001). Satisfactorily design transfer steps are:

- Establish and maintain procedures to ensure that the device design—its components and configuration—is correctly translated into production specifications.
- Transfer the product design into production methods and procedures.
- Create a production environment that ensures the product complies with regulatory requirements and industry standards

2.3. Problems in Design Transfer

The design transfer may not be necessarily about a finished &complete process. The new product development process may also be transferred through cultural and socio-economic boundaries. For example problem &need can be defined prototype be developed and the product be innovated in the same cultural context, then the combination of these steps can be transferred to an other cultural context and finalized there.

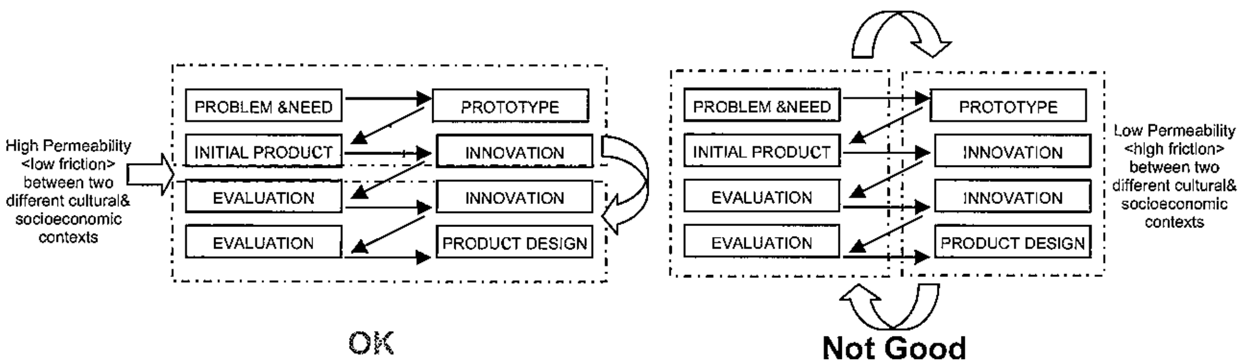


Figure 4. Design Transfer Matrixes

Zinner underlined that the effectiveness of the best-conceived design transfer process will be diminished if it is not properly supported and carried out. He claimed some of the common problems in design transfer as follows, (Zinner, 2001):

- Product developers do not have a finalized design.
- Business managers and technical experts do not grasp the scope of the design transfer effort and underestimate the amount of time and effort required.
- Manufacturing processes have not been developed, documented, or validated.
- Developers bring unresolved cost, reliability, or safety issues to the manufacturer.
- The design transfer process is well understood by both parties, but the inability to plan the transition of a product design into a controlled manufacturing environment results in slow starts and unacceptable delays.
- The workflow of the manufacturing organization is disrupted by having to wait for released materials, procedures, and test fixtures.

3.1. The Case of a Home Appliance

This study mainly relies on studies about a home appliance. This appliance was developed to overcome difficulties of mixing soups and puddings during cooking. This saucepan stirrer is specially designed to be hands-free so one can work on other kitchen tasks while soups are on the stovetop. The adjustable arms unfold to fit any saucepan from various diameters. When it is not in use, it folds easily to be stored in your utensil drawer.

In the new product development endeavor, firstly patent examination completed. It was found that there was no related product record in the patent literature. After the patent survey the first prototype was developed in 1996 and the second prototype was remodeled in 1997. The appliance was studied as an ergonomics case in the Industrial Design Department of the Middle East Technical University. Based on these research findings, a paper explaining the implementation of the usability analysis on the case of a new product development was issued, (Ergin, 2000b). In this study it was underlined the current prototypes are not satisfactory to meet customer needs &expectations of Turkish people. It was concluded that setting of the stirrer to the pot and cleaning of the appliance was very difficult therefore prototype should be improved, (Ergin, 2000b).

At the same time a US company interested in the appliance. The company was informed about the prototypes, utility model application and research results. However the company contented to the immature product because of commercial expectations.

The company developed the production dies, usage manuals, packaging, etc based on the latest but incomplete level of the stirrer in very short period of time. In 2003 the product, Stirchef, lunched in the US market. Nevertheless Stirchef never marketed in the Turkish market because of present deficiencies. . Table 1 summarizes the development of the stirrer in two different contexts.

Dramatically US customers buying and using the Stirchef were completely unsatisfied. They were unhappy mainly because the appliance doest fit to present pots. They were also concerned about the quality of the product. Figure 5 samples US customer opinions about Stirchef based on Amazon. Contrarily, people attended to usability analysis in Turkish market were concerned about the usage and cleaning of the prototypes.

Figure 5. Customer Experience (based on Amozon):

A Stirring Experience, February 22, 2005
By A. Consumer - See all my reviews

After visiting six stores and searching the internet, I finally found a deep saucepan with an 8 1/2 inch diameter to handle the not very long arms of the StirChef. Attaching the StirChef to my new 4qt saucepan, I turned it on to stir some chopped vegetables for 10 minutes at low heat. After about 4 minutes the flimsy plastic blades began to melt, adding an interesting but unwanted taste to the vegetables. Well, at least I have a nice new saucepan. Comment | Permalink | Was this review helpful to you? (Report this)

Nice idea but worthless, December 27, 2005
By Brynn Fraser (USA) - See all my reviews

The first thing I made was a marinara sauce, on the lowest possible heat setting. First, the intermittent setting does not work, it continues to stir constantly. Second, within just a few minutes of use, the plastic began to melt and stain beyond recognition. I attempted to contact the manufacturer via the weblink listed on the box, and guess what? It took me to a LAN/Wan support site. I wonder where they went? I emphatically DO NOT recommend this item! Not worth the cost of the batteries! Comment | Permalink | Was this review helpful to you? (Report this)

Worse than useless., December 24, 2007
By Michael Selby

I sepent one dollar on this at a thrift shop and I still feel like I was ripped off. It is no surprise they are already out of business. The thing doesn't even fit on all but one of my saucepans.

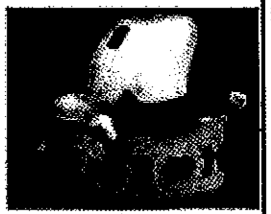
As a result, Stirchef has been an unsuccessful product to meet customer needs and expectations. Obviously it was also a commercial failure. When we look at the main reasons of the failure we can see that incompletion of the prototypes was the first link of the failure. From the beginning, the company should have trusted previous usability analysis and research findings, (Ergin, 2000b). Then it should have carried out similar inquiries for the intended market where customer expectations are different. Nevertheless none of the customer expectations could be reflected to subsequent models. Stirchef has halted at the stage of invention and could not be innovated. Product quality also played secondary role in the failure. As glue integrating design &innovation &marketing, the quality of the Stirchef was also inadequate which effected customer feelings directly.

4. Conclusion

Cultural &Socio-Economical potentials of different countries allow challenging opportunities especially through globalization in marketing, design, production and service industries. The design transfer is the contemporary way of integrating these potentials. However in the particular domain of new product development; cultural features, user expectations &needs keep their dominancy. When the innovation &evaluation and design &quality cycles neglected, ultimate course of the design transfer would be disappointing

A product can be developed and manufactured in different countries for economic or technical reasons. Nevertheless, it should always be designed for the intended users with respect to their particular cultural/social context. Thus, even if a product idea originated elsewhere, before its introduction to a country, it should first be used as a prototype to test its suitability to the particular context. Such a correctly executed design process should prevent most of the cultural and practical misfits described in this paper.

Table 1. The case of new kitchen appliance development

	NEED & PROBLEM	MARKET STUDY	1.ST PROTOTYPE	2.ST PROTOTYPE	INITIAL PRODUCT	MARKET EVALUATION
TURKISH CONTEXT	- Stearring Soups and Puddings during cooking time consuming, tiring &boring.	- No relevant Product in the market - No Patent about relevant appaliance	 - Cleaning - Clamping - Storage conceins.	 INNOVATION: - Ease for filling - Ease for charging - Ease for cleaning		NO LAUNCH - Usage difficulties - Cleaning difficulties.
US CONTEXT	Save time and extend the life of your cookware. Use it for any dish that calls for continuous or occasional stirring, including puddings, pasta, chili, rice and gravy.	- No relevant Product in the market - No Patent about relevant appaliance		X		Customer Reviews 5 star (1) 1 star (2) Average Customer Review

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Er, Ö. and Ergin, A. Ö., 2000. *Product Innovation in the Turkish Manufacturing Industry: The Case of a Medium Sized Electrical Home Appliance Company.* ERC/METU International Conference in Economics IV Proceedings and Conference CD-ROM, ***13-16 September 2000, Ankara***

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http://www.amazon.com/review/product/B0000TPBYG/ref=dp_top_cm_cr_acr_txt?%5Fencoding=UTF8&showViewpoints=1

http://en.wikipedia.org/wiki/Design_history_file

http://pcsiwa12.rett.polimi.it/~phddi/uk/01/dpr00/syno/272.htm

CONSTRAINED CREATIVITY: INFLUENTAL DYNAMICS BEHIND FASHION DESIGN

Deniz Atik[1] and Deniz Türsel Eliiyi[2]

Abstract

This paper aims to lay out the influential dynamics behind fashion design, integrating the constraining forces on creativity both within and outside the company. The study offers a conceptual framework of these forces, supported by examples from a Turkish fasbion firm. The leading sources of constraints for the creative process emanate from the internal dynamics of a company such as the cost of production of the design. Other factors may include the firm's image, production capabilities of the firm and its suppliers, capacity considerations, availability of raw materials or subcontracted accessories, and the constraints imposed by the whole supply chain. Trend fairs, seminars, magazines, and creations of other firms are also studied before starting a design, and these form the extemal dynamics. Furthermore, creativity cannot be isolated from sales performance, as consumers' and producers' interests are higbly embedded in one another. In summary, commercial creativity such as fashion design does not have the complete freedom of expression as in the case of artistic creativity since its purpose lies in its ability to satisfy botb the market needs and the firm's objectives.

Keywords: Fashion, Design, Creativity, Constraints

I. Introduction

The purpose of artistic creativity is not to satisfy the needs of a mass market. Artistic creativity is above all the means througb which artists express themselves. Commercial creativity, on the other hand, does not have this freedom of expression. This is because its purpose is to acbieve another subject's objective, the firm. The firm's reason for existence lies in its ability to satisfy market needs (Saviolo & Testa, 2002: 23).

As it can be synthesized from the above statement of Saviolo & Testa (2002: 23), creativity in fashion design is far from free since it has to satisfy botb the firm's and market's needs. Designers' artistic freedom is constrained by forces both within and outside the company. This paper aims to lay out these different influential dynamics behind fashion design, on one hand highlighting the interactions between production, design, and marketing departments, and on the other hand external interactions from broader forces outside the company.

To start with, when we look at the fashion cycle, at the invention pbase of fashion, the sources and circumstances of creativity are not very much different from those obtained in the arts generally; designers, especially those aspiring to international reputation, take pride in being thought of as original and innovative (Davis, 1992: 125). Where designers get their ideas from is anywhere and everywhere. Designers have been known to consult books of costume history for ideas, as well as to borrow from their own earlier work and that of others, and they are usually in close contact with leading creative and progressive elements in the arts, sciences, politics, and culture generally (e.g. Davis, 1992; McCracken, 1988). However, a strongly institutionalized motive is in place as the key players of the fasbion world like the fashion press, sustain and reinforce the designer's quest for originality; also, the massiveness and demand constancy of the apparel market, along with heavy fixed capital investments in clothing manufacturing and distribution, restrain the creativity of designers more than in other arts (Davis, 1992; Saviolo & Testa, 2002).

In the introduction phase of new collections, not all creations make it to the fall and spring openings where typically new fashions are introduced. The social construction of seasons, competition among designers and fashion centers, the fashion choices of buyers for big department stores, the fashion press, and the merchandising strategies, they all have a great deal to do with bow fashion happens (Davis, 1992; Saviolo & Testa, 2002). By the time the new collections are displayed to the public, they have already gone through an extensive filtering process; "more gestures are arrested than completed, and more ideas are abandoned than kept (Davis 1992:

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136)." How the crafts, skills, and talents are coordinated and integrated have a great role in the introduction of a new fashion and on the reception it receives (Saviolo & Testa, 2002). These tasks devolve upon the management of the fashion house rather than on the designer per se. As with cuisine, where the culinary talent of the chef hardly guarantees the success of the restaurant, so it is for fashion (Davis, 1992: 137).

Moreover, once a fashion is presented to large department store chains along with members of the international press, there follows a period of uncertainty, in which interested parties attend closely whether key persons adopt the fashion. In fact, if an innovation does not diffuse to larger market segments, it is not likely to become a trend (Solomon, Bamossy, & Askegaard, 2002). During the acceptance stage, new fashion enjoys increased social visibility and acceptance by the larger segments of the population. However, rarely, a new season's popular fashion is a dramatic departure from the past. The average consumer seldom accepts new styles that are radically different from what they are already wearing. For many of us, style changes occur relatively slowly; it is evolutionary rather than revolutionary (Davis 1992); thus, producers decisions are closely linked to the sales performance in the larger market segments. Finally, at the regression phase, the fashion trend reaches a state of social saturation as it becomes overused, and eventually it sinks into decline and obsolescence as a successive fashion starts taking its place (Davis, 1992; Solomon, Bamossy, & Askegaard, 2002).

Those involved in this complex process (of fashion) include fashion designers (independents, or those operating within a fashion-house or industry, or retailers), producers (of semi-finished or finished products), distributors, retailers, mass media, research and trend institutes (including fairs), consumers (opinion and market leaders), product category associations, banks, and government (Saviolo and Testa, 2002).

As Saviolo & Testa (2002: 13) nicely summarizes above the different actors involved in the making fashion, in the following sections, we aim to take a deeper look at these different influences constraining designers' creativity. Furthermore, we hope to offer a conceptual framework of these different dynamics with the help of our observations and findings in a Turkish Fashion Company, which will be deemed as Company X throughout the text out of confidentiality principle.

Company X, founded in 1987, ranking since then among the top 500 large industrial firms of Turkey, produces casual and sports wear from woven and knitted fabric. It has customers such as Adidas, Diesel, Guess, D&G, Marks& Spencer, and Zara. The company decided to create its own brand in 1997, offering its first collection. This brand meets its customers through 25 stores in Turkey and 70 points both at home and abroad, targeting middle-class female and male consumers between the ages of 18 – 25. The theoretical arguments made through the text will be supported by examples from this company.

In the following sections, different categories of the factors affecting the creative process in fashion design will be identified.

2. Influential Dynamics behind Fashion Design

As synthesized from literature and our observations in the case of a Turkish Fashion Company, the influential dynamics behind fashion design can be grouped in three main sections as the institutional influences, influences from socio-cultural context, and the influences from consumers. In the next sections, we analyze these influences in more detail.

2.1 Institutional Influences

The institutional influences represent the effects/constraints imposed by the company itself, or other stakeholder companies. The stakeholders may be competitors, suppliers, or even customer firms. Hence, the influences can be divided in two sub-sections as the influences from within and outside the company. We present these in the next two subsections. We provide examples from the observed firm whenever appropriate.

2.2.2 Influences from the Other Fashion Institutions outside the Company

Organizations (textile fairs) like Moda-In in Milan and Premier Vision in Paris control a major part of the textile supply in the world. Such organizations establish a common ground for co-operation and provide visibility to the innovation of the companies that belong to this value-adding network, and legitimize them as the benchmark to which all other companies in the industry will adapt to. Rinallo, Golfetto, & Gibbert (2005) disclose in detail this highly institutionalized process, involving collective investment for trend forecasting, consensual agreement on future styles, communication of new trends to exhibitors, incorporation of these trends into new fabric collections, and finally their presentations to visitors.

If the major fashion trends are largely managed by the influential textile organizations, how much creativity is left to a single designer? Designers reveal that they do not mind taking a look at the trend-books of the season (which are often in line with the presentations of textile organizations) mainly to get some ideas or to confirm and check their own ideas. This does not necessarily mean that they follow exactly the trends declared in these books. Besides reading the trend-books of the season and participating in international fashion fairs, designers also mention other designers' work (big names such as D&G, Cavalli, Versace, or Gucci), as an inspirational source for their creations, observing their windows, watching their fashion shows, and reading fashion magazines like Vogue. Although this does not necessarily mean that they copy each other's creations, there is a clear interaction among designers and other producers within the fashion industry.

The designer of Company X admits the effects of the external factors in the creation process. In fact, these effects are respected as natural part of creativity. That is, the designer usually does not start making a creation from scratch. Trend fairs, seminars, magazines, and creations of other firms are studied before starting their own designs. The styles of visitors of the textile fairs are observed implicitly, as well. For Company X, previous collections prepared for subcontracting companies are also a source of inspiration. All these sources are examined to come up with the best choice of colors for the next season, as well as the entire themes for the collections.

2.2.2 Influences within the Company

The foremost sources of constraints for the creative process originate from the internal dynamics of a company. One of the main shaping factors is the cost of production the design. Other factors include the firm's image, production constraints (technical limitations) of the firm and its suppliers, capacity considerations, availability of raw materials or subcontracted accessories, and the constraints imposed by the whole supply chain.

These are only a few examples of the inter-dependent institutional mechanisms, all influencing each other and the fashion creation. For instance, the little accessories (such as buttons and zips) that can be the order winners of the product in certain cases can restrain some of the characteristics of new creations. The choices of materials that will go into design are in fact very limited when cost, availability and marketing issues are considered. Limited advertising resources can hamper the visibility of new creations. On the other hand, higher investment in advertising and successful management of the supply chain can enhance new creations' success, thus acceptance by the larger consumer segments.

At this stage, we present the process of creation of a season's collection in Company X, in order to see the internal influences more clearly. The design process of the company starts with making observations in high-prestige fairs, seminars and magazines. Previous collections produced by Company X for the subcontracting companies are considered as inspirational sources, as well. These observations give ideas to the designers about the trends of the next season in theme, color and fabric. A general theme (story) is selected for the collection after making the observations (e.g. marine theme, African theme etc.). Coming up with a theme is a hard practice; it involves people from almost all departments in the company such as marketing, sales, purchasing and production. Based on this fact, one can argue that the limitations for the designer are initiated at this stage. To start with, the entire theme of the collection is in fact a matter of "choice" rather than an "invention" to a large extent. The choice is made among marketable ideas, and even the development of these ideas is not allowed to be entirely unique.

After the theme is determined, the choices of fabric and accessories are made. The choices here are also limited; the prospective price range of the products imposes a serious boundary on possible choices. Additionally, the long-term supplier commitment issues come into picture at this stage. The availability of materials and capabilities of the supplier firms affect the decisions in material selection. Hence, the freedom of the designer is also restricted at this particular stage in the creative process. Also, the number of models for different products and the production sizes for each model are predetermined by the marketing and sales departments based on previous year's sales statistics. For instance, if shirt sales have been good in the previous year, increasing the number of shirt models could be considered. Some product lines or entire themes could be eliminated, also based on previous information gathered from the customers.

After the sketches are prepared with detailed product specifications, a series of meetings are held to discuss the designs and materials. The marketing and sales departments, productions and purchasing departments participate in this meeting as well as the designers. What is tried to be achieved in this meeting series is in fact some form of value engineering and design for manufacturability on the designs. Value engineering in operations management (Heizer and Render, 2008) is concerned with improvement of the design and specifications of a product. The obvious benefit being cost reduction, other benefits include reduced complexity of the product, improvement of functional aspects, improved maintainability, etc. Based on the inputs by different departments, modifications in the designs take place considering mainly marketing and cost issues. For instance, the choice of a certain button may cause higher cost on the product, and this choice may be modified during these sessions. Alternatively, a material which would not be easily supplied could be replaced by another to facilitate manufacturability. The finalized designs are formed after this process.

Based on the design process summarized above, it is obvious that the internal constraints such as operational or marketing constraints hinder the creation. The general concept of the design for the product is seldom affected; however, the material choice can alter the definition of the product in general.

Apart from all internal influences, there is a striking fact: The designer of Company X admits that, after working a few years in the firm, self-limitations form the most important contribution to the constrained creativity. The designer in fact filters some ideas of him/herself as "non-marketable" or "too-costly", and narrows down the creative path. This inner practice can be regarded as a practice of design for manufacturability. As Saviola and Testa (2002) suggests, commercial creativity does not have complete freedom of expression as in the case of artistic creativity since its purpose lies in its ability to satisfy market needs, thus firm's objectives.

In Company X, only about 8-10% of the products are kept outside this value engineering phase. For these privileged products the designer has more freedom, as there is very little cost or marketing consideration. These are included in the collection as high-cost prestige items, and are a source of consolation for the designer.

2.3 Influences from a Broader Social Context

As stated earlier, at the invention phase of fashion, the sources and circumstances of creativity are not very much different from those obtained in the arts generally. Where designers get their ideas from is anywhere and everywhere. The creative experts engaged in trend forecasting spend a considerable amount of time in the observation of street-style and often travel around the world, identifying consumption patterns through which they anticipate the directions in which society as a whole will move (Rinallo, Golfetto, & Gibbert, 2005).

Designers mention practices like observing the streets, traveling, meeting new people, being updated about actuality such as following music groups, films, or concerts, reading books of art, design, fashion, or cinema, watching TV, or using the internet for developing the sensitivity towards understanding the social happenings of the moment.

As Barnard (2002) suggests, the source of meaning is within the larger context, which may be considered as a fabric of intertextual relations that produce and construct fashion.

We make a note at this point: The above-stated inspirational sources for the designers can in fact be thought as constraints on creativity for a small fashion firm. Prominent firms like Dior and Dolce & Gabbana are "fashion-builders", and all other firms can be considered as "fashion-followers". Within this context, what the designer of Company X perceives in movies or on the streets are, as a matter of fact, the designs created by the fashion-builders or some variants created by followers. Since the designs are made in a broader socio-cultural environment, the environmental factors apparently also hinder the creative process.

2.3 Influences from Consumers

Economic uncertainties drive producers towards conformity with the market place, which means investing in what sells most, while differentiation through new creations involves high risk, considering that mass consumers do not accept every new creation. Though, some producers are still willing to take this risk or at least to try for a chance of bigger success. This is a critical tension experienced especially by fashion designers between their artistic freedom and sales performance (Saviolo & Testa, 2002).

As it was stated in section 2.2, designer of Company X suggests that only 10% of the creations are like the extravagant presentations in fashion shows while 90% of the production is for mass consumption or in other words for what mass consumers desire. Thus, creativity, in the case of fashion design, cannot be isolated from sales performance, as consumers' and producers' interests are highly embedded in one another through a process of interagency (Kozinets et. al, 2004). Mass consumers greatest power lies in the fact that they just do not accept radical changes of styles from the ones that they are already wearing (Davis 1992).

Some designers get feedback directly from consumers, trying to develop a better understanding of their wishes and desires when consumers may have an active role in new creations, expressing their thoughts and feelings; though they may still be influenced by the external forces such as a design taken from a magazine. The designers of Company X are very particular in obtaining customer feedback. They utilize the ideas generated from these feedbacks in the next collection.

3. Discussion

In this study, we flesh out the influential dynamics behind fashion design, by identifying several categories of constraining factors. Figure 1 summarizes the dynamics that were elaborated in Section 2. Our study offers a conceptual framework of these forces, supported by examples from a Turkish fashion firm.

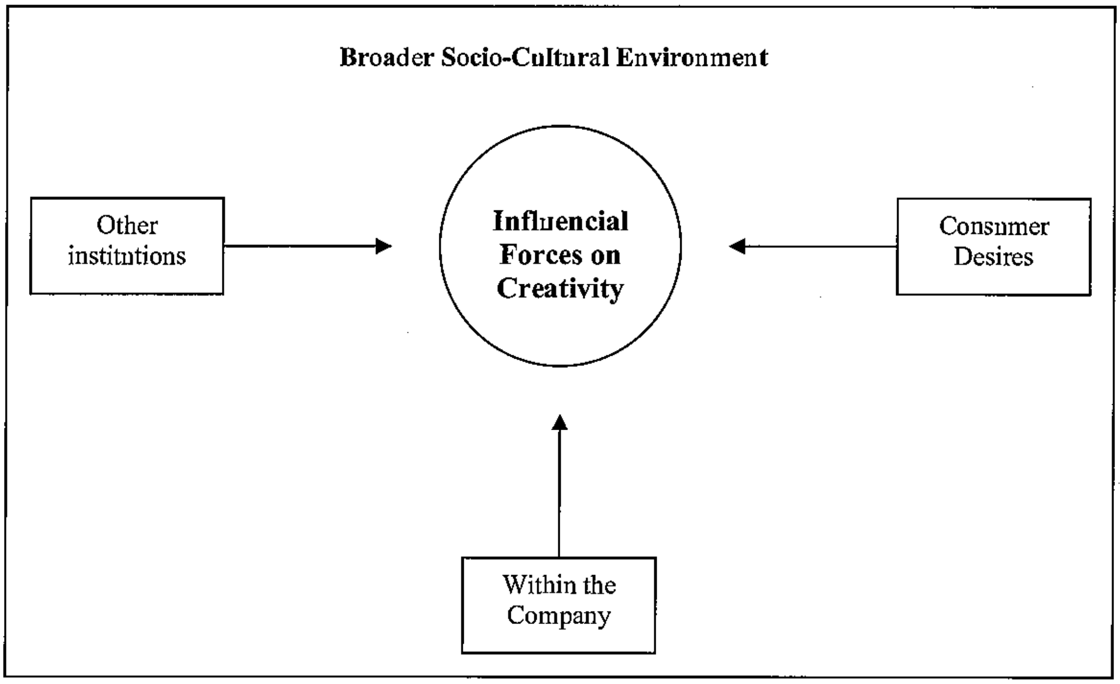

Figure 1. The Influential Forces behind Designer's Creativity

Where there is mass production, there are the drivers of cost and marketability of a product. Our study reveals tbat, in fashion design and in mass-producing fashion firms, these drivers are no different than in other sectors. A very large portion of the collections are created witb many constraining issues. The foremost sources of these constraints for the creative process originate from the internal dynamics of a company, such as the cost of production of the design.

Apart from internal dynamics, constraints imposed by the whole supply chain and the environment also exist. Furthermore, creativity cannot be isolated from sales performance, as consumers' and producers' interests are highly embedded in one another. Examples indicate that the combination of these factors create invisible barriers in the mind of the "mass-designer", causing some brilliant designs to be shattered before they are even formed. As a result, forms of stereotype, repeating collections are materialized.

In summary, commercial creativity such as fashion design does not have the complete freedom of expression as in the case of artistic creativity since its purpose lies in its ability to satisfy both the market needs and the firm's objectives. This challenge is tried to be overcome by today's mass customization approaches, which provides a little more freedom to the designer, at least in the selection of accessories, by burdening the choice on the consumer. Mass customization is the customization and personalization of products and services for individual customers at a mass production price. The concept was first conceived by Davis (1996), and further developed by Pine (1992).

Traditionally customization and low cost have been mutually exclusive. Mass production provides low cost but at the expense of standardization. Today, new interactive technologies, like the Internet, allow customers to interact with a company and specify their unique requirements which are then manufactured by automated systems. Whilst this may at first seem complicated and beyond the average consumer, there are various ways to hide the technical details, and many fashion firms are in fact utilizing the principles of mass customization.

Clearly, there are some challenges for the designers due to mass customization. For some designers, the only form of true mass customization is what can be called as "design-to-order". However, it should be kept in mind that the key to cost-effective customization is modularization and configuration. One of the key ideas and strategies to achieve mass customization is modularization - products are 'decomposed' into modular components or subsystems that can be recombined to more nearly satisfy consumer needs. Firms like Nike (http://nikeid.nike.com) and Puma (http://mongilianshoebbq.puma.com) are successful implementers of this principle.

The other side of the coin is the configuration systems that present the choices to consumers and determines what goes with what, but of course, out of a limited number of choices provided by the firm's designers. The customer taking the responsibility of modifying some aspects of the design and willing to bear the ensuing price takes some burden off the shoulders of the designer. As a result, a less-constrained and more independent design process may prevail. As a last word, we can say that the territory of mass customization is yet to be fully explored by fashion firms.

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BUILDING A GREEN BRAND: YOUR SUPPLY CHAIN TELLS HOW GREEN YOU ARE

Bengü Sevil[1] and Tuğba Örten [2]

Abstract

Due to the rising importance of environmental issues, there is an emerging need for integrating eco-friendly processes into the supply chain. In this study the green supply chain strategies are classified as tactical, transformative and strategic depending on the environmental approach of supply chain strategy, the scope of the selected strategy and the inclusion of environmental concern criterion to the traditional performance goals of the supply chain. A holistic approach to green supply chain is developed by focusing on the activities of sourcing and purchasing, manufacturing and design, packaging, transportation, warehousing, and reverse logistics. This paper also provides a deeper understanding of tactical, transformative and strategic green supply chain strategies by giving sample applications from the well-known brands. Implementation level of green supply chain processes define the green strategy adopted and tell how green the brand is.

Keywords: Green Supply Chain, Brand, Green Strategy, Supply Chain Process

1. Introduction

Climate change is one of the most significant and world wide environmental challenges of our times. The average temperature of the Earth's surface is increasing gradually as a result of harmful human actions, practices and behaviors on the natural environment. Industrial nations take the lead in green house gas emissions by burning of fossil fuels mostly occurring in automobiles, in factories, and in electric power plants that provide energy (World Book at NASA, 2008). However, both wealthy and low-income nations are encountering the destructive impacts of global warming on natural environment and thus on not only present human populations but also on future generations. Consequently, some consumers, some businesses, some governments and some societies have started to consider their actions on environment and be environmentally responsible. Even though the process of becoming environmentally friendly in truth is problematic for many companies (Hartman & Stafford, 1998), pressure of environmental activists, consumers and international trade regulations force companies to operate more environmentally conscious (Lee & Rhee, 2007). Companies also differ in terms of the degree of inserting environmental goals into their marketing strategies (Menon & Menon, 1997). In fact, positioning as a green company or green brand should not be based on only environmental marketing strategies. Building a green brand is a complicated process which requires a holistic approach to brand's all decision areas such as supply chain activities. Thus, our purpose is to identify different types of green supply chain strategies and to highlight to wbat extend green brands adopt these strategies, namely how green they actually are. In this respect, firstly we discuss the green supply chain concept and activities associated with it. Then, categorize different green supply chain strategies according to environmental approach embraced, diffusion level of selected strategy along the supply chain and finally the addition of eco-efficiency measure into traditional performance criteria. Finally, some prominent examples from different green brands that have different green supply chain strategies are presented.

2. A Holistic Approach to Green Supply Chain

Green Supply Chain has emerged as an important topic for the firms that seek to become more environmentally oriented. Firms have begun to integrate supply chain applications with environmental concerns in terms of reducing waste and energy consumption in each step. According to the holistic approach developed in this study, full implementation of green supply chain approach requires to diffuse the green perspective overall supply chain processes. To wbat extent the firms pay attention to green processes identifies the brands.

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2.1 Green Supply Chain Management

Increasing societal and ecological concerns have begun to force the business makers to integrate environmental management with supply chain management concept. Though there exists a respective amount of academic studies dealing with green logistics in the literature, the ones with an integrative approach in supply chain context are inadequate in number. Depending on the academic literature reviews, it can be stated that green supply chain management has been mostly taken from the reverse logistics angle. Activities like protective packaging reduction can be included in green logistics activities not in reverse logistics (Rogers & Tibben-Lembke, 2001). Due to the fact that green supply chain management requires a cloosed loop structure (Zhu et al., 2008), reverse logistics is an important part of the operations. However in order to have a real green supply chain, environmental efforts should be diffused over the whole processes along the chain rather than just focusing on reverse operations or green logistics activities separately.

Green supply chain management has been defined by Srivastava (2007) as "integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life." Hartman and Stafford (1998) put emphasis on the green strategies adopted while performing inbound and outbound logistics, operations, and post-use processing as shown in Table 1. Zhu et al. (2008) focused on internal environmental management, green purchasing, customer cooperation with environmental concerns, investment recovery and eco-design dimensions of green supply chain management.

Table 1. Green supply chain activities and strategies

Green Supply Chain Activities	Strategies
Inbound Logistics: Receiving, storing, and disseminating inputs to the product operations **Outbound Logistics:** Collecting, storing, and physically distributing transportation the products to buyers	• Collocation • Energy-efficient, reduced-pollution • Transposition material reuse • Implementation of just-in-time principles • Transportation equipment and vehicle lease
Operations: Transforming inputs into final product forms	• Production process standardization • Energy efficient equipment and process use • Waste/pollution reduction • Renewable or "clean" energy use • "Closed-loop" manufacturing • Recycled-content/refurbished equipment
Post-Use Processing: Turning discarded products and wastes into inputs or environmentally inert materials	• Discarded material sale or reuse • Waste-to-energy cogeneration • Products made for easy disassembly and recyclability • "Closed-loop" recycling systems with suppliers and customers

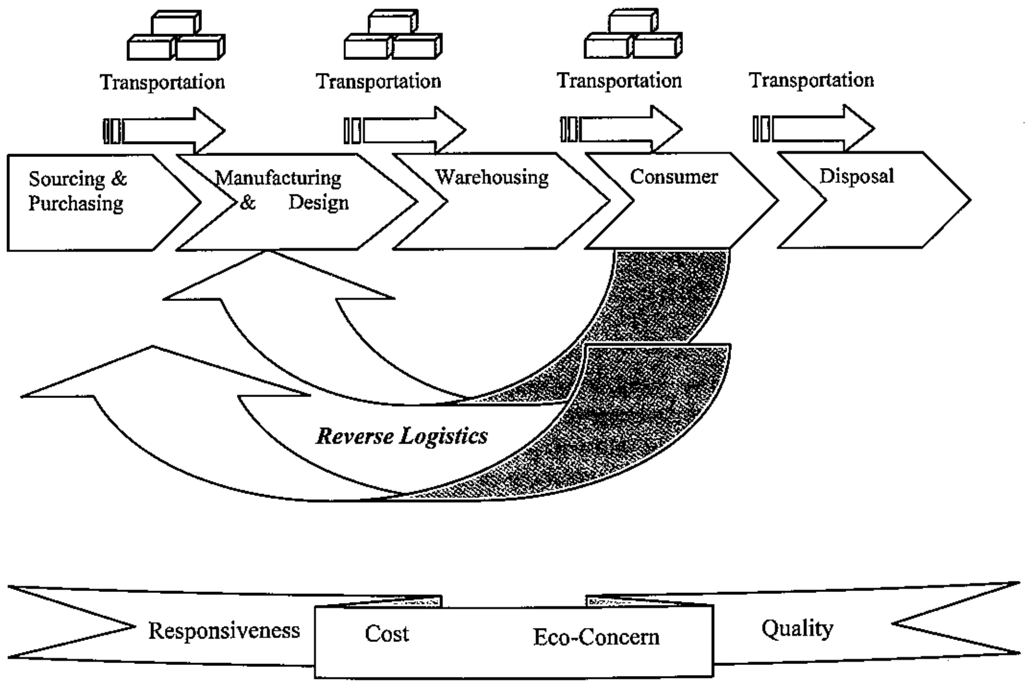
Source: Hartman & Stafford, 1998.

Ciliberti et al. (2008) studied separate logistics processes such as purchasing, transportation, packaging, warehousing, and reverse logistics in the scope of Logistics Social Responsibility which is a wider concept encompassing environment, ethics, diversity, working conditions, human rights, safety, philanthropy and community involvemet issues. In this study, instead of dealing with separate processes and partial implementation, an integrative approach is adopted by developing a conceptual model of Green Supply Chain.

Even though both the members of the supply chain and the organizational units are involving in individual environmental actions, the firms that realized the significance of implementing all the supply chain processes in green perspective are rare. Adopting green processes in a supply chain context will assist to reduce supply chain risk, costs and hazards to the environment while adding value to the customers. Developing more eco-friendly supply chains can be achieved by carrying out all the operations in an enviromental perspective and setting environmental performance standards in addition to cost, quality and responsiveness standards in every process of the chain.

According to the developed holistic approach represented in Figure 1, all of the supply chain processes classified as Green Sourcing and Purchasing, Green Manufacturing and Design, Green Packaging, Green

Warehousing, Green Transportation and Distribution, and Reverse Logistics should be performed together and sequentially rather than partial implementation.



Performance Criteria

Figure 1. A Holistic Approach to Green Supply Chain

2.2 Green Sourcing and Purchasing

Green sourcing and purchasing is defined as the sourcing and purchasing actions that aim to facilitate recycling, reuse, and resource reduction. Green procurement can be made in terms of service contacts with suppliers including the resumption of packages, unused materials and products, and identifying the environmentally responsible practices that should be applied continuously for decreasing the destructive environmental and social hazards (Anonymous, 2006). The environmental practices associated with these functions can be purchasing goods with reduced, recyclable and reusable packaging, requesting suppliers to commit in waste reduction or cooperating with suppliers to ensure that their processes and products are environmentally sustainable (Ciliberti et al. 2008).

2.3 Green Transportation and Distribution

Green transportation and distribution can be accomplished by monitoring the vehicles, the amount of pollutants emitted and fuel consumed. Additionally, by using environment friendly innovative fuels, reducing the vehicle fleet, optimizing distribution routes and freight loads, using intermodality as well as alternative and innovative transport means like hybrid vehicles (Ciliberti et al., 2008), green transportation can be supported. Enhancing driving skills and performance for the reduction of fuel consumption, automating transportation management systems, combining inbound and outbound shipments in order to reduce carbon emission, consolidating freights of suppliers will also assist to have the desired green levels in transportation (How to green your supply chain, 2008).

2.4 Green Packaging

Green packages are made of recyclable materials that do not contain hazardous ingredients for ecology and human health. Environmentally sustainable packages provide efficient containing and protecting all through the supply chain while informing the consumer (James et al., 2005). Using reusable and recyclable materials for transit or tertiary packages in transportation and handling activities can be another environmental solution for green packaging. Apart from these, reducing weight/volume of materials in protective packaging by means of new developments in material and packaging technology like lighter cartons (Prendergast & Pitt, 1996) can be functionated in order to reach to the standards of sustainable packaging.

2.5 Green Manufacturing and Design

Design and manufacturing processes are gaining significance due to the rising eco concerns. Eco design, a term that encompasses design for disassembly, design for recycling and reuse, enables to execute the reverse logistics activities (Zhu et al., 2008). To design considering the multi-functionality, upgradability and modularity may also helps to green the supply chains. Manufacturing processes are causing many of the 100,000 chemicals to accumulate in the biosphere (Anonymous, 2006). Thus, endeavoring to reduce the level of air pollution and waste during the production stages would be a step for greening the supply chain. In manufacturing great attention should be paid while using and extracting the materials. Manufacturer should be responsible of analyzing product life cycle to evaluate the environmental compliance of products and enabling to remanufacture.

2.6 Green Warehousing

Green warehousing can be reached by integrating energy conservation strategies in the warehouses like implementing new technologies for cooling in order to reduce the green-house gas production or lessening usage of electricity by means of low voltage lighting (How to green your supply chain, 2008). The real time visibility of the inventory should also be provided in the warehouses in an attempt to reduce the inventory risks like obsolescence and corruption. Additionally, environment friendly warehouses can also be built up by the help of innovative architectural techniques for suiting the surronding environment in a harmless way. The usage of photovoltaic cells with roof tiles and advanced window glazing can allow warehouses to produce more energy than they consume (Anonymous, 2006).

2.7 Reverse Logistics

Application of proper disposal has been a major problem if the main consideration is to minimize the environmental risks. Due to the emergence of environmental concern and rising costs of directing unwanted waste to landfills, firms are trying to find out the economic and eco-friendly ways of for disposal (Johnson, 1998). Reverse logistics is defined as in the context of product returns, recycling, reuse of materials, landfill and refurbishing, repair and remanufacturing (Rogers and Tibben-Lembke, 2001). For providing resource efficiency, products should be kept in the closed loop supply chains. By this way, the release of the components especially the toxic and environmentally hazardous parts of products to the air, water and soil can be prevented. Reverse logistics enables the reduction of need for raw materials as it is shown in Figure 1, and additionally reverse flow of the used goods makes the remanufacturing and reuse possible.

3. Green Suppty Chain Strategies

Derived from the holistic approach to green supply chains, a firm's green supply chain strategy may differ depending on its environmental commitment and related sub-strategies followed along the supply chain at different levels. Material selection, design, packaging, manufacturing and transportation are the examples of some of the decision areas that companies have to consider when greening their supply chains. Therefore, we suggest three types of green supply chain strategies (GSCS) based on following dimensions: environmental approach of supply chain strategy, the scope of the selected strategy and the inclusion of environmental concern criterion to the performance goal of the supply chain optimizations. These dimensions are summarized in Table 2 and later the examples of brands having different green supply chain strategies are presented subsequently.

3.1 Tactical Green Supply Chain Strategies

Day by day more firms are becoming or positioning themselves as concerned with environmental problems. This ongoing environmentalist trend within many businesses seems to have two main reasons: the shift in consumer choices against environmental destruction and/or the increasing environmental regulations all around the world (Osterhus, 1997). Similarly, many firms give the impression that they green their supply chains only to take the advantage of consumers' environmental interest or discharge a legal obligation. Since their main objective is shaped by meeting current customer needs in the market or responding to a deregulation of the market, their approach to environmental challenges cannot go beyond being reactive. Consequently, the scope of environmental strategies applied to supply chain is mainly activity focused. Many of the changes under a tactical GSCS address product design (such as energy efficiency or recyclability), packaging (such as recyclability or less material usage) or waste management areas to strengthen their green brand image, and do not aimed at redesigning the entire supply chain for optimizing environmental efficiency. 'The integration across functional areas is rare to nonexistent' in the supply chain within a tactical orientation (Menon & Menon, 1997, p.58). Thus, the narrowly positioned environmental philosopby of a tactical GSCS does not require, unless oblige by laws, an environmental performance goals be part of key output measures such as cost and productivity in lean supply cbains or such as responsiveness in agile supply chains (Harrison & Hoek, 2002).

Table 2. Green Supply Cbain Strategies

		Dimensions		
	Main Objective	**Environmental Approach**	**Scope of Strategy**	**Environmental Performance Criteria**
Tactical	To attract environmentally conscious consumers or to discharge a legal obligation	Reactive	Activity Focus	Nooe or obligatory
Transformative	To attract environmentally conscious consumers and to protect environment simultaneously	Adaptive	Transformatioo Focus	Key measure at some level
Strategic	To prevent environmental deterioratioo, to achieve environmental recovery and to protect environment, or simply to reach eovironmental sustainability	Proactive	System Focus	Key measure

3.2 Strategic Green Supply Chain Strategies

In contrast to tactical orientations, strategic GSCS are not driven by simply the opportunistic efforts guided by dominant consumer concerns in the marketplace but by a robust environmentalist stance applied to entire supply chain. This long term and system focus environmental supply chain perspective does not only attempt to lessen the impact of tbe business operation on the environment but also to "explicitly incorporate an assessment of the future environmental impact of these efforts" (Menon & Menon, 1997, p.57). The decision areas of environmental concern in the supply chain are not limited by product design and packaging as in the case of tactical GSCS, and covers wide range of decision areas such as manufacturing, sourcing, transportation modes and inventory policies and post-use processing. Some of the other possible green supply cbain activities throughout the supply chain and related environmental strategies under a strategic GSCS are given in Table 1. Firms that follow proactive and system focused green strategies in their supply cbains tend to add environmental criterion in their overall supply cbain performance goals. By measuring green performance (stated above as Eco-efficiency), they can determine and reduce the environmental cost of their operation in short term, and also enable them to prevent ecological cost before they occur in long term.

3.3 Transformative Green Supply Chain Strategies

Transformative GSCS lies between tactical and strategic supply chain orientations to environmental issues in terms of integrating environmental goals and concerns with business strategy concerns of attracting environmentally conscious consumers and achieving competitive advantages within the market. Since the degree of integration of environmental issues into supply chain differs at different decision areas and by different levels of integration, there is no organization-wide green strategy applied at all level of traditional supply chain as in strategic GSCS. In order to make the differences more clear, consider a firm that adapts environmental approach in supplier auditing practices and product procurement activities while it does nothing in the manufacturing process. Although it seems that the green approach applied more than one pace in the supply chain not only because modifying the visual or significant attributes of the product which makes it attractive to customers, the integration of environmental goals into those product decision areas makes clear whether it is a tactical or transformative GSCS. Therefore a firm's green supply chain strategy may be defined as its "selection of the depth and width of environmentally friendly practices and activities" as in the case of different corporate environmental strategies (Lee & Rhee, 2007). Relatively, environmental goals appear as part of the traditional performance measures where the green supply chain strategies are followed.

4. Evaluation of Green Brands' Green Supply Chains

Kumar and Malegeant (2006) studied a strategic alliance with Nike (shoe manufacturer) and National Recycling Coalition (NRC, an eco-non-profit organization) to collect used tennis shoes in order to reprocess them. In the program, the logistics of collecting the shoes was carried out by the NRC and the recycling and reusing of grind materials was performed by Nike. The recycled and reprocessed materials then used in different ways to make sport products' surfaces such as soccer and football fields, basketball and tennis courts, tracks and playground surfacing. The green supply chain (reverse) implemented by Nike during the collection process of used shoes is illustrated in Figure 2.

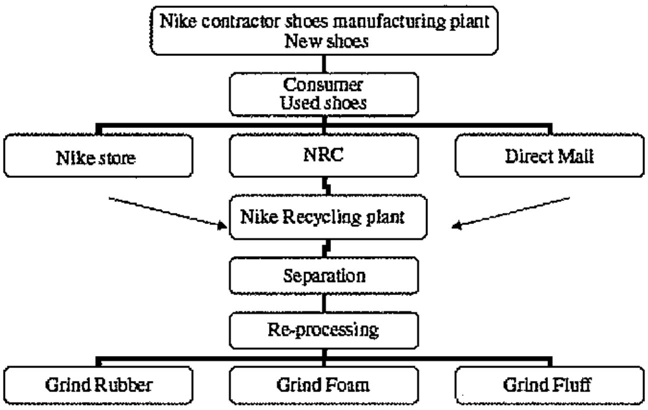


Figure 2. Nike Reverse Supply Chain (Kartman & Malegeant, 2006)

This reuse-a-shoe program enabled Nike to create a green image, to attract environmentally conscious consumers and to achieve a competitive advantage in the marketplace, and consequently to generate more profit. However, Nike also became able "to reduce its impact on the environment by helping to close the loop on the life cycle of literally millions of pairs of old, worn-out or otherwise unusable athletic shoes" by this program (Kartman & Malegeant, 2006, p.1133). As a matter of fact, the green supply chain strategy implemented by Nike was a typical transformative GSCS. Since the company integrated its profit seeking goals with its environmental concerns, and adopted a reverse supply chain as a part of its long-standing commitment to environmental protection, the environmental orientation was more a tactical one. However, the lack of similar green concern on other supply chain activities shown in Table 1, at least at the same level, indicates that the company does not have a uniform environmental strategy employed by the whole supply chain, and thus cannot be termed as a strategic GSCS.

According to Schweinsberg (2008) auto makers all around the world seems to be becoming more environmentally friendly mainly by improvements in their vehicles regarding fuel efficiency and gas emissions reductions. For instance, Ford is one of the companies that produce hybrid-electric vehicles (such as Escape CUV) to protect environment. However, this modification in product design could not help the company to have the lowest average fuel economy number among the all U.S. automakers. On the other hand, although Toyota takes the lead in developing hybrid vehicles offering salient fuel efficiency, we cannot conclude that the company has a strategic GSCS unless this environmental protection approach can be seen on other supply chain activities as a whole such as material sourcing, manufacturing processes, transportation and also end-of-life management of the product after its useful life. These kind of environmentally efforts concentrated on a company's single operation or in other words on a single activity along the supply chain seem to not to make the company green truly. Meanwhile, it can be seen that to what extend a brand is green is closely related to the integration of the environmental concerns and ambitions into the supply chain.

4. Conclusion

Environmental issues started to show their disastrous effects on the natural world and on human populations equally. For instance, many people and many species are experiencing the impacts of one of the most well-known environmental problems, global climate change. The decisions made by individuals and mainly by companies such as improving energy efficiency in their operations, preferring renewable energy resources in electricity generation or reducing the amount of waste generated during and after production process (Marshall

& Toffel, 2005). Consequently, consumers, governments, and societies demand businesses to take their responsibility in preventing environmental deterioration (Hartman & Stafford, 1998). As a result of this environmentalist movement spread all over the world, it seems as if the whole world is going green (Schweinsberg, 2008). However, going green or in other words being a green company or green brand requires a uniform and holistic environmental approach to all decision areas, simply to all supply chain activities and decisions.

Therefore, this study first aims to provide an insight to the green supply cbain processes and then to investigate to what extent tbe brands are applying these processes. The brands' supply chain strategies are evaluated and classified as tactical, strategic and transformative depending on the scope of their green supply chain strategies and environmental approaches adopted as well as their concern on environmental performance criteria. Full implementation of green supply chains can provide decrease in energy and resource consumption as well as reduction in costs in every step of the chain.

This paper represents a conceptual basis for explaining the relation between the brands and the green supply chain applications. We argue that for being entitled as green brands, full implementation of green supply chain processes is required. In further researches, in order to support this argument and the classification above, empirical analysis can be done.

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