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Success Factors of Mass Customization Cases: Chocri and Shoes of Prey

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ABSTRACT
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SUCCESS FACTORS OF MASS CUSTOMIZATION – CASES: CHOCRI AND SHOES OF PREY

PURPOSE OF THE STUDY

The purpose of this study is to combine theoretical background and empirical analysis in order to better understand the relationships between mass customization process and success factors necessary to make it work. We will also determine which mass customization approach is most commonly used among MC companies. Mass customization theory is thoroughly covered in the literature review and includes topics from both international business and marketing fields: internal and external success factors; MC levels and approaches; flexible manufacturing systems, and perceived added value though customer integration. This thesis focuses on mass customization start-ups hence its managerial implications can be seen as particularly relevant to new ventures that consider entering the ever-growing mass customization arena.

RESEARCH METHOD

The empirical research is of this thesis is broken down into two parts. The first part is based on two case studies of mass customization start-up companies: Chocri and Shoes of Prey. The second part is an analysis of an online database of mass customization companies. A theoretical framework also serves as a central tool to relate literature review with the empirical findings.

RESULTS

Findings of the study show that all of the identified success factors were indeed applicable for and present in the case companies. We also conclude that increased customer integration leads to a higher perceived added value of a product/service and in addition we were able to identify four types of drivers that add value in mass customization. Finally we conclude that a collaborative approach is most commonly used among mass customizing companies because it offers the highest extent of customer co-creation, which in turn leads to a higher added value.

KEYWORDS

Mass customization, success factors, customer integration, collaborative approach, consumer added value.

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MASSARÄÄTÄLÖINNIN MENESTYSTEKIJÄT – ESIMERKKI YRITYKSINÄ: CHOCRI JA SHOES OF PREY

TUTKIELMAN TAVOITTEET

Tutkielman tarkoituksena on yhdistää teoreettinen taustatieto empiirisen tutkimuksen tuloksiin, ymmärtääksemme paremmin massaräätälöinnin prosessien ja mahdollistavien menestystekijöiden välistä suhdetta. Pyrimme myös määrittelemään mikä massaräätälöinnin lähestymismalli on yleisimmin käytössä. Kirjallisuus katsaus kattaa massaräätälöinnin teorian perusteellisesti sisältäen, sekä kansainvälisen liiketoiminnan, että markkinoinnin aihealueita kuten: sisäiset ja ulkoiset menestystekijät, massaräätälöinnin tasot ja lähestymismallit, joustavat valmistusmenetelmät, sekä kuluttajan kokema lisäarvo. Tutkielma keskittyy start-up yrityksiin, mistä johtuen sen käytännön vaikutukset ovat eritoten mielenkiintoisia niille liiketoimintaansa aloitteleville yrityksille, jotka harkitsevat mahdollisuuksiaan massaräätälöinnin saralla.

TUTKIMUSMENETELMÄ

Tämän tutkimuksen empiirinen osuus on jaettu kahteen osaan. Ensimmäinen osa pohjautuu kahteen esimerkkiyritykseen: Chocri ja Shoes of prey, jotka molemmat voidaan luokitella start-up yrityksiksi ja ovat perustaneet liiketoimintansa massaräätälöinnille. Tutkimuksen toinen osa analysoi verkko-pohjaisen tietokannan massaräätälöinti yrityksistä. Teoreettinen viitekehys toimii keskeisessä roolissa yhdistäessämme empiirisen tutkimuksemme tulokset ja kirjallisuuskatsauksen teorian.

TULOKSET

Tutkimuksen tulokset osoittavat että kaikki ennalta määritellyt menestystekijät olivat sovellettavissa, sekä selkeästi havaittavissa, kummassakin esimerkkiyrityksessä. Tutkimustulokset viittaavat siihen, että lisättäessä asiakasintegraation tasoa kuluttajan tuotteesta tai palvelusta kokema lisäarvo kasvaa. Pystyimme erottelemaan neljä hallitsevaa tekijää jotka vaikuttavat massaräätälöinnissä kuluttajan kokemaan lisäarvon nousuun. Lopuksi päättelemme, että yhteistoiminnallinen lähestymismalli on yleisimmin käytetty massaräätälöinnin taso, sillä se mahdollistaa syvimmän asiakasyhteistyön, mikä johtaa suurempaan asiakkaan kokemaan lisäarvoon.

AVAINSANAT

Massaräätälöinti, menestystekijät, asiakas integraatio, yhteistoiminnallinen lähestymismalli, kuluttajan lisäarvo.

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1 INTRODUCTION

The purpose of this study is to identify the key success factors of mass customization and to show how they contribute to the delivery of added customer value. This chapter begins by describing the background of our study and what led to the choice of the topic and case companies. The following section defines a research problem and the objectives of the study. Finally, the main definitions of the study will be outlined.

1.1 Background of the study

Mass customization (MC) refers to a business strategy that combines two different business practices, which are mass production and craft production. It aims to provide customers with individualized products at near mass production efficiency (Tseng and Jiao, 2001 in Piller, 2004). The concept of mass customization is relatively fresh in international business, first discussed by Davis in 1987. Its development lagged behind because customers' needs did not have effective means, i.e. technology, to be expressed and reached by product and service manufacturers. In the recent decade, changing economic and social environments gave the push for the demands of individualized products and services. Companies in a wide variety of sectors are becoming more and more customer-centric. The major objective of mass customization is to improve the ability of companies to react faster to changing customers' needs and to address the heterogeneity of demand more efficiently. The interest and involvement into mass customization is growing not only among businesses, but is also intensified in research and academia. The number of papers published on mass customization has grown threefold in the last decade of the 20th century. (Tseng and Piller, 2003) The voluminous body of publications in the short period of the notion's existence has created a need to study the directions, trends, application potential, and research strategies embedded in these publications (Kumar et al., 2007).

With this in mind, the intention of this study is to address research gaps that have been identified by scholars throughout academic papers. In particular, we aim to concentrate our attention on success factors that companies should consider before embarking on their journey of mass customization. Given our background in international business administration and marketing, the focus will be on customer integration and added value creation. Of course, in the literature review we will thoroughly consider a broad range of success factors, but our research will focus on the customer involvement in mass customization.

For reasons stated above, to build our empirical component, we choose companies that offer customization to their customers from the very early stage of the production process. We feel that such examples will provide a deeper insight to customer integration and creation of a superior customer value. Moreover, we are limiting our case companies to start-ups. We believe this approach will eliminate carry-over effect of existing success factors, such as brand value, or successfully launched products in the past. In addition, we would like to encourage entrepreneurship and hope that present and future entrepreneurs will benefit from this study.

1.2 Research gap and research problem

A study on theory of mass customization, performed by Silveira et al. (2001), reveals that, while there is little debate on theoretical aspects of concepts and objectives, there are several pending issues regarding its practical implementation. In addition, Piller (2004) quotes a team of scholars - Duray et al. (2000: 606): "Extant literature has not established good conceptual boundaries for mass customization" – and argues that unless a common understanding is established, mass customization will become neither an academic discipline nor a broad strategic concept recognized by managers. Literature on implementation of mass customization is still developing. There is plenty of research that showcases examples of mass customization strategy, but critical success factors and essential steps leading towards a successful implementation of mass customization have not been systematically identified. We have been unable to find conclusive research that would build links between the 'success stories'. Most claims are drawn from limited case examples or based on

educated guesses from authors rather than from hard evidence obtained through research. According to Tseng and Piller (2003), the critical success factors of mass customization still represent a research topic that is not sufficiently explored by academia. Piller (2004) also suggests that further research is needed to provide more insight in the mechanisms of the strategy and to determine their relative causality for its success. Therefore in this study we will review existing theoretical foundation about success factors of mass customization and draw parallels with real-life success cases, and the steps that have been taken.

1.3 Research objectives

This study attempts to use a theoretical basis and empirical analysis to investigate relationships among mass customization process and success factors necessary to make it work. Hence, the objectives of this study are:

1. To determine what key success factors of a mass customization process are;

2. To empirically assess whether all of the identified success factors need to be present for a successful mass customization start-up;

3. To verify how customer integration in mass customization is related to perceived added value;

4. To empirically assess which mass customization approach is most commonly used among mass customization companies.

In order to link our empirical research with the academic literature, we will introduce propositions after the theoretical framework is established. In turn, we will test our propositions through case companies.

For the empirical research mass customization case companies were selected. These companies operate in different industries but have selected the same mass

customization approach. The goal is to investigate if their strategy involves identified success factors and if links between these success-stories can be established. In our findings we would like to find indications that would point towards the notion that all identified success factors can be considered as a necessary pre-condition, regardless of industry. To achieve the fourth research objective, an analysis of an online MC company database will performed and conclusions drawn.

1.4 Methodology of the study

This study is divided into theory and empirical research. The theoretical part consists of a literature review, which concentrates on understanding the success factors of mass customization and the strategic motivation that companies have in pursuing this strategy. The theory part is build to support the framework that is introduced in the end of the chapter.

The empirical part tests the theoretical framework and propositions we have put forward after the literature review. Our empirical research is divided into two parts – qualitative and quantitative, to assess respective propositions. The identification of success factors and added value creation will be verified by using interviews and questionnaires to collect qualitative data. Qualitative method, in the form of semi-structured interviews, is chosen as it is seen as the best approach to capture even small factors in creating consecutive success stories, yet it allows us to collect comparable information from the interviews. The qualitative method is also useful, as there are no standard reporting methods in use and the success factors can be recorded in various ways, even within the same industry.

Quantitative research will be used to assess the objective that MC companies most vastly use a collaborative approach as their strategy. Finally this part concludes with an analysis and recommendations derived from the results from empirical study.

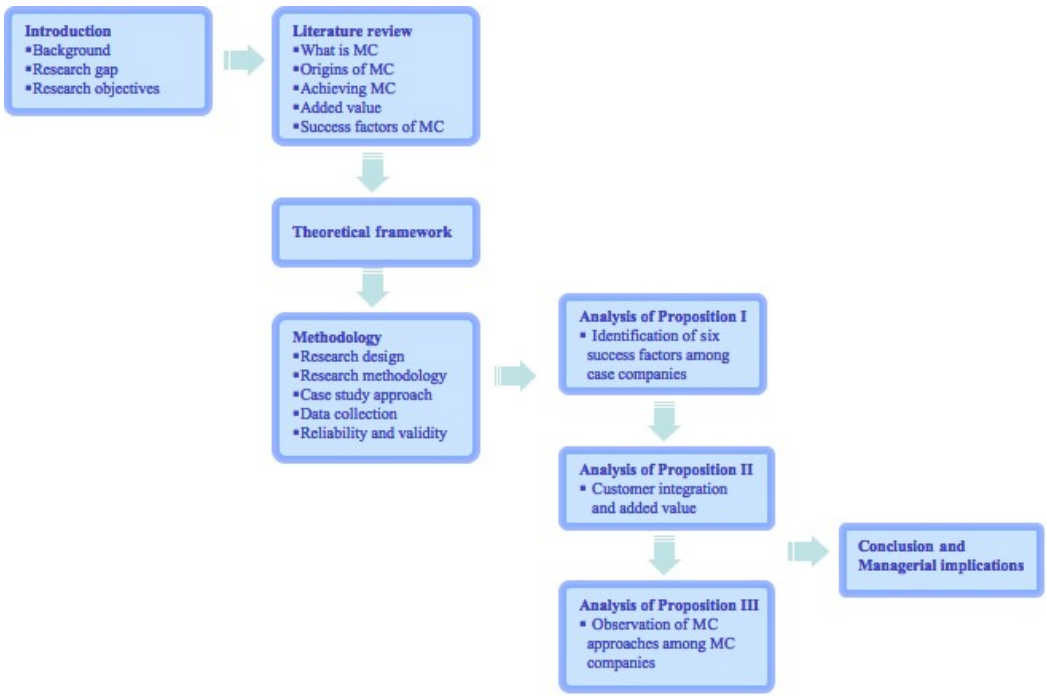
1.5 Scope and limitations of the study

- We define the success of mass customization as the ability to provide a higher customer value products in contrast to mass-produced ones. We understand there are many other avenues to define success, but they are not the focus in this study.
- Our identified success factors are linked to the existing literature on mass customization. However, we recognize that success of MC can be influenced by other conditions that are not characteristic to MC. We keep in mind that there are more factors positively affecting overall success of MC businesses.
- In MC the line between products and services is blurry. In this study we concentrate on the former, even though in the literature review we discuss both.
- Our empirical research is limited to mass customization start-ups because we believe it to be more objective to analyze newly established companies that have not operated in mass production manner. Hence the success can be more directly attributed to mass customization. In addition, we believe the managerial implications would be more useful for young MC entrepreneurs.
- Our empirical research is limited to mass customization companies that reach their customers through an online channel. The recent advances in information technologies, the increased speed and availability of the Internet, have changed the way people engage with environment and have created new possibilities for companies to sell their products. Especially for start-ups, these changes have opened the door to a cost efficient way to start new businesses. A great number of online mass customization companies has emerged during the past few years, offering customers their products exactly the way they want them. The elimination of a retailer is potentially more convenient for the customer, and is more profitable for the company, thus resulting in a win-win situation for both. In the light of these arguments, we believe that an online web-based customization platform embodies the progress of mass customization and enables the companies to communicate with their customers in the most advanced manner. There a number of companies offering offline MC solutions, but for the sake of simplicity and relevance, we

will exclude those cases from our empirical research. This does not mean that these examples will not be referred to, or discussed in literature review.

1.6 Structure of the study

Figure 1. Visual structure of the study



1.7 Definitions

We will begin this section with a table to outline definitions of mass customization, proposed by scholars in academia.

Table 1. Definitions of Mass Customization

Scholar	Definition
Davis (1987: 169)	"When the same large number of customers can be reached as in mass markets of the industrial economy, and simultaneously treated individually as in the

	customized markets of pre-industrial economies".
Kotler (1989)	"Mass customization is a kind of scope economies application, through single manufacturing process modularization, providing tremendous variety and individual customization, at prices comparable to standard goods and services."
Pine (1993a)	"Providing tremendous variety and individual customization, at prices comparable to standard goods and services with enough variety and customization that nearly everyone finds exactly what they want".
Kay (1993)	"Use information technology oriented production and delivery system to meet individual customer need efficiently at cost of mass production."
Lau (1995)	"Mass customization is a capability of rapid design, production and delivery of products that meet the customer's need at prices similar to mass production. Basically, mass customization is to meet customer's feedback, cost effectiveness and higher productivity by releasing scale production customized products without compromising effectiveness."
Joneja and Lee (1998)	"The practice of mass customization by using information technology, flexible manufacturing and organizational structures in offering diversified yet individualized products and services at prices similar to that of mass production."
Silveira et al. (2001)	"Mass customization is an ability providing customized product or service by high volume flexible process and reasonably low cost."
Tu et al. (2001)	"Businesses of mass customization must not only be able to design, produce and deliver products in a rapid and reliable fashion, but also to meet specific demands of the customer at the similar cost of mass production. If we take mass customization as a capability, its basic law

	would mean meeting customer's demand, cost effectiveness and mass production at the same time."
Tseng and Jiao (2001)	Mass customization corresponds to "the technologies and systems to deliver goods and services that meet individual customers' needs with near mass production efficiency."

Source: Chiou (2009), p. 5

Perceived added value – in mass customization it can be explained as the improved value that can be attributed to the products and services as the result of introducing an aspect of customization.

Start-up – is a company with a limited operating history; generally newly created, and in a phase of development and research for markets.

Customer Order Decoupling Point – "(CODP) refers to the point in the material flow from where customer order–driven activities take place" (Tseng and Piller, 2003, p. 74).

2 LITERATURE REVIEW

In this section, the theoretical foundation for this study will be established. The literature review will begin with an overview of mass customization theories and a further exploration of our chosen definition. Next, the origins and reasons for companies choosing mass customization approach will be discussed. The section about benefits of MC will be reviewed because they will deepen the argumentation for companies choosing MC as a strategy. Here, the added customer value will be discussed because this concept has been found to influence the success of MC businesses. In order to bridge the gap towards the literature about success factors of mass customization, we will introduce the framework upon which the strategy of mass customization is developed. In this context the 'four faces' of MC will be reflected on. Finally, the success factors of MC will be looked in to. The section will conclude with an establishment of the theoretical framework and propositions of the study.

2.1 What is mass customization

The objective of mass customization is to produce goods and services meeting individual customer's needs with near mass production efficiency (Tseng and Jiao, 2001). Mass customization is a hybrid manufacturing concept existing to provide highly value added products. It is about delivering the desired product after the needs of an individual customer have been expressed (Piller, 2004). A standard product that bears certain flexibility, so that the retail or customers themselves can customize it, can be regarded as a mass customized product. In addition, providing a set of individual value added services around a standard product could also be regarded as a form of mass customization. On the other hand, a service can be constructed in a way where it is partly 'pure customization' and party mass customization, in which some of its components are standardized and some custom made for each customer (Blecker and Friedrich, 2006). It is important to note that in mass customization, where customers are presented with a variety of choice, they are not involved in the specification of that variety (Duray et al., 2002). Customers must first interact with the manufacturer, the retailer, or the product itself in order to configure the end

solution. In order words, depending on the situation, customers can be involved in specifying features of the product during phases of design, fabrication, assembly, or use (Zipkin, 2001; Broekhuizen and Alsem, 2002). Please see chapter 2.3 for examples of each.

The difference between mass customization definitions, presented in section 1.6, is that some are broader, more visionary (Davis, 1987; Pine, 1993), while other scholars (Kay, 1993; Lau, 1995; Silveira et al., 2001) use narrower, more practical concepts. They introduce specific tools, such as information technology and organizational structures that are essential building parts of MC system. However, almost every definition of mentions *individual customer needs* in one formulation or another. The focus appears to be on the dynamic demanding consumers.

Despite numerous attempts to conceptualize the term, Piller (2004) argues that in practice, mass customization is "not there yet". Today the term is mistakenly used for all kind of strategies connected with high variety, personalization, direct deliveries, and flexible production (Broekhuizen and Alsem, 2002). We support Piller's concern – not all agile manufacturing strategies that involve customer interaction can be classified as mass customization. Moreover, conceptualization of MC began more than two decades ago, hence it has naturally evolved in its nature and execution. Piller, Europe's leading expert on mass customization, has been revising the definition of MC several times within the last decade in order to focus on issues that are relevant and distinguish MC from similar concepts. We certainly do not want our study to suffer from the definition debate; therefore we choose to concentrate on the most definition by Piller (2004), which will guide this study. In this paper we refer to mass customization as:

"Customer co-design **process of** ***products and services*****, which meet the** ***needs of each individual customer*** **with regard to certain product features. All operations are performed within a** ***fixed solution space*****, characterized by stable but still** ***flexible and responsive processes*****. As a result, the** ***costs*** **associated with customization allow for a** ***price level*** **that does not imply a switch in an upper market segment."**(Piller, 2004, p. 315)

The elements used in the definition are explained in the following paragraphs.

Today there are many businesses that utilize mass customization: sports shoes (Adidas and Nike); hockey sticks (Branches Hockey); notebook and desktop computers (Dell); industrial plastics (GE Plastics); clothing and footwear (Bivolino; Spreadshirt; Selve; Shoes of Prey); lighting systems (Lutron); breakfast cereals (My Muesli); chocolate bars and candies (Chocri; M&Ms by Masterfoods); vitamins (Mitamins); bicycles (National Bicycle); beauty care products (Procter & Gamble); golf clubs (Taylor-Made); messenger bags (Timbuk2); and candles (Yankee Candle). This list is by no means complete, but it reflects the diversity of industries in which customization is gaining ground. More complete information on mass customization in practice is provided by Tseng and Piller (2003), and in the website edited by Piller since 1997 at http://www.mass- customization.de/.

2.1.1 Customer co-design and integration

Customer co-design and integration are key to mass customization (Kumar, 2007); this is the core element that differentiates mass customization from other strategies like lean management or agile manufacturing (Piller, 2004). With today's information technology, MC customers can be included into the value creation chain by defining, configuring or modifying an individual order. Though an interactive website customers can configure specifications of the product or service, packaging and even delivery options. For example, when ordering an iMac computer on the Apple Store website, one may choose a monitor size, two or four GB RAM memory capacities, desired pre-installed software, keyboard and mouse. It is essential for customization that consumers contribute to specification of the product by communicating their needs and desires. Different than a do-it-yourself approach, which is an autonomous creation by consumers, this is done through "co-creation" – a mode of interaction with the manufacturer, who is responsible for providing the custom solution (Ramirez, 1999). Chen and Tseng (2007) describe such interaction as "negotiation" because a middle ground between the supply and demand flexibility can be explored,

as recent advances in information technology enables both parties to settle on a product that is beneficial to both.

Customer co-design also establishes an individual contact between the manufacturer and customer, which offers possibilities for building up a lasting relationship. If the customer is satisfied with an individual purchased item, it awards the manufacturer with an increased chance for customer loyalty as reorders become simplified (Pine, Peppers and Rogers, 1995). For example, online MC companies offer a service where a customer creates a user profile and is able to save previous orders and hence combinations of preferences. The future orders therefore become simplified for the customer and the seller is rewarded with preference database. Broekhuizen and Alsem (2002) challenge the importance of such relationships. If the time gap between purchases is substantial, it becomes increasingly difficult to benefit from the knowledge gained from the individual consumer. In other words, the more time passes by since the last customer order, the less can the mass customizer understand its customers current preferences, needs and wants, so the knowledge sharing gets impaired.

Even though co-design activities are the necessary prerequisite of mass customization, these activities are also a major cause for complexity, effort, and perceived risk from the customers' perspective, creating obstacles for the success of mass customization strategies. For instance, if a customer decides to order a mass customized bicycle through an online channel, it presents an element of complexity, such as multiple possible combinations; perceived risk, such as the uncertainty of the final visual and technical outcome, delivery and even fraud. Pine coined the term "mass confusion" (in Piller et al., 1995) to describe the perplexity and downsides that a customer experiences as a result of mass customization interaction processes. Hence, it turns out customer co-design is both, a necessary prerequisite, and one of the major factors for the delay in adoption of mass customization technologies in business practice. (Piller et al., 2005)

Customer integration plays a key importance in a mass customization strategy (Piller, 2004; Kumar, 2007; Kumar and Stecke, 2007). Integration means getting the customer involved in designing or configuring a product, which is by definition, an

essentially central element of mass customization. By integrating the customer into the design or configuration process, a possible adversarial relationship between a customer and provider may be transformed into a synergy (Kumar and Stecke, 2007). Customer's positive experience of a co-creation may lead to further gains for the company, such as positive word of mouth. This psychological transformation is a significant factor in the success of a mass customization strategy. With the development of technologies in user interface, customers are enabled to choose from offered options in a modular manner. Often, the online tool contains a price calculator, which can advise the end price of a solution, based on the selection of offerings and product configurations. This creates visibility for the consumer and reduces the barrier of uncertainty, often associated with customization. Successful customer integration depends on many factors. The following is an outline of the ones we consider to be the most relevant to this study, as presented in Kumar and Stecke (2007):

- *Demand flexibility*: This translates into the extent to which a customer is willing to compromise on product features or performance in order to meet budget (price) or schedule (delivery) constraints. In other words, it can also be understood as product/service flexibility, because the manufacturer or service provider offers alternative configurations of the product/ service that fall within the range of the offering. (Chen and Tseng, 2007)

- *Supply flexibility* is another essential element of customer integration, permitting the execution of customer's choice. Supply flexibility is enabled by the presence and use of advanced manufacturing systems, such as flexible manufacturing systems (FMS).

- *Smart information system* is needed for negotiations between a customer and company to be successful, where both parties engage in a dialogue until the negotiations are concluded. There are several information technologies available to accomplish meaningful negotiations, which can present the offerings, receive customer inputs, collate information as needed, and carry a meaningful dialogue between the customer and producer. Web 2.0 technology

can be further empowered using data mining technology, which can permit selective offerings for repeat customers.

- *Affective design*: As markets become efficient, customers tend to look for products that not only serve their needs, but also appeal to their emotion. This is consistent with the concept of "experience economy", coined by Pine and Gilmore (1999): "To be successful in today's increasingly competitive environment, companies must learn to stage experiences for each one of their individual customers. We have entered the Experience Economy, a new economic era in which all businesses must orchestrate memorable events for their customers that engage each one of them in an inherently personal way." (Kumar and Stecke, 2007, p. 561)

2.1.2 Meeting the needs of each individual customer

A major success factor of mass customization is the ability to match the level of customization offered with customers' needs (Piller, 2004). Referring to Chamberlin's (1950) theory of monopolistic competition, mass customization is a consequence of a differentiation strategy. Here customers gain added value from a heterogeneous good that fits their needs better than the best standard product within reach. From an implementation point of view, customization can begin on three levels: fit & comfort (measurement), style (aesthetic design) and functionality (Piller, 2004). Let us take a simple example of cereals. Here, fit can be translated into packaging options – material or size of the package. Functionality can refer to both – packaging (size, shape, material) and nutrition (added vitamins, fibre-rich flakes). The style is defined by the aesthetic aspect of packaging – individualized design solutions.

However, a significant point of conflict in MC debate is determining the level of individualization that characterizes a truly mass-customized product. On the one hand, purists attribute mass customization concept only to products that fulfil all requirements made by individual customers. On the other hand, pragmatists do not require complete individualization in order to quality as MC. They suggest that mass

customization is about customers choosing from independent number of options and adjusting their final solution based on them (Silveira et al., 2004). According to Hart (1995) the solution for this debate lies in company's ability to determine and maintain the range in which products or services can be customized, and how individuals make options upon this range, which leads us to the next section – fixed solution space.

2.1.3 Fixed solution space

Creation within a stable fixed solution space is what differentiates mass customization from one-of-a-kind (craft) customization. A crafted goods manufacturer re-invents both its products and its processes for each individual order. On the other hand, a mass customizer uses fixed processes to deliver varied goods (Pine et al., 1993). Fixed solution space implies that configuration options are limited to certain product features. The reason for the solution space in mass customization being fixed is the power of modular design, which reduces the complexity of processes (Kumar et al., 2008). This enables a mass customization company to achieve a near mass production efficiency, but also implies that the customization options are limited to certain product features. Customers are allowed to perform co-design activities only within a pre-defined list of options and components, which means customers' choice is restricted to a modular product architecture existing in the fulfilment system (Piller, 2004).

Setting the solution space is one of the primary competitive challenges of a mass customizing company, therefore we find it important to review what academia has concluded on this subject matter. As defined by von Hippel (2001) in Piller (2004, p. 316), solution space is "the pre-existing capability and degrees of freedom built into a given manufacturer's production system". According to Pine (1995), flexible and responsive processes characterize a successful and dynamic flow of products in mass customization. By indicating flexible and responsive processes, Pine is referring to Flexible Manufacturing System (FMS), a manufacturing concept that we believe is very important for the evolution of mass customization and hence will be discussed in more detail (see 2.3.2).

2.1.4 Tolerable price and cost levels

Evident from Table 1, in their definitions scholars often emphasize a requirement that mass customization should not be associated with price premiums traditionally attributed to craft production (Kotler, 1989; Pine, 1993; Kay, 1993: Silveira et al., 2001). Also in practice it is becoming apparent that a great variety of MC can be achieved at prices equal to or even lower to those of mass production (Pine, 1999). In fact, MC has clear strategic cost advantages for the firm. As new customer acquisition is more expensive than retention of existing ones, firms should prefer to concentrate on customer relationship building rather than continuously marketing to "the masses". Mass customizers believe that customer involvement into the product creation process builds the relationship between the two, and the customer is more likely to feel attached to the product that he or she participated co-creating. Mass customization strategy is one solution for this kind of retention. Even if customized products or services are more expensive to produce, the savings generated from increased customer satisfaction and developed brand loyalty, can make up for or even exceed the costs. (E-Commerce blog) Research and observations show that consumers are often willing to pay a price premium for a customized solution to reflect added value they gain from a product that better fits their needs than the standard product (Franke and Piller, 2004; Levin et al., 2002).

Traditionally, craft customization is targeted to an upper market segment as a consequence of price premiums associated to such goods. To distinguish mass customization from craft customization, it is important to note that mass customized goods are targeting the same market segment that was or could be purchasing the standard, un-customized goods (Piller, 2004). Added value of mass customization may be considerable, but the product still needs to remain affordable to maintain competitiveness against mass-production. Here we enter uncharted territory, but in theory mass customization pricing generally lies somewhere in between the mass-production prices and those of craft customization. From the manufacturer's point of view, the discussed price level must be based on a cost level that allows such a "price premium". Customer co-design process equips with valuable information. It enables

to reduce fixed costs associated with inventory stock and thus allow for a higher level of operational flexibility. (Piller, 2004)

2.1.5 Products and services

As mentioned earlier, in mass customization the line between products and services is blurry. In MC, customers are integrated into a product co-creation process, and in turn, they receive a customized end solution. Essentially, a service becomes an integral part of the product, thus diluting the product from a mere commodity. Management literature suggests to product manufacturers to integrate services into their core product offerings (Gadiesh and Gilbert, 1998; Quinn et al., 1990). The rationale for such integration is based on three arguments: economic, demand, and competition. As for economic arguments, a) revenue can be generated from an installed base of products with a long life cycle b) services, in general, have higher margins than products; and c) services provide a more stable source of revenue as they are better resistant to the economic cycles (Oliva and Kallenberg, 2003). Second, customers are demanding more services. Finally, there is the competitive argument, meaning that services, being more labor dependent, are much more difficult to imitate, thus becoming a sustainable source of competitive advantage. (Oliva and Kallenberg, 2003)

According to Jiao et al., 2003, there are two angles to understand services: (1) a service can be an activity (Illeris, 1996; Payne, 1993; Murdick et al., 1990); or (2) a service can be an output of a system (Illeris, 1996; Sherwood, 1994; Gummesson, 1994; Lovelock, 1992). The activity definition refers to services as a set of activities or acts that are performed for customers, for example a pre-set hotel room or in-flight menu based on the customer preferences. The output viewpoint of services is relatively transparent to customers; as in these situations the service itself is defined as an output, instead of a physical object. (Jiao et al., 2003)

The essential characteristic associated with services is that they contribute value to customers in an immaterial way. In contrast with a manufacturing system, which produces goods (physical products), a service delivery system is considered to be an

operations system that produces services – a particular kind of goods with immaterial nature. Nevertheless, both goods and activities are supposed to provide certain kinds of benefits (or services). Some services are supposed to emerge through the use of goods, and in such context service delivery systems and manufacturing goods exhibit no difference from a customer perspective. (Jiao et al., 2003)

Table 2. Comparison of physical products with service systems

Attributes	Goods (Physical products)	Service delivery systems
Exchange	An organization produces or maintains products and exchange with customers in the market. Through exchange, the product ownership changes.	Only the use of the product is exchanged rather than the ownership.
Consumption (the use of)	Customers participate in the consumption and interaction with the product. Customers perceive benefits through the use of the product. Benefit perception and product operations are simultaneous. The product's capacity is time-perishable.	
Structure	A product possesses components and related arrangement (facility and layout, working units, etc.). It consists of inanimate things without human involvement.	The product has loose, open structure. Besides inanimate things, there is human involvement. The customer process (how the customer uses the product) is more concerned.
Operations (product working method)	More technical. Product's behaviors are relatively stable and predictable.	Technical and more human involvement. Process-emphasized. Management of operations is critical.
External properties	Quality involves appearance, reliability, suitability, etc. Consumption is relevant to sales price and the cost of using the product.	Quality involves reliability, responsibility, assurance, empathy, convenience, appearance/aesthetics, etc. Consumption is relevant to the sales price only.

Source: Jiao et al., 2003, p.10

2.2 Origins of mass customization

2.2.1 The paradigm

The system of *Mass Production* has propelled industrial growth and economic strength of many economies between the eighteenth and twentieth centuries. For many years it was the only production system practiced by large manufacturers and service providers, except for small craft-based shops. However, new forms of competition, society, markets, technologies and consumers have challenged the system. The breakdown of mass production began in the 1960s, accelerated in 1970s and finally alerted the management in 1980s, when a "paradigm crisis" occurred. (Piller, 1993). In the 1990s it was no longer possible to ignore changes that had been accelerating during the past decades. So, in the 1990s, why were so many companies in various industries eager to enter or switch to another paradigm? It happened because many of these industries were undergoing a fundamental change and mass customization provided a solution to overcome these challenges (Piller and Schaller, 2002). They were no longer focusing on standardized products or services for homogeneous markets. Mass Production, associated with *efficiency through stability and control*, was becoming neither stable nor under control, due to "ever-spoiled" consumers and opening markets, therefore efficiency was compromised. Emerging technology and new management methods have opened the door to *variety and customization through flexibility and quick responsiveness*, which is essential to Mass Customization. (Pine, 1993a).

While mass producers stand behind products and services at prices low enough, that nearly everyone can afford them, mass customizers advocate producing goods services with enough variety and customization so that everyone finds what they want (see Table 3). Pioneers of mass customization, having in mind flaws associated with mass production, believed that a company, which better satisfied its customers' individual needs, would have greater sales, profits, and better knowledge of market needs. This, in turn, would lead to even more variety and customization, which will fragment the market even further. (Pine, 1993)

Table 3. Mass Customization vs. Mass Production (Pine, 1993a, pp. 263-264)

	Mass Production	Mass Customization
Focus	Efficiency through stability and control.	Variety and variety and customization through flexibility and quick responsiveness.
Goal	Developing, producing, marketing, and delivering goods and services at prices low enough that nearly everyone can afford them.	Developing, producing, marketing, and delivering affordable goods and services with such variety and customization that nearly everyone finds what they want.
Key Features	• Stable demand • Homogeneous markets • Low-cost high-quality standardized goods and services • Long product development cycles • Long product life cycles	• Fragmented demand • Heterogeneous niches • Low-cost high-quality customized goods and services • Short product development cycles • Short product life cycles

The rationalization for the development of mass customization systems is based on several central ideas (Hart, 1995; Kotha, 1995; Pine, 1993a; Silveira et al., 2001):

- Due to decreasing productivity in 1970s, the ability of Mass Production system to lower real costs and therefore prices inhibited its expansion across markets.
- More accessible international markets lead to a gradual change in consumers' needs and wants. What used to be a stable demand for standard goods has fragmented into a demand for differentiated goods.
- Large, homogeneous markets have become heterogeneous due to the fragmenting demand. Therefore niche businesses are emerging, shifting power to buyers who prefer individualized higher quality goods.
- Companies realize new ways to generate profits, hence they enter niches to try to meet the changing needs. First it can be done through tailoring the end product after production, but this method being costly, customization during production becomes an option.
- Creating high levels of individualized production requires flexibility in manufacturing process, which is a challenge to mass production.
- Hence manufacturing processes and machinery need to change. Driven by markets and customers, high-quality customized products need to be produced

at mass production capacity via short production runs and short changeover times.

- As a result of better addressing customers' needs, a premium price can be charged. This additional margin covers for a loss of volume. After some experience is gained from MC processes, goods with many variations can be produced at the same costs or lower than MP.
- Due to the dynamic nature of new niche markets, continuous success can be achieved by quickly producing a greater variety of goods. As the rate of technology change increases sharply, product development cycles must be shortened accordingly.
- Shorter product development cycles are followed by shorter product life cycles, which means that products and technologies are constantly improved and/or replaced.
- This results in demand fragmentation (less demand for each individual product), and a higher demand for the company and its products relative to the old system and to its competitors. Niche markets become attractive avenues due possibilities to fulfil ever-growing demand fragmentation (Pine, 1993) as well as due to new distributions channels and information technologies that allow direct contact between customers and manufacturers.

To sum up, mass customization originated because of external pressures and changes across industries. However, we acknowledge that many companies withstood the pressures and only some companies saw MC as a clear strategic alternative. First, increasing global competition puts pressure on cost structures. At the same time, customers increasingly demand for product variety and customized goods to fulfil their individual needs. These demands, though, are changing all the time, which makes them difficult to determine and difficult to rely on, therefore companies become reluctant to rely on mass production. In addition to all that, while technological changes are accelerating, product life cycles are shrinking. These factors increase market turbulence, which in turn brings volatility, uncertainty and lack of control in the firms' operating environment. If businesses can no longer count on a stability of the demand, they can no longer realize the efficiencies and the economies of scale of mass production. At this stage and point, for some companies mass customization becomes a clear strategic alternative. (Pine, 1993)

2.2.2 The companies

These afore-mentioned arguments are explaining the origin of mass customization paradigm. In addition, we were curious in the nature of firms that decide to embark on this strategy. Duray (2002) conducted an empirical study of 126 companies from different industries to examine the origins of mass customizing companies. It was discovered that these companies predominantly came from two alternative backgrounds:

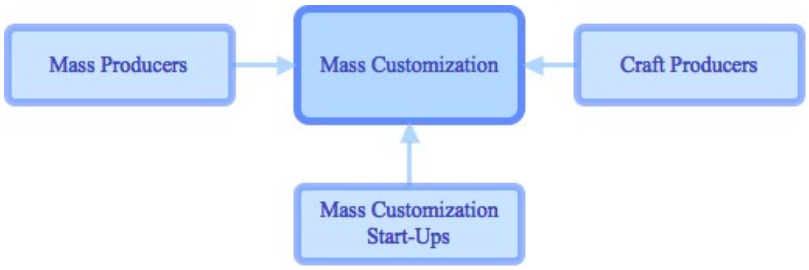
- Mass producing companies side-stepping to MC because of market pressures and customer demand for a broader product portfolio (Blecker and Friedrich, 2006), and
- Craft producers (one-of-a-kind manufacturers) shifting to MC due to volume expansion and existing similarities between end products (Blecker and Friedrich, 2006).

If the same study was carried out today, almost ten years later, it can be speculated that the findings pointed out the other direction. Emerging technologies and boldness of consumer demand for individualized goods has encouraged new businesses, i.e. start-ups, to enter the mass customization market. Piller (2004), in fact, builds an argument for a third type of business, emerging in mass customization:

- Highly specialized companies adopting MC and targeting niche markets.

Zipkin (2001) also thinks that mass customization is still very much a niche business, dominated by highly specialized businesses that are small and often young. Only very selected number of mass production brands have moved to mass customization beyond pilot testing and niche markets. (Piller, 2004)

Figure 2. Origins of mass customizing companies



In order to contribute to MC research and to possibly benefit aspiring star-ups, in this study we concentrate on the latter entry to mass customization (start-ups).

2.3 Achieving mass customization

In order to bridge the gap towards the literature about success factors of mass customization, we must introduce the methods through which mass customization can be achieved. According to Åhlström and Westbrook (1999), these methods can be categorized into two categories a) required organizational transformation and b) mass customization approach. The first - (a) - depends on the initial point of customer involvement, i.e. "decoupling point" in the value chain (Lampel and Mintzberg, 1996) and therefore the earlier the decoupling point occurs, the more organization transformation will be required (Duray, 2002). The key to efficient mass customization is not only finding the right variation of a product, but also locating the right point of entry of customization, which can be a dilemma. On one hand, the earlier the customer is involved into product development, the higher the impact on the perceived customer value. On the other hand, cost pressures mean that 'decoupling point' must be placed as late as possible in the value chain. (Svensson and Jensen, 2003) The initial customer involvement leads to four types of mass customized products: customized additional services, adaptive products, modular products and tailor-made products (Piller, 1998 in Broekhuizen and Alsem, 2002). Their relation to MC approaches is pictured in Figure 3 below.

The second category – mass customization approaches – relates to how customer value can be created and engage the nature of customization rather than the organizational changes needed (Broekhuizen and Alsem, 2002). With reference to their empirical observation, Gilmore and Pine (1997) recognize four approaches, or 'four faces' of mass customization: adaptive, cosmetic, transparent, and collaborative. This means that MC can be introduced at various stages along the value chain, ranging from a simple adjustment after-sale to a complete customization of the design, assembly, or packaging, based on customer's vision. When designing or redesigning a product, or service, managers should examine each of the approaches for possible insights into how best to serve their customers. The 'four faces' demonstrate the possibilities to combine the direct interaction of collaborative customization, the embedded capabilities of adaptive customization, the straightforward acknowledgment of cosmetic customization and the careful observation of transparent customization. Each approach will be explained in more detail in the following chapter. Often, managers realize that a mix of some or even all four approaches need to be utilized. Individual customers tend to value when their particular needs are addressed; therefore businesses must design and build a set of customization capabilities that meet those needs. (Gilmore and Pine, 1997)

2.3.1 Levels and approaches

Research on mass customization tackles several issues with regard to developing, producing, and selling individualized products and services for rather large customer segments (Piller et al., 1995). In order to demonstrate the differences between methods of MC, we develop a framework to illustrate how customers are integrated into value creation by defining, configuring, matching, or modifying their individual solution. We show four stages in a firm's value chain: design, assembly, additional services and product usage. The final stage – application (or usage), represents the customer's interaction with the end solution. Each column in Figure 3 refers to a different approach and indicates at which stage of the value chain mass customization occurs and into which type of a product it results. For instance, cosmetic customizers may standardize a product up until production stage and make it possible to

individualize it only towards the end of the value chain, eg. packaging, which results into a product type 'customized additional services' (see Figure 3).

Below we summarize each of the four approaches and conditions for when they are appropriate to be used (from Gilmore and Pine, 1997):

- Adaptive customization – means that standard goods can be modified to suit each customer's needs after the purchase, through use or application of the end product. Here the provider has created multiple variations into a standard, but customizable, offering; therefore each individual derives his or her own value from the product. This approach is appropriate when customers want the product to perform in differently on different occasions, and available technology makes it possible to customize the product on their own. The dialogue is rather between a customer and a product than between a customer and a provider.

  For example, companies like Nudie Jeans and Baldwin Denim make and sell high quality unwashed denim jeans and instruct their customers to wear their jeans for at least six months before washing them. By doing this, each resulting pair is completely "custom worn", shaped and coloured, as a function of the way the wearer has used them. Both companies use this element heavily in their consumer communication and advertising.

  In 1991, Gillette introduced the Sensor razor, which automatically adjusts to the contours of one's face while shaving, i.e. through application. Gillette could have segmented the market and created several models to satisfy each segment. Instead, they created one standard product that is mass produced, yet is designed to customize itself to the individual user. (Pine, 1993)

- Cosmetic customization – this approach is adopted when a standard product satisfies a customer and only its outward appearance or the way the service is presented needs to be customized. Cosmetic approach is appropriate when customers use a product the same way and are only interested in unique ways of how it should be presented. Rather than a product being customized, a

standard offering is packaged individually for each customer. Cosmetic customization mostly happens at or near the end of the value chain. For instance, a simple tailoring process of including a customer's name to the product creates individualization without a dialogue associated with collaborative customization. Although it may seem that such personalization is *merely* cosmetic, it still adds value to customers.

The examples are various, as this level of customization does not require dramatic changes to the value chain. A Swiss cigarette brand 'Parisienne' had launched a campaign, inviting customers to customize the visual look of the packaging through an online software interface. After designing the look of the pack, using text and a limited set of images, the customer could order the standard product in the customized pack design.

Another cosmetic customization approach is executed by Heineken, one of the biggest beer manufacturers worldwide. The campaign 'Your Heineken' was launched and currently is limited to Ireland. Through an interactive 3D website interface, customers can customize the outward appearance of the beer bottle, and place the order for delivery. In a fixed solution space customers can choose from 6 different base categories (party, sports, festive, etc.) and apply personalized messages and picture to the bottle. Like the case of Parisienne, this is entirely cosmetic customization because the product remains the same (beer and cigarettes) without being customized, only the outward appearance, in this case packaging, is customized within the fixed solution space. Similarly, wineries will often provide customized labels for bottles, where the product (wine) remains the same, but the outward appearance is tailored to an individual customer.

- Collaborative customization – this approach, also known as co-creation, involves customers already at the product design stage, and represents the essence of mass customization, because through "customer integration" a dialogue is created between the manufacturer and the end user. Mass customizers help customers to articulate their needs and influence the outcome of the product based on the possibilities available to them. Collaborative

customization is suitable when customers cannot easily express what they want and may become frustrated when presented with an overabundance of options. This approach also reduces the customer sacrifice, i.e. the gap between what the customer wants and what he or she settles for. The possibility to influence on the design of the product allows minimizing that gap (Broekhuizen and Alsem, 2002).

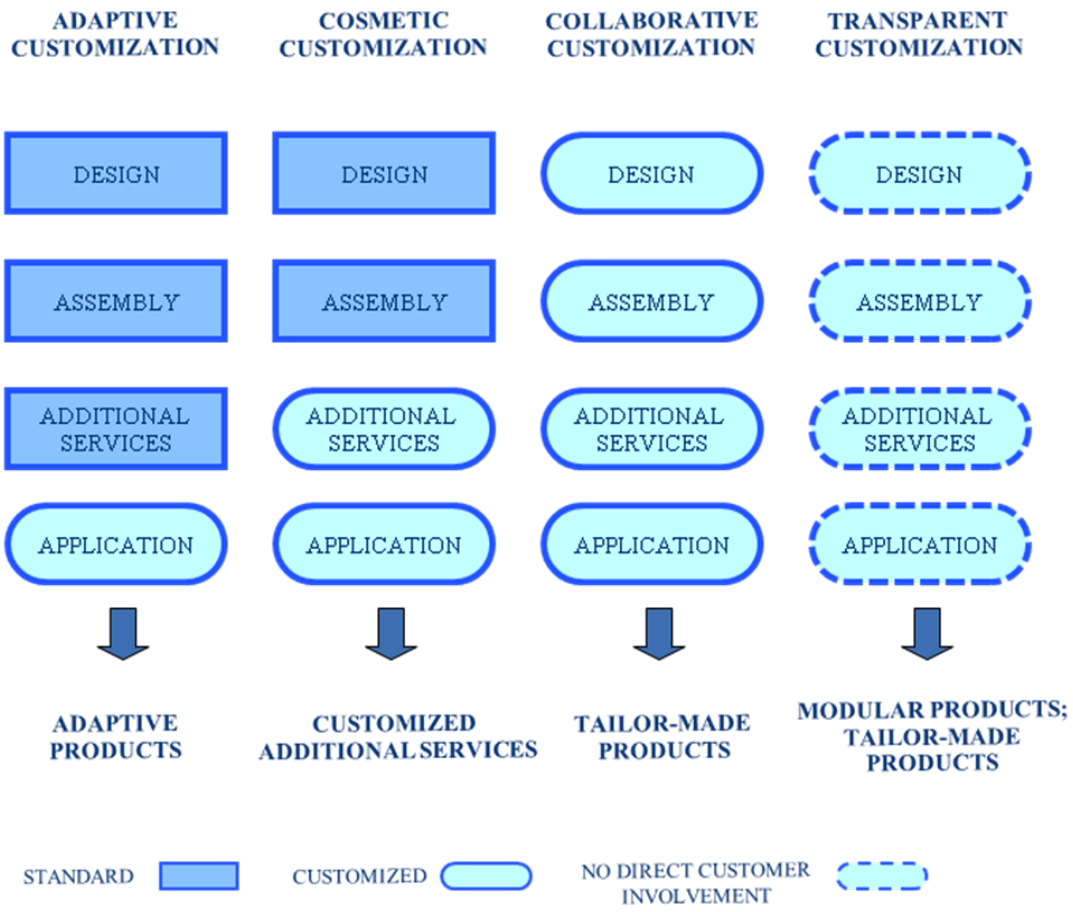
MyMuesli is a recent German start-up which has, in reasonably short time, become one of the most successful mass customization companies in Europe. MyMuesli builds on the current trend of customizing food and nutrition and it works as a great example of 'collaborative customization'. It offers its customers a possibility to mix their own blend of muesli using a broad, but predetermined, selection of ingredients. The customer can then customize the packaging to their liking, before ordering a delivery. In essence the customer is offered a controlled access to the entire value chain of the company.

- Transparent customization – provides customers with individualized goods or services in an unobvious way, without letting them know that customization ever took place. Such approach is appropriate for businesses whose customers' needs are predictable and especially when customers do not want to be bothered with direct collaboration. Instead of engaging into customer co-creation, transparent customizers observe behaviours over time, looking for predictable preferences and then discreetly customizing their offerings within a standard package. This approach is as deep into value chain as collaborative one, but the underlying difference is that there is no dialogue with the buyer and the provider, i.e. customer co-creation is non-existent. To demonstrate that lack of customer co-creation, and the transparent nature of the customization, we use dotted line in Figure 3.

  For example, Ritz-Carlton hotels came up with a discrete way of learning about its customers' needs. It observes individual guests each stay – preferences for pillows, newspapers, or meals. The company then stores this information in a database and uses it to tailor the service each time a customer returns to the hotel. In the end, the more someone stays in Ritz-Cariton hotels,

the more the company learns about the guest and thus is able to fit more customized goods and services, resulting in increasing the guest's preference for that hotel.

Figure 3. Levels and approaches of mass customization



Adapted from Lamper and Mintzberg (1996); Broekhuizen and Alsem (2002)

2.3.2 Mass customization manufacturing systems

This section discusses mass customization manufacturing systems (MCM), which is of central significance in the strategy of mass customization. Initially, we briefly overview the evolution of flexible manufacturing systems (FMS), which metaphorically speaking gave birth to the concept of MCM; further, we indicate that a successful performance of MCM system depends at least on four critical areas, which are: product design, product configuration, production processes, and supply chain

operations. (Blecker and Friedrich, 2007) The requirements on each of these areas are briefly discussed.

Already in the 1950s Diebold (1952) envisioned a concept that is reminiscent of flexible manufacturing, as we know it today. He recognized flexibility to be essential for short-run manufacturing of separate parts and designed a concept for simultaneously performing a bundle of related functions. These designs remained on the 'drawing board' until the invention of microprocessor technology (Sethi and Sethi, 1990). In the beginning, flexible manufacturing was seen as a trade-off between efficiency in production and agility in the marketplace. It was not until 1970s that flexible manufacturing made it possible to batch multiple products at the efficiency of mass production. The efficiency of mid-variety production was accomplished by a reduction of setup costs and times required for switching from the production of one product to another (Sethi and Sethi, 1990) and the economies of scale were replaced by the economies of scope (Panzar and Willig, 1981; Goldhar and Jelinek, 1983; Talaysum et al., 1986 in Sethi and Sethi, 1990).

Flexibility in manufacturing means being able to reconfigure manufacturing resources to efficiently produce different products of acceptable quality (Sethi and Sethi, 1990). An earlier definition goes back to Ropohl (1967) quoted in (Sethi and Sethi, 1990): "manufacturing flexibility is the property of the system elements that are integrally designed and linked to each other in order to allow the adaptation of production equipments to various production tasks." Jaikumar (1986) stresses that flexible manufacturing system is always constrained within a domain (see also Goldhar and Jelinek 1983; and Gerwin 1989). Such a domain is defined in terms of portfolio of products, process, and procedures and should be well understood by all participants in the value chain, i.e. product designers, manufacturing engineers, and software programmers (Sethi and Sethi, 1990). What these scholars tried to define decades ago, is later integrated into Piller's (2004) definition of mass customization's fixed solution space, (see 2.1.3).

Just as mass customization is evolving around better fulfilling changing customers' needs, the manufacturing industry is also gradually adapting and focusing on the ability to flexibly and rapidly respond to changing market conditions. Over time, with

shortening product life cycles, some manufacturers find it challenging to capture market share and remain profitable by producing large volumes of standardized products. (Qiao et al., 2010; Blecker and Friedrich, 2007). Mass production is successful in stable business environments, where the supply side is more powerful than the demand side. As a response to increasingly dynamic and competitive environment, mass customization paradigm is an appropriate approach, keeping in mind the modern customer is more demanding than ever due easy access to a global marketplace (Blecker and Friedrich, 2007). For some companies, especially start-ups, success in manufacturing requires the adoption of modern methods in order-fulfilment processes to manage change while providing a fast and flexible response (Fulkerson, 1997). Some companies are challenged to change their manufacturing systems to meet demands of the current market place and that is how mass customization manufacturing system is born. The design of an MCM is an extension to the flexible manufacturing system and the goal is to achieve a balance between product standardization and manufacturing flexibility. Successful MCM is accomplished through being able to rapidly reconfigure operations and processes and integrating new functions to keep up with the dynamic manufacturing demand. (Qiao et al., 2010)

As previously mentioned, MCM systems result form the integration of four key elements, which are product design, product configuration, production process, and supply chains (Blecker and Friedrich, 2007). In the following, we briefly discuss each of the elements to demonstrate what requirements exist for the MCM system to function.

- *Product Design Requirements* for mass customization should address the conflicting goals of reusability and differentiation. Reusability can be achieved through commonality and modularity by simultaneously benefiting from the economies of scale and scope. Component commonality aims to increase the use of identical components in many products. Pine (1993a) argues that the best method to achieve mass customization is to develop modular products.

  Another product design requirement for MCM is product platforms. A product platform is a product module, which is common to an entire product family (e.g., automobile platform is common to many car models). This definition imposes stronger constraints on the product design since it requests modularity and

commonality of one or more modules across the product variants. (Blecker and Friedrich, 2007).

- *Product configuration requirements* are defined within two main contexts. The first context is very technical where the main concern is to provide error-free product variants (modules) in an efficient manner to avoid redundancies and to facilitate the data maintenance.

  The second context is customer-oriented. Software applications are needed to automate ordering process and hence reduce the corresponding costs. These software applications are intended for step-by-step guidance of customers during their search for products that corresponds to their needs and match the existing offering. Here the task of the configuration system becomes twofold: a) to support the customer and b) to avoid orders of incompatible product variants. With an adequate IT (information technology) support, customers would be able to self-configure and order/buy products over the Internet, simply not permitting incompatible product combinations (Blecker and Friedrich, 2007).

- A fundamental requirement on *Product processes* in mass customization is flexibility – "…the ability to respond effectively to changing circumstances" (Gerwin, 1987, p. 39) and it may occur at different levels: the individual machine, the manufacturing system, the manufacturing function such as cutting or assembling, the manufacturing process, the factory, etc. (Gerwin, 1987). The basic dimensions of MCM flexibility are product mix and changeover flexibility. Product mix flexibility is the ability to produce and adapt to diverse customers requirements, whereas changeover flexibility is the ability to switch between components fast and cost effectively. (Blecker and Friedrich, 2007) This can be referred back to previously mentioned modularization.

  Technology used on the shop floor has a major stake at influencing the flexibility of manufacturing systems. The progress of computer-aided design (CAD), computer-aided manufacturing (CAM) systems and their evolution to computer-integrated systems (CIM) have greatly contributed to the emergence of the mass customization paradigm.

  However, MCM does not only rely on the advances in manufacturing technology. For an efficient customization, the production process to some extent

should be based on customer orders as to avoid build up in stock. The production process therefore is divided into two steps: 1) producing basic components regardless of specific customer orders; 2) after an order is placed, at the "Customer Order Decoupling Point (CODP)" (Tseng and Piller, 2003, p. 74), the product is further customized. This approach involves some degree of uncertainty, because basic components are manufactured according to forecasts. However, in Step 2, production volumes are accounted for because only confirmed customer orders are released into production. (Blecker and Friedrich, 2007)

- *Requirements on Supply Chain Operations* incorporate management of physical and information flows with suppliers and customers in order to improve operating efficiency. The involvement of delivery service providers within supply chain operations can enable a better achievement of scale economies through order consolidation. Furthermore, collaboration with suppliers improves the efficiency of supply and inventory management and it should not only occur during production, but also at earlier stages. (Blecker and Friedrich, 2007).

2.3.3 Aligning demand and supply flexibility in customer co-design

Flexibility of supply and demand plays an important role for a successful implementation of a mass customization strategy that generates a sustainable competitive advantage. Supply flexibility is defined by the range of options, available in flexible and agile manufacturing systems. Manufacturing system flexibility allows manufacturers to be more responsive to demand changes without steep setup cost, lead-time, or production disruptions. In MC context, demand flexibility is the extent to which a customer is willing to compromise on product features or performance in order to meet financial (reflected in price) or time (reflected in delivery) constraints.
As mentioned earlier, the process of translating individual customers' needs into particular product specifications has been recognized as a customer co-design process. During that process, customers define, configure, or modify an individual solution thus becoming an integral element of a value chain (Piller et al., 2004). Consequently, flexibility in demand and supply enriches the range of solution alternatives and

increases the possibility of finding the most suitable option. However, both customers and manufacturers need to interact and through a careful analysis align the flexibility in demand and supply. (Chen and Tseng, 2007)

Co-design is challenging partly because customers and manufacturers have differing information, which needs to be reconciled for effective customization process (Von Hippel, 2005). Co-design can be classified into manufacturer-centered or customer-centered. In manufacturer-centered co-design, manufacturers analyze customer preferences, investigate demand flexibility, and then customize the product accordingly. Zipkin (2001) identifies that a key challenge of manufacturer-centered co-design is the challenge to accurately obtain customer preferences. Research in marketing reveals that customer preferences are often vague and subject to influences (Bettman et al., 1998 in Chen and Tseng, 2007). In customer-centered co-design, naturally, customization decisions are made by the customer. Even though a manufacturer can allocate less effort to sales, this co-design approach often involves a large number of options thus burdening customers with choices, which can be particularly straining when customers do not have enough knowledge of the product (Piller et al., 2004). To sum, various attempts have been made to exploit the value of demand and supply flexibility in solution co-design. Tools, such as design toolkits, sales automation systems, and product configurators have greatly reduced the complexity of customization decisions for both customers and manufacturers (Chen and Tseng, 2007).

2.4 Added value through mass customization

The modern consumer is more demanding than ever in the past and due to the increasingly easy access to a global marketplace the industry dynamics are continuously changing (Cox et al., 1998). Companies operating in a demanding environment may need to react by providing flexible manufacturing systems, but these systems exclusively are not enough to offer variety without compromising on profitability (Forza et al., 2002). It is these pressures that mass customization attempts to address, by providing an option to answer new market realities while maintaining high levels of efficiency (Pine, 1993).

Mass customization technologies make it possible for companies to create a cost efficient value chain, while increasing flexibility towards answering customers' needs from heterogeneous market demands. In this relatively new concept of industrial value creation, companies listen to their consumers (Fournier et al., 1998), pay higher attention in delivering services (Gronroos, 1997) and, instead of solely acquiring new customers, they concentrate on building lasting relationships with the existing clientele (Peppers et al., 1997). Introducing consumer participation into the company's value creation process, increases customers' sense of involvement in the end product and brings real first hand consumer knowledge back into consumer product manufacturing. (Wikstrom, 1996)

In mass customization, the customers can be seen as partners where companies allow consumer input to influence the value creation process to a predetermined degree (Piller et al., 2004). In order for mass customization to work, it needs to function near the mass-production efficiencies, and therefore managers must find an optimal balance between the additional customer value created and the investments required to allow customization on a mass scale (Broekhuizen et al., 2002)

2.4.1 Consumers' willingness to pay

The traditional customization, or craft production, is based on the possibility to charge a higher premium from the consumer as the added value of the product more accurately meets the customers' specific needs. (Piller et al., 2004) The customer gains an "increment of utility" from the better fitting customized product over the best standard product alternative. Because of this added value, some consumers will choose the more expensive customized product over the mass-produced generic alternative (Chamberlin, 1962).

Customers also experience hedonic and instrumental benefits when customizing their selection. One critical factor for the creation of perceived value is the shopping experience (Broekhuizen and Alsem, 2002). The possibility to configure one's own product can be pleasant (eg., creating customized pair of shoes at Shoes of Prey)

because of the entertainment value and the enhanced control. In addition, customers will likely be more satisfied obtained something that fits exactly what they want.

Berger and Piller (2003) refer to a concept mentioned in the earlier chapter when they argue that often consumers are willing to pay a higher price premium for products which physical dimensions have been customized, than for more simple products with customized design patterns. When customers move from less to more co-creation (collaborative approach), they experience an increased willingness to pay for the product or service. Berger and Piller (2003) highlight an example of two sport shoe manufacturers, Nike and Adidas, who both offer mass customized products for their customers. Whilst Nike offers its customers the possibility to change the colours of a standard shoe or include personalized embroidery, the Adidas concept 'mi adidas' allows its customers to adjust cushioning to increase functionality and influence exact measurements of the shoe to increase comfort. In this example Nike charges up to 10% more than similar uncustomized products standard retail selling price, where Adidas can charge up to 50% more. (Piller et al., 2004) This phenomenon is further explored in our theoretical framework (Figure 7).

Even if through mass customization companies can sometimes find a niche market which can yield an abnormal profit margin, it should be pointed out that mass customization is meant to satisfy the needs of the same market segment as mass-production, but to do it better. Mass customization occurs when approximately the same number of consumers can be served as in the traditional mass markets, while maintaining the ability to treat the consumers nearly as individually as in the craft production (Davis, 1987).

By definition mass customized products offer an increased level of product uniqueness when compared to mass-produced products. This co-creation process introduces a perplexing effect, where the consumer's ability to perform objective price comparisons are limited. This in turn decreases the pricing pressures companies are facing. (Grover et al., 2004)

2.4.2 Incremental costs of mass customization

When compared to the requirements for companies in the traditional mass markets of the industrial economy mass customization brings with itself a myriad of complexity, and complexity means costs. Setting up an operation that is able to receive customer information, produce a customized solution and deliver it in time for the right consumer requires investments in the organization's sales operations. For the companies who are already established in the traditional mass production markets and now expand to MC may increase their requirements for the supporting customer service centres, which might lead to a higher total costs. Also the delivery of the physical products becomes more expensive due to need to make smaller quantity shipments (Piller et al., 2004).

In order to mass customize, the companies are required to collect more customer specific information than in traditional mass-production, and while it is essential that companies receive the required information and manage to manufacture and ship the correct product to the correct destination, it is increasingly important that the information is collected in a way that is convenient to consumers. If the customers become frustrated, overwhelmed or if they are not satisfied with the user interface, customization strategy will not turn into competitive advantage. (Huffmann et al., 1998)

Also the cost of manufacture is higher compared to mass-production; to a certain degree mass customizing companies lose aspects of the economies of scale. The manufacturing processes cannot be equally standardized, when each unit produced can be different from the previous one. Setting up the machinery, increased requirements from the labour, larger inventory of components, flexible production units, more complex production planning and quality control are all factors that contribute to a higher production cost. (Piller et al., 2004)

This research does not attempt to capture and analyze all factors that increase the costs in mass customization (for more research on this topic see, e.g., Zipkin 2001 and Reichwald et al., 2003), but it is essential to this research to point out that when a company has successfully implemented mass customization strategy, and manages to

produce individually customized products close to the mass-production efficiencies, it has managed to go trough a profound rearrangement of its operations.

2.4.3 Balancing the increased cost with benefits

Unlike one might assume, after going through a list of factors increasing cost in the previous chapter, mass customization of a product hardly ever justifies substantially higher consumer prices than its mass-produced alternatives. This is most notably due to high levels of competition that pose pressure on pricing. These pressures grow stronger as, through technological advancements, the barriers to entry are low for non-established mass customization markets and geographical location sets lesser limitations to the size of serviceable consumer base.

To help companies in balancing between increased cost and consumers' willingness to pay premium prices for the customized product, Piller (2004) has identified three strategic approaches:

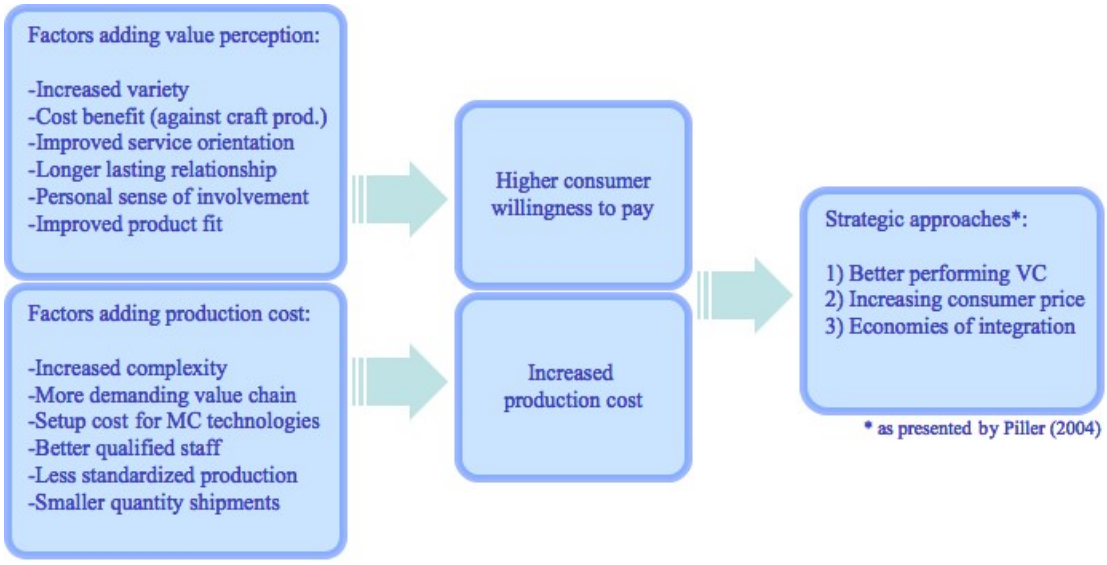
> Firstly the company can gain competitive advantage through a better performing value chain. The overall performance can be improved, as the requirements need to be set higher. Companies can obtain a more stable processes, high variety of production planning and better control (Martinez et al., 2000), but also gain from specialized information systems, order tracking and improved ability to interact with individual customers (Lee et al., 2000).
>
> Second, and the most common way to deal with customization-related costs, is by increasing the consumer price of the customized product or service. This can be easily observed in cases when the company traditionally offers a portfolio of mass-produced items and, by the means of mass customization, reaches out for the niche consumer segments that are willing to pay premium for added customization.
>
> Thirdly Piller and Schaller (2002) introduce a concept *'economies of integration'*, where a better-integrated consumer can be harnessed to provide

the company with new cost-saving potentials. The cost savings can be obtained by using the insights collected from the more precise information about individual consumers' behavior, by postponing some activities, which are traditionally made without the involvement of the consumer (or the first supplier) to the point when the order is placed. This way of direct interaction with the buyer may also boost consumer loyalty (Kotha, 1995; Piller and Schaller, 2002; Squire et al., 2004). Piller, Möslein, and Stotko (2004) build on the thought and claim that economies of integration not only result in cost saving potential, but also bring a higher customer loyalty and hence create value for the firm.

All of these three approaches are supplementary and often times used together to maximize the benefits obtainable through mass customization strategy (Piller et al., 2004).

As an attempt to simplify the dynamics of added value creation in MC, discussed in this segment, we have drafted Figure 4. This figure simplifies the different factors that influence consumer perception of value, the total cost of production and the most generally used reactions by mass customizing companies.

Figure 4. Simplified added value model in MC



2.4.4 Increased accuracy in marketing

Mass customization provides various new opportunities in better reaching the right consumer with the right product proposition. Essentially the companies that practice mass customization allow consumers to directly or indirectly have an influence over the entire traditional marketing mix, as introduced by McCarthy (1960). The increased consumer involvement in mass customization is discussed in below through the traditional marketing mix to offer examples of opportunities for increased marketing accuracy:

- **Product**, and the ability to change the product offer, is the main driver for consumers that turn into mass customization. In theory this influence over the product, or service, increases customer satisfaction over mass produced alternatives.
- **Price** of the product or service is dependent on many occasions on the decisions consumer makes during the mass customization phase. Mass customization thus enables a customer-centric pricing process, which exploits the individual buyer behavior and value perception to capitalize on varied price sensitivity. For example the more features or the better quality materials the customer wants to have in the final product the more he/she will be required to pay for the product. (Grenchi et al., 2007)
- **Place** of purchase is a less obvious element in the marketing mix, especially as the examples raised in this research are all distributed online. However due to the increased level of shared information between the company and customer, the interface can be adapted to better service the individual consumer. Repeating customers can be better serviced due to customized shopper interfaces.
- **Promotion**, again due to the increased level of individual consumer information, this becomes more cost efficient. As opposed to mass-production where the companies need to collect information about customer preferences in other means, the MC companies receive immediate information for the preferences of each unique customer. The naturally collected an in some instances, with high levels of repeating purchases, constantly updated in-depth consumer knowledge provides MC companies a competitive advantage against mass-producing companies.

As discussed, due to the nature of MC, the purchasing process involves a much higher exchange of customer specific information when compared to the traditional mass-production. The natural dialogue with the consumer leads to a higher than average level of information exchange and provides opportunities for a more accurate, and more efficient, ways of reaching the customer. The information, if collected and managed in an appropriate manner, may contribute in optimizing the provided benefits. The interface, in which the consumer operates and feeds in the required information, must be designed in the way that best supports the needs and expectations of the consumer. (Piller, 2002).

According to Rackham and DeVincentis (1998) there are two alternative approaches to how the e-consumer can be serviced during the time of purchase. Selecting the appropriate one depends on the nature of the product and the level of product understanding of the general customer base. The customer of an average "design-your-own-T-shirt.com" does not expect the same level of interaction as when one is buying a customized Fiat 500. Rackham and DeVincentis argue that the purchasing situation can be either compared to the to the traditional consultative selling method, where the salesperson is expected to assist consumers in understanding their needs and give advice in product selection, or to the ones in transactional selling, where consumer understands the product and does not require assistance in completing the purchase (Rackham et al., 1998).

To further discuss the opportunities mass customization can offer in the place of purchase, and during the time of purchase, the sequence of information exchange must be carefully planned through. Successful mass customization manages to build added value through increased consumer involvement during time of purchase, even though the increased involvement demands more attention and input from the consumer. When gathered in a successful manner the knowledge of individual consumers needs may allow companies to offer better service, meaningful decision support, targeted bundling options and altogether build more fruitful longer lasting relationships with their customer base. (Grenchi et al., 2007; Piller et al., 1998)

Mass customization methods enable companies to take a better use of consumer relationship management and data mining tools, than the traditional mass production

companies utilizing the Web as a mere selling interface. The technologies required for mass customization can help in providing better customer decision support (Grenchi et al., 2007), but the additional collected information can also be used to create precise customer segmentation. Yankelovich and Meer (2006) point out the importance of segmentation for companies operating in Web environment, as they are provided with a massive amount of information. Dell, for example, has moved from the traditional generalized segments (home, small business etc.) to sub-segments that go into a more specific description of the consumer behaviour and preferences (e.g., traveller, professional) and help the company to better offer the appropriate product to the specific consumer group. (Yankelovich et al., 2006)

2.5 Success factors of mass customization

In this section, we discuss the success factors of a firm's mass customization strategy from the perspective of an organization's capabilities as well as market conditions. To accomplish this, we identify conditions (or factors) that impact the outcome of MC success and we believe are relevant to this study. According to Blecker and Abdelkafi (2006), if necessary conditions are satisfied, the implementation of mass customization strategy has great chances of success. Before a company decides to shift to or start with mass customization, it is important to investigate those conditions and see if they can be met. Not all business are ready or even suitable for mass customization, therefore serious failures can be avoided if the evaluation of success conditions is done properly.

Whether mass customization is a competitive strategy or not can be attributed to external and internal factors. While the former are market-related, the latter are a direct consequence of an organizational setting (Silveira et al., 2001). The factors that are most commonly emphasized in the literature are discussed in the following sections.

After reviewing the literature of mass customization, it became apparent that only a few researchers have attempted to assess necessary conditions for successfully pursuing MC strategy. Broekhuizen and Alsem (2002) provide a rather rich overview

of these attempts, several of which we would like to reflect on in our study. Pine (1993a) developed a market turbulence questionnaire that managers can use to evaluate whether a shift to mass customization is feasible. A high enough score represents an indicator favourable to move to this approach. However, Pine's tool does not link organizational capabilities with external market opportunities, which inhibits its ability to estimate the probability of success. In the end, it is clear that companies' competencies certainly affect the probability of mass customization success.

Hart (1995) analyzed opportunities for MC and identified four key factors. Two of them were industry factors: competitive environment and customer customization sensitivity; and two organizational factors: process technology feasibility and organizational readiness. Even though these four factors provide a comprehensive framework, they are rather general and provide little practical guidance for business managers (Broekhuizen and Alsem, 2002).

Kotha (1995) also analysed the success factors of mass customization, and identified the following: a) industry and competitive conditions; b) culture and organization design; c) resources and capabilities; and d) inter- and intra-organizational coordination. While on the one hand, Kotha (1995) addressed the compatibility between organizational and market factors, and improved on Pine's (1993) model, on the other hand we believe there was a too high emphasis on organizational capabilities, three out of four factors being on that subject. Even though a significant contribution, Kotha's (1995) model slightly ignores the importance of external factors.

2.5.1 The definition of success

First, we need to define *success* within this study, because there are many angles to approach and estimate what a success factor is. Mass customization tends to cultivate an alternative method of measuring a company's success. Traditional indicators, such as market share, measure the percentage of the total market that is captured by one firm without distinguishing individual customers or their groups between each other.

In mass customization, companies place more importance on the lifetime value of individual customers. Since the companies practicing mass customization seem to greatly value customer profiles and outreach, the acquiring and retaining a customer becomes a major success factor.

Referring to the alternative MC success measurement scale, and to our academic background in international business and marketing, we choose to touch upon the success of MC from the perspective of added consumer value. We refer to an approach by Broekhuizen and Alsem (2002), who suggest that ultimately the success of mass customization depends on the perceived added value from buying mass customized solutions as opposed to mass-produced ones. In other words, the success of MC is the ability to provide superior customer value through customization on a mass scale.

2.5.2 External success factors

The literature around mass customization points out several success factors, which are grouped by the theme in the list that follows. In order to better structure our approach we have divided the success factors into external and internal, depending on whether the factor is of a nature which the company can directly influence (internal) or of the kind that is determined by greater market dynamics (external).

Customer demand for customization

The need to deal with increasing customer demand for innovative and customized products is the fundamental justification for mass customization (Pine et al., 1993; Lau, 1995). However, the key to success is the skill to balance between customer's perception and company's ability to fulfil. It is crucial for a company to produce and deliver individualized products within an acceptable time and cost frame without burdening a customer with a price premium and long delivery times of mass-customized products (Kotha, 1996).

In later research on this topic Pine and Gilmore (2000) call customer demand the main driver for the implementation of mass customization as they make the point that customer satisfaction surveys do not provide adequate information for companies to make decisions on whether to mass customize or not. These surveys are designed to provide companies with information of the general needs of the consumer base, and as the consumers can only evaluate their needs based on the current market offering, companies must conduct alternative research to support their decision-making. (Pine and Gilmore, 2000)

Research on the conceptual underpinnings, opportunities and limits of mass customization suggests that companies should measure "customer customization sensitivity" in order to establish an understanding on how ready their consumer base is for mass customization. This concept measures two basic factors, which are the "uniqueness of customers' needs" and "level of customer sacrifice". (Hart, 1995, p. 40)

The industry and the type of product define to a great extent the uniqueness of the customers' needs, as where in one industry, IT or fashion for example, the customer will appreciate a high level of variety, in another industry, for example pharmaceuticals, the consumer would probably be relatively indifferent to the option for a customized product. (Blecker et al., 2006)

The second factor, level of customer sacrifice, can be defined as the gap between what a customer settles for and what he wants exactly. The customer will be ready to purchase a product as long as it satisfies his/her needs to a certain extent. The more unique needs the customer has the wider is likely to be the gap between complete satisfaction and a mass produced product offer and the more susceptible the consumer is to pay for a customized product instead. (Hart, 1995)

Appropriate market conditions

Another external factor that influences the likelihood for success is general market conditions. Companies who are the first in their respective industries to implement MC may benefit a substantial first mover advantage. As mass customization allows companies to differentiate their offering from competition, it may offer a long-term change in the corporate image in consumers' mind towards a more customer driven and innovative image (Kotha, 1995).

The more turbulent the market conditions, the more likely it is that companies will benefit from adopting a mass customization strategy. Pine (1993b) points out that mass production is a successful strategy as long as the business environment is stable, such that there is little or no demand for differentiation. When these conditions change companies are forced to reconsider their product offering to better position themselves against competition.

The discussion continues on whether entire industries that traditionally used to rely on mass production will be replaced by mass customization. Pine (1993a) hypothesized that mass customization will completely replace any other kinds of value chain setups, where Kotha (1995, 1996) built a strong case for an argument that companies can benefit from synergy effect where they to implement both mass production and mass customization simultaneously. It remains to be seen if a modern consumer is willing to make the effort of continuously specifying their needs in order to be able to purchase better fitting products. (Kotha 1995, 1996)

It seems that when Pine and Kotha discuss market conditions, they primarily consider competitive pressures, and less so reasons for any customer initiated development that would increase the demand for mass customized product offers.

2.5.3 Internal success factors

Customizable nature of the product

The nature of the product offer has to support the strategy of MC. The product must be *modularized* in a way that it is possible to be assembled into different forms (Feitzinger et al., 1995). The best method for achieving mass customization – minimizing costs but at the same time maximizing individual customization – is by creating modular components that could be configured into a variety of end solutions. Economies of scale are achieved through the wide variety of components; economies of scope are gained through using the modular components in numerous products, and customization comes to life through countless end product options. (Pine, 1993b)

A module can be described as a standardized unit, which can be joined with other units in order to form larger or more varied end solution. For instance, plastic bricks used in Lego® toys are perfect examples of modules and what they can result in. Due to the standardized architecture of modular systems, the units can be joined or disconnected from each other and re-assembled in various configurations, thus resulting in different end solution. There are two types of modular systems: open, and closed. The former allow for a potentially limitless number of units to be added or subtracted; whereas the latter present a fixed number of units or options to choose from. This interchangability allows customization and variety, associated with modular design. Modularity is not limited to physical objects, and it can be found in any system in which attributes are standardized, interchangeable and subject to choice. In Nike apparel, for instance, the colours and patterns form the modular set, rather than the article of clothing itself. (Art Re-Thought blog)

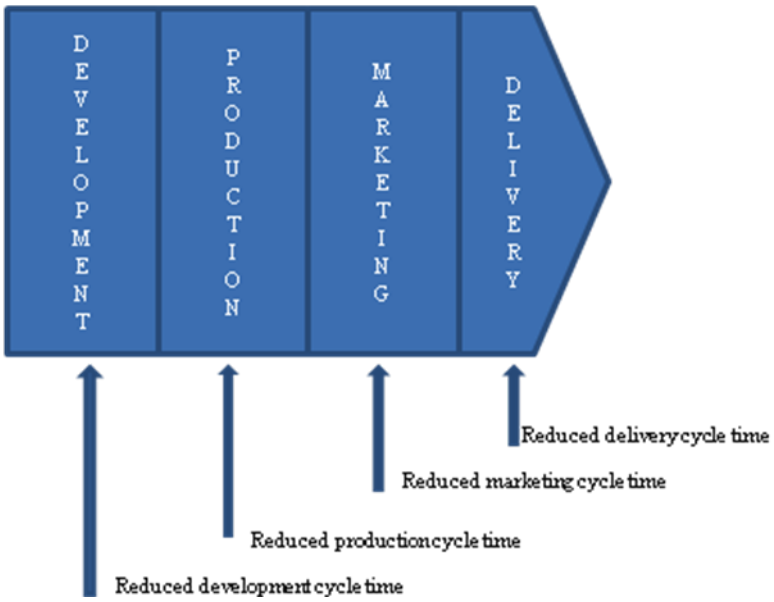
Mass customization system is enabled by modular design because it consists of a dynamic network of relatively autonomous operating units,

where each unit/module is a specific process or task. These modules, which may be external suppliers and vendors, are not designed to interact in the same sequence every time. Rather, product parts are designed to interchange in certain combinations, and machinery is outfitted with modular components to make a product or service in response to what each customer wants and needs. Mass customization results from continually trying to meet these demands. (Pine et al., 1993). The product also needs to be versatile and constantly renewed, as the nature of MC usually requires support through innovation capabilities and rapid product development (Silveira et al., 2001).

Functioning (integrated) value chain

The need to provide a quick response to customer desires forces the company to shape its value chain accordingly. When a company enters the frontier of MC, each involving functional unit within the organization needs to adjust to the strategy. Commitment to react to constantly changing customer demands starts a chain reaction that flows from the development to production to marketing all the way to the point of delivery. As illustrated in Figure 5, each step along the value chain must reduce cycle times and increase variety (in comparison to mass production), because being able to reduce the time in the value chain will contribute towards to being able to provide an increased variety of products and offer a level of individual customization. Companies suited to MC are characterized by integrated functions with dynamic boundaries, flexibly specialized resources and the integration of thinking and doing. To be successful at MC, companies must form an integrated organization, where each unit, function and employee is focused on reduced cycle times and the individual customer in order to develop, produce and deliver a customized product. (Pine, 1993a)

Figure 5. MC Value chain



Mass customization is a *value chain*- based concept. Suppliers, manufacturers, distributors, retailers and other value chain entities must be dedicated to change or adapt their ways of working in order to be able to deal with the increased complexity that mass customization brings, in comparison to traditional mass-production. (Kotha, 1996) To achieve successful mass customization, production and supply chain processes need to be turned into modules. Then managers need to link them in a way that will permit integrating them in the best combination required to tailor products or services. The coordination of the overall dynamic network is often centralized, while each module retains operational authority for its particular process (Pine et al., 1993).

Supply chain

Based on previously discussed literature, the prevailing view is that a higher product variety leads to higher added value, which allows setting a price premium, ultimately leading to higher profits. However, empirical and analytical studies have shown that a mismatch between product plans and supply process leads to poor performance (Alptekinoglu and Corbett, 2008). Hence, adopting customization requires shifts in operations

strategy, which often means radical changes in the entire supply chain. The decision to enter mass customization can have a great impact in the existing supply chain and aligning the strategic intent with entire value chain is of high importance. For mass customization to be successful the supply chain needs to be configured so that it can deliver according to customers' requirements and ensure a high level of responsiveness. (Alptekinoglu and Corbett, 2008). Furthermore, the performance of the mass customizer is dependent on the capabilities of suppliers with regard to costs, delivery promptness, supply quantities, quality, etc. Collaboration with suppliers is necessary, so as to improve the efficiency of supply and inventory management. (Blecker and Friedrich, 2007).

However, the relationships with suppliers can change as the nature of the required skills and capabilities change. (Blecker et al. 2006) Hence, more often customization tends to be employed by new entrants (e.g., Dell) rather than by established mass production firms (e.g., Compaq). Besides, firms differ in their ability to adopt new technologies and are often constrained in their technology choice by unfamiliarity with the new technology. (Alptekinoglu and Corbett, 2008).

Manufacturing

Even though the entire value chain needs to be reconfigured to service the mass customization strategy, it is manufacturing that needs to stretch the most. As the production becomes more diverse the manufacturing must be able to enable fast changeovers, minimize setup times and maximize process flexibility. If this cannot be achieved the strategy of mass customization becomes unfeasible as it is built on the assumption that value chain can be reconfigured in a manner that can supply consumers without a significant negative impact on lead times or cost. (Ahlström et al., 1999)

Flexibility in supply chain (logistics)

A flexible supply chain, when adjusted to a mass customization approach, can reduce negative effects associated with wider product variety. The decoupling point should be placed at distribution, after the production process in the factory. The original standardized product can be delivered to local warehouses, where it is adapted to country-specific (for example where the product is faced with specific legal requirements) and/or individual customer-specific needs and wants. Following this logic, forecasting accuracy can be considerably improved. In some cases, the logistics service providers actually greatly contribute to mass customization by executing these value-adding tasks. A flexible supply chain can also contribute to the customization process by offering transport options that are economically planned. Where the mass-producing companies benefit from being able to gather the finished goods into regional warehouses before final delivery to the consumer, the MC companies are generally faced with the challenge of having to ship the finished goods in small quantities resulting in higher transportation costs. By marginally increasing the delivery times, the companies may be able to design individual delivery times that result in moderate economies of scale. (Blecker and Friedrich, 2007)

Retail

In order to maximize the impact a product/service can make for its consumers it needs to be supported with a consistent message throughout the different channels the consumer makes encounters, still "despite the overwhelming amount of online/offline customer interaction, Jupiter (a consumer research company) finds that 76% of (traditional) retailers are unable to track customers across those channels" (Peppers et al. 2000, p. 5 in Piller and Schaller, 2002). Piller (2002) claims that the reason for this outcome can not only be attributed to flawed collaboration with external partners, but also inefficient internal cooperation between a firm's functions such as marketing, sales and services. This lack of channel integration and weak response to customers needs has a direct negative

effect on customers' dissatisfaction and lower customer loyalty. (Piller and Schaller, 2002)

Technological feasibility

The whole concept of MC only appeared after companies managed to harness the advanced manufacturing technologies (ATMs), which would allow a high level of variety and faster setup times, and combine that with the developing information technologies (Hirsch et al., 1998). In addition to the initial technological requirements, the dynamic nature of retaining consumers and competitive edge requires continuous investments in technology. (Silveira et al., 2001)

Mass customization customers bear additional psychological costs by experiencing uncertainty over the outcome of their product. There is two sides to this uncertainty. Firstly the consumer may rarely experience the product prior to purchase, as is does not physically exist yet. One way for companies to reduce that uncertainty is through visual presentation of the specified end product using a technology for interfaces and demonstrations. Secondly, on the occasion it happens that the consumer orders a product that is impossible to manufacture (i.e. when the fixed solution space has a flaw), and it cannot be delivered. (Broekhuizen and Alsem, 2002).

Even though it was mentioned above that modularization is required from the product, it should be pointed out that the most purist view on MC does not define modularization as a fundamental characteristic, as true MC products are individually made (Silveira et al., 2001). Modularization allows high volume industries to adopt mass customization as a feasible strategy, without having to make dire compromises on effectiveness or cost of production.

Active knowledge sharing

Mass customized products are high value added products, which makes them "intrinsically knowledge intensive" (Blecker et al., 2006). As noted by Piller (2004), customer co-creation process equips with financially valuable information, because it enables a reduction in fixed costs associated with inventory stock and thus allows for a higher level of operational flexibility. The success of mass customization depends on the company's ability to receive information about consumers' needs, and to share that information with the value chain in order for it to be translated into relevant products and services (Silveira et al. 2001) and thus add superior value. Also knowledge sharing between consumer and company, if utilized wisely, is expected to result in financial gains associated with lower inventory levels.

Three prerequisites that make this knowledge sharing possible have been identified: dynamic networks (Pine et al., 1993), sharing the expertise on manufacturing and engineering (Kotha, 1996) and in-house development of new product and process technologies (Kotha, 1995).

2.6 Theoretical framework

Based on the research gap, research objectives, and the literature review about mass customization, this study develops a conceptual theoretical framework shown in Figure 7. The identified six success factors are what are viewed as the necessary building blocks for a successful MC implementation. Perceived added value and consumer integration are intentionally portrayed on parallel axes. Four approaches, or 'faces' of MC are connecting blocks to demonstrate that consumer integration is expected to be greater with each approach, which is then positively related to perceived added value.

As noted in the Research Objectives, propositions for this study are based on the theoretical framework and are listed below.

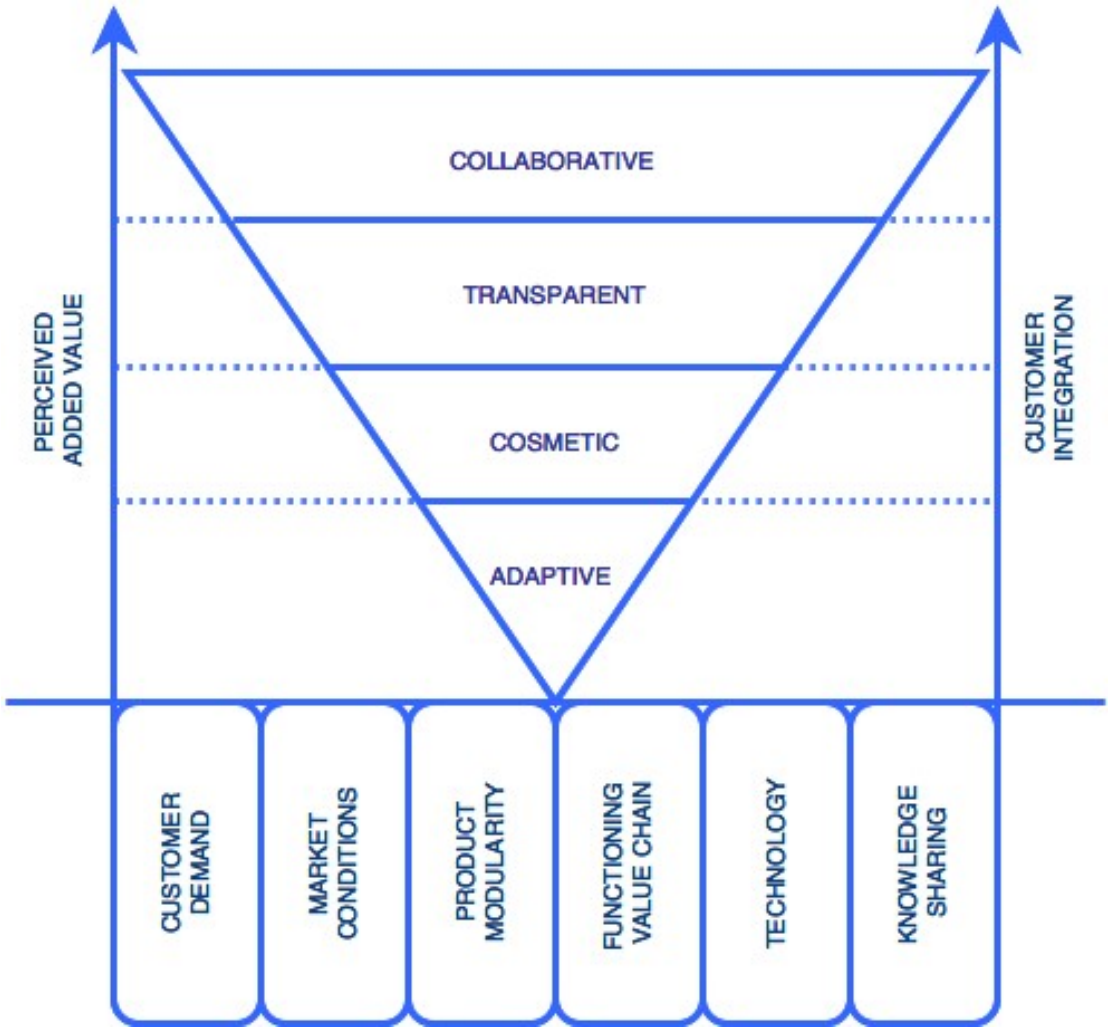
P1. All of the identified success factors need to be present for a successful implementation of mass customization strategy.

P2. Customer integration is positively related to perceived added value, which is positively related to success.

P3. The collaborative approach is most commonly used in mass customization to achieve the higher level of perceived added value.

Collaborative approach means that the customer is an integral co-creator in the customization process.

Figure 6. Theoretical framework: Success of mass customization



3 METHODOLOGY

This section contains a presentation of the research method and techniques used for the empirical part of the research. The aim of the empirical study is to gain insight whether previously identified success factors are viable in the case companies and to observe which MC approach is most prevalent in current MC companies. Chapter 3.1 presents the research design. The next chapter rationalizes the choice of methodology and suggests the use of a case study. Later we justify the selection of the sample and discuss the case selection process. Chapter 3.5 looks at the data collection process and how the data was analyzed. Finally the reliability of the results is contested.

3.1 Research design

In this paper, following the literature review, we explore selected case companies and use findings from these case studies on customer integration and mass customization to identify success factors. As we focus on start-up companies we have an opportunity to capture indications about the success factors these companies struggle during the initial stages of their operation, and how they have mitigated these issues. In addition to the case studies, we analyze an online mass customization database to observe and conclude which of the predetermined approaches are/is most commonly used by MC companies.

3.2 Research methodology

After raising the research objectives, we had to make a decision about the research method. As mentioned earlier, in this study we concentrate on success factors of mass customization companies, therefore this choice needs to be reflected in our research. As pointed out on literature review, not all business are ready or suitable for MC, and serious failures can be avoided if the evaluation of success conditions is done effectively. Therefore, we wanted to collaborate with founders and managers of successful MC firms and observe, how and which factors were applicable in their path towards success.

When choosing between research methodologies, we came across several approaches. From the multitude of possible strategies Hirsjärvi et al. (2009) argue that three major strategies prevail: experimental research, quantitative (survey) research and qualitative (case study) research. In turn, Malhotra and Birks (2001) argue that research can be quantitative, qualitative or a combination of both. In quantitative research data is collected in a standardized structured way and statistical methods are used in the data analysis. In qualitative research, data is verbal or visual and it aims to provide insight and understanding of the given phenomena. It is also unstructured, exploratory and based on smaller samples, where the intent is to provide insight into the research problem. According to Miles and Huberman (1994), in qualitative research the conducts analysis with words that permit one to contrast, compare, analyze and form patterns upon them. Our thesis does not include any numerical data; therefore the quantitative approach was not an option. Given our objectives, the qualitative case study approach is most suitable to provide insight into our research subject. Through a case company approach we can establish parallels between the literature review and real life successful MC companies. It will allow us to compare and contrast case companies in an exploratory manner and to identify their success factors.

Mchunu at el (2003) refer to Saunders (1995), who explains that an inductive approach is best applied in situations where the researchers seek to get a better understanding of the problem and what is going on. In this setting, the data helps to formulate or further develop the initial theory. We have a preliminary theory and propositions, which emerged from the analysis of the MC literature. However, the theoretical framework is only conceptual, therefore the aim is to use the theory as a guide to focus our research on the factors likely to have the most significance on the success on mass customization. These factors, if studied in detail, would greatly benefit and contribute to understanding of MC theory. Therefore we choose to select the case study approach to address our Propositions 1 and 2 to identify success factors.

Proposition 3 – that the collaborative approach is most commonly used in mass customization to achieve the highest level of perceived added value – proved to be a challenging proposition to test given the limited scope of our research. With our

resources it is virtually impossible to identify all MC companies and their approaches, hence we needed to limit our objective and find the most effective and efficient way to grasp the maximum scope. We chose to only look into online mass customizers because it is easier to find information about these companies. Any reliance on a previous analysis of 'current' mass customizers would prove to be outdated. Therefore we had to find a current and up-to-date database of today's mass customizers. After a thorough search, a web portal *Milkorsugar.com* was discovered. It enlists and reviews all the mass customization companies worldwide, serving their customers online. The website has an extensive up-to-date database of online customization, ranging from customized tea to bicycles to handbags. The database is divided into categories: Accessories; Body & Cosmetics; Clothing & Footwear; Food & Beverages; Games & Toys; Home & Decoration; Music & Electronics; Parts & Materials; Print & Video; and Sport & Outdoor. Each category includes various numbers of companies, totalling to nearly 300 companies. Through an integrated commenting function, visitors of *MilkandSugar* can report new MC companies, hence the database is constantly growing. Based on the broad scale and scope of the website, we believe this to be the most relevant and extensive compilation of modern mass customization companies to date. Therefore Proposition 3 will be tested through an observation and analysis of MilkandSugar.com. As mentioned earlier, we do not intend to establish new scientific theories, but rather provide a stepping-stone towards the future research. We assume that collaborative approach will be most commonly used among mass customizers and we will test this assumption with our resources at hand.

3.3 Case study approach

Metsämuuronen (2008) discusses that case studies are qualitative in their nature, can be used as a method of qualitative research and delivers results that make it possible to inspect complex structures through the means of simplification and generalization. Other advantage of case study approach is that results can be discussed in an explanatory, descriptive manner, which allows a reader to make own conclusions (Metsämuuronen, 2008). Hirsjärvi et al. (2009) propose that the primary aim for qualitative research is to describe a real life situation in an accurate manner. On the

downside, qualitative study is not as objective as quantitative one, since the values and views of the researcher and research subject influence the results. Some of the key characteristics of qualitative research are to use people as a source of information, conducting inductive and detailed analysis of collected information. (Hirsjärvi et al., 2009)

As quoted in Yin (2003, p.13), "a case study as a research strategy can be defined as an empirical inquiry that investigates a phenomenon within its context". Case studies can have different aims, for instance, to illuminate a decision, a set of decisions, individuals, organizations, processes, programs, neighbourhoods, institutions or events and the underlying reasoning behind them (Yin 2003, p. 12). In this study the research objective is to first identify the critical success factors of mass customization and then to find parallels between the theoretical and empirical data. The objective of this research complies with aims of a case study method, as the goal is to identify decisions by firms, which lead to success in the context of mass customization. Moreover, given the lack of previous empirical research on this subject, the research questions can be hardly addressed through a quantitative research approach.

In addition to being inductive, the case study approach is also exploratory. Dubois and Gadde (2002) suggest using a tight and evolving framework that does not limit the study into certain borders. In case studies, the researcher needs to be open to the multitude of meanings that a certain concept can give rise to. So, the case study should be based on certain boundaries (research objectives), but it can be expected to evolve over time. We will keep the focus on the preliminary research objectives, but at the same time we are open to the emergence of new research avenues. We are not testing the correctness of the theory, but we are using it as a reference point to guide our research process.

3.4 Choice of case companies

Understanding the underlying reasons for the success of mass customization start up companies is the main objective. Given the lack of an established knowledge of success factors in practice, an in depth study of a small sample of cases was

recognized as the most appropriate approach. The aim of studying several cases is to portray an accurate profile of MC firms in their own contexts (Mchunu et al., 2003) and to establish a richer cross-case analysis. Yin (2003) also argues that single case study methodology is inferior to that of a multiple case study. When it comes to case selection, researchers do not support the logic of random sampling or selection (Perry, 1998). Rather, the choice of each case should be based on the fact that it:

- predicts similar results for predictable reasons (literal replication); or
- produces contrary results for predictable reasons (that is, theoretical replication) (Yin, 1994 in Perry, 1998).

In sum, for qualitative research, the selection of case companies should be systematic, involving the replication logic and largely influenced by the developed theoretical framework. But most importantly, whichever selection strategy is used, "information-richness" is a fundamental factor. Referring to the theoretical guidelines for selection of case companies, the goal was to use the replication logic and to systematically select companies, in line with our theoretical framework. A website, administered by the most current mass customization expert Frank Piller (www.mass-customization.de), provides an extensive up-to-date overview of present and past developments in mass customization field. This website served as an excellent source for identifying start-ups that presently are leaders in MC. Tens of successfully functioning MC start-ups are identified in Frank Piller's website, but we had to narrow down the scope and concentrate on a few most relevant ones. For that purpose, *www.milkorsugar.com* was referred to in order to identify the biggest categories of mass customization companies to date, which are 1) Clothing & Footwear, 2) Accessories, and 3) Food & Beverages. The first two categories are fairly similar in terms of product nature – the process for customizing shoes is rather similar to that for customizing bags, therefore it was decided to choose only one example from these two categories. Combining the secondary sources, we chose two case companies from top three categories, which are also identified by Frank Piller as emerging leaders in mass customization. As a result, the following companies were included to the study.

Company name	Product category	Mass customization strategy	Operations	Contact information
Chocri	Co-created chocolate bars	Collaborative	Europe, USA, Canada	Mail: info@chocri.co.uk Phone: 020 3239 8124
Shoes of Prey	Co-created women's shoes	Collaborative	Worldwide	hunter@shoesofprey.com

Both *Chocri* and *Shoes of Prey* were very relevant to our research because these companies were innovators of mass customization in their product categories and both companies offer their services solely though online channels. In fact, Chocri is the World's first 'Design Your Own Chocolate Bars' company.

Both Chocri and Shoes of Prey are start-ups, created by groups of friends who were passionate about their products and mass customization. Both Chocri and Shoes of Prey can be viewed as inspirational success stories, because the founders' determination and hard work took both companies to international success. A partial objective of our thesis is to serve as an information guide for future MC start-ups, hence we felt that Chocri and Shoes of Prey were extremely suitable companies to portray the path to success.

3.4.1 Company profile – CHOCRI

Chocri is a German start up, founded in Berlin in 2008. It started from a birthday gift and soon grew into thousands of chocolate bars produced every month. Such strong growth resulted into the expansion to the United States in January 2010 with *www.chocri.com*, and to Great Britain with *www.chocri.co.uk* in September 2010. Chocri's aim is to create great tasting premium chocolate customized to the wishes of the customers. It is the world's first company bringing consumers the possibility to create customized chocolate bars through an online store. All customized chocolate bars are hand-made with fair trade, organic chocolate from Belgium. Customers can choose from four bases (dark chocolate, milk chocolate, white chocolate or a combination) and over 100 toppings, ranging from chili to small pretzels and even real gold flakes. That allows for more than 27 billion combinations. Chocri also

permits to personalize the chocolate bar through packaging. Consumers can name the product, or include a greeting, and send it directly to the recipient, thus turning the chocolate into a gift.

Like MyMuesli, Chocri is another successful example of pure mass customization, with a website configurator, where one can co-create own product, which is then produced with at a cost comparable to mass production. Mass customization is a huge trend both in Germany, and increasingly in the U.S., hence the company expansion strategy is following those trends. Standard delivery time is 14 days, but expedited shipping is also available, at a premium price but with a delivery guarantee for a specific date. In summertime the chocolates are shipped in cold packs, so the products do not melt until they reach the destination. Chocri currently delivers to France, Belgium, the Netherlands, Luxembourg, Liechtenstein, Austria, Germany and Switzerland via their German website www.chocri.de, and to the UK via chocri.co.uk. The US and Canadian markets are served through the local website www.chocri.com.

Related trend of mass customization is "open innovation" – the idea of integrating consumers in the product creation process and more. Chocri's customers do not only influence which topping choices are offered on the website, but also proposed the name of Chocri, or determined the term "toppings". To get in touch with those external innovators, Chocri has tapped extensively into social media, such as Facebook, Twitter, and engages in a dialogue with their customers via blog. Also, on their website Chocri announces that they donate 1% of every purchase to the charity DIV Kinder, an organization that supports children on the Ivory Coast, which is the source of the majority of cocoa.

3.4.2 Company profile – SHOES OF PREY

Shoes of Prey is an Australian start-up that has been serving its customers since the October of 2009. Three friends Mike, Michael and Jodie, enthusiastic about entrepreneurship, founded the company. As claimed on their corporate website, "Shoes of Prey was born out of desire" because Jodie's passion for bespoke shoes

served as an inspiration. The aim of Shoes of Prey (SoP) is to help customers create premium quality customized shoes to fit their exact needs and wants. It is the first company allowing consumers worldwide to create customized luxury shoes, varying from stilettos to boots, through an online channel. Experienced shoemakers with highest quality leather and other materials professionally make all of the customized shoes. Customers can choose from four base shoes (ballet flats, 1.5-3.5 inch heels, 4-4.5 inch heels and ankle boots) and then customize the rest: size, leather, heel type, toe type, pattern and colours. The prices vary from 130 EUR to 235 EUR depending on the base model plus shipping. There is no additional cost for selecting the desired leather. SoP has a wide variety of leathers available - including soft leather, patent leather, fish skin, snakeskin, and more. Sizing is flexible and can be customized to an extent, but generally refers to European, Australian, US, UK and Japanese size ranges. It is possible for SoP to make shoes outside these ranges, but it will cost extra as new shoe moulds need to be made. As part of their post sale service, SoP promise to remake or repair the final pair of shoes if they do not fit to the customer. Their shipping partner is DHL and shipping is charged as a flat fee of 15 EUR per order for worldwide deliveries.

Shoes of Prey is a true mass customizer because the company ideology is based on communicating with a consumer in a collaborative manner and company's processes are being built in order to facilitate individual orders as efficiently as possible. The company is a start-up hence it is obvious that many operational processes are being built and polished at the moment. However, the growing customer base and media attention allows and encourages Shoes of Prey work towards being a top quality shoe manufacturer in its category. That is one of the reasons why we chose Shoes of Prey as a case company for this study.

3.5 Data Collection

3.5.1 Interview and questionnaire

In the first part of our empirical research we will assess Propositions 1&2, namely empirically verify the existence of success factors and the importance of customer

integration for creating superior added value. To collect most insightful data from the case study approach, semi structured interviews are used as a tool for information gathering. It is important to design questions so that they link literature review with the case company and address our propositions. Makela (2010) gives a concise but comprehensive justification for usage of semi-structured interviews in case studies. She refers to Hirsjärvi and Hurme (2006) and explains a semi-structured interview being a middle ground between a structured interview, with predetermined questions, and an unstructured interview, where open-ended questions are used.

In a semi-structured interview, it is important that the subject matter remains the same, whereas questions to different respondents may vary. With regard to this study, semi-structured interviews are revolving around research objectives, but at the same time allow them to be conducted as guided conversations, flexible enough for the interviewee to elaborate on the topic. In other words, unstructured interviews do not have clear rules, and enable using an evolving framework that does not limit the study into certain borders, as previously mentioned in Dubois and Gadde (2002). Perry (1998) also reveals that, through trials it was found the starting question should invite the interviewee to tell the story of their experience and hence capture the interviewee's perceptions.

To ensure all necessary topics and questions were covered in the interviews, an interview guide was used. It was designed into a matrix form to allow the interviews to maintain their natural flow, as different topics were discussed, and to ensure that the data between different interviews remained comparable to an acceptable degree (Lindlof et al., 2002). Using the matrix approach also allowed the questions to be tailored during the interviews, when an opportunity to probe a theme more closely presented itself. The interview guide matrix presented below (Table 4) is a simplified version of the guide used during interviews. It does not provide full questions but rather bullet points for the main issues that were addressed in the interviews. The full list of questions, with all pre-planned approaches, can be found in the appendices.

Table 4. Interview guide matrix

Success Factors	Key questions
Demand for MC	- Demand identification - Understanding changing needs and wants of customers - Challenges to meet rising customer demand
Market conditions	- Influence to business by external economic cycles - First mover advantage - Competitive landscape - Customer profile: loyal or new? - Definition of future business climate
Customizable product	- Customization potential of a product - Continuous/ discontinuous customization - Flexibility of customization
Functioning value chain	- In-house operations/ outsourced operations - Sourcing channels - Manufacturing operations - Delivery channels - Challenges with the value chain - Efficiencies
Technological feasibility	- What technologies is the company dependent on - Plans for future investments - Manufacturing machinery - The significance of a company website
Knowledge sharing	- Knowledge intensive products - The significance of a pre-sale and post-sale service - Utilization of customer specific information
Added Value through Customer integration	
	- Does customization have a higher perceived added value to your customers as opposed to mass production? - Price premium customers are willing to pay for customization - Do customers request for more interaction to further customize the end product? - Customer reactions to the variations of customization possibilities - Next steps to increase customer integration

In addition to the interview, a questionnaire was designed based on the findings from the existing MC literature and the interview. The interviewees were given a choice to

either participate in the interview, or answer the in depth questionnaire. A questionnaire consisting of multiple questions, which were tailored specifically for each company, was also used to collect primary data. A questionnaire was chosen as a tool for our primary data collection process and it allowed for the respondents to get a glance at the scope of our study. After the questionnaire was answered, we used interviews for the follow up and collected more in depth information. Saunders et al. (2003) claims that questionnaires used in descriptive studies enable the researcher to identify and describe the variability of several phenomena. Before sending out the questionnaire, it was tested with a non-native English speaker to verify whether the questions are easy to understand. Testing questionnaires is also encouraged by Saunders (2003) in order to ensure that the respondents understand the questions well and to secure a reliable data collection.

The interviewees were chosen based on their expertise and knowledge within the case company setting. Data was collected over the month of December 2010. Table 5 shows the names, titles and companies of the interviewees, as well as the date when the interviews were held.

Table 5. Interviews

Interviewee	Company	Title	Date	Mode
Julian	Chocri	Head of business development, UK	8 Dec 2010	Questionnaire
Michael Fox	Shoes of Prey	Director of Operations and Founder	21 Dec 2010	Skype Interview

3.5.2 Secondary data and observations

In order to interpret the empirical data and to enrich the research, secondary data sources were also used in this thesis. These sources included case company websites, online case studies as well as additional information found on the Internet. According to Saunders et al. (2003), secondary data should be used to support the primary data findings. One important source of secondary data, to assess Proposition 3 – *the*

collaborative approach is most commonly used in mass customization to achieve the higher level of perceived added value – is an online database www.MilkorSugar.com, aggregating all mass customization companies presently operating online worldwide. This study puts an extra emphasis on MC start-ups, offering their products through an online channel; therefore this online database was identified as a suitable source of secondary data. In addition, our research aims to provide a relevant and up-to-date situation within mass customization circles, and to empirically assess whether collaborative approach is mostly used among current mass customizers. MilkorSugar poses as a suitable source for that matter.

The crew behind the MilkorSugar is an Amsterdam based design agency that built a database of websites where one can customize and order products online. MilkorSugar is the web's first custom shopping portal, with reviews of everything one can customize, order and pay online. The website not only enlists and categorizes MC companies based on their products or services, but also reviews the mass customization websites and how much customization they offer. We have selected this online database as a reliable source of secondary data, because it is constantly updated and maintained by the administrators. Also, website visitors are allowed to leave a comment if any discrepancies or mistakes are identified. Such two-way communication signals for less room for mistakes and thus enhances reliability.

Even though we choose to use the website for information purposes, the content of the website is viewed critically. We utilize the information, but we check if listed MC websites actually exist and if the listed companies fit the MC business model. A number of companies were eliminated from the research scope. The reasons and argumentation for elimination will be discussed in more detail in data analysis chapter.

3.6 Reliability and validity

Reliability and validity are important elements of the research in order to produce descriptions of the social world that in a controllable manner contribute to the

knowledge of social phenomena (Saunders et al, 2003). Reliability is related to the expectation that any researcher would be able to achieve the same findings if the research would be re-conducted. In order to ensure this, careful documentation of the steps taken during the research process is required (Saunders et al, 2003). The methodology chapter guides the reader through the research and therefore supports the opportunity to repeat the implementation of the study. In order to ensure an appropriate documentation and interpretation of the data, all the interviews were recorded and transcribed immediately. All of the interviews were conducted in English, therefore no translation related errors are feasible. The interview questions as well as the questionnaire are available at the end of this research (see Appendices 1, 2). However, the later results of future researches could be different since the MC processes are likely to develop in the course of time.

Another crucial criterion for a research is validity, which is the integrity of the conclusions of the research (Saunders, 2003). Triangulation, which refers to using multiple research methods for finding answers to same research dimension, is an excellent tool for ensuring the validity of the findings. This study utilized triangulation to ensure that the survey responses are coherent with the qualitative findings.

4 ANALYSIS AND DISCUSSION

In this chapter, empirical findings collected through interviews, questionnaires, researchers' own observations, and secondary data are analyzed in order to achieve the research objectives and to verify research propositions, defined in theoretical framework. Data analysis is divided into three parts, which are based on the research propositions. The first part analyses case companies with regard to success factors of MC; the second part analyses case companies with regard to customer integration and added value; finally the third part analyses the online mass customization database, which is directed to observing the prevalence of collaborative approach among mass customizers.

4.1 Proposition 1 – The presence of success factors in MC companies

In this chapter case companies are analyzed in terms of primary and secondary data. Case by case, first background information is presented, which is followed by the analysis of interview answers for the purpose of relating success factors identified in the literature to empirical evidence.

4.1.1 Case company: Chocri

As mentioned earlier, from Chocri we interviewed the head of business development to get an in depth understanding of company operations and the presence of success factors identified in academic literature. The company profile is available in an earlier chapter, hence in this section we will jump straight to analysis. In order to empirically verify whether all of the identified conditions for successful mass customization were prevalent when the company entered the market, below is the analysis based on the Chocri interview and literature on the subject of MC success factors. For the most consistent and thorough examination, the analysis is sub-divided based on the earlier identified success factors in Chapters 2.5.2 and 2.5.3.

Customer demand

Customer demand has been identified as the main driver that motivates companies towards mass customization strategies (Pine et al., 2000). This was also the case with Chocri, as their original inspiration to enter the market came from witnessing continuing success of similar ventures such as MyMuesli.

Chocri was the first company in chocolate category to offer mass customized solutions, which made it difficult to evaluate exactly how ready the potential consumers would be if they were offered a mass customized product. The two basic factors in this evaluation, as suggested by Hart (1995), are *uniqueness of customers' needs* and *level of customer sacrifice*. Chocri felt confident that their product would be differentiated enough to attract consumers and that the interface, in which the potential consumers would operate, would not make the service difficult to approach.

Being the first in category Chocri benefited from positive publicity, which in turn provided an access to the initial consumer base. In fact, one of the greatest challenges in the beginning was to answer the rapidly growing demand and quickly establish production know-how. Since the first days the demand has grown steadily and production has become more optimized allowing the management to concentrate on increasing its consumer base. The current growth phase that the company is going through can be attributed to both repeating customers as well as new customers. Chocri identifies word-of-mouth as a powerful tool for their new-customer-acquisition as the nature of the product encourages its consumers to share the story with their networks. In addition to the word-of-mouth, Chocri has more recently started to use traditional marketing tools, such as TV campaigns, to acquire new customers.

Market conditions

Chocri describes the market conditions to be "very turbulent" when the company entered the market in 2008, but points out that the nature of the product makes the company more resistant to market fluctuations. This is in line with the literature

around this subject, which indicates that unstable market conditions drive consumer demand for change and differentiation. (Pine, 1993)

Chocri also points out that their competition is mainly distinguished through product differentiation as opposed to price competition. The importance of product development is highlighted, as the barriers to enter the market are low. Chocri is attempting to raise these barriers by using its know-how, which was acquired by being the first-mover in the market, to enter into collaborations with larger manufacturers to improve product development capabilities.

Product modularity

Feitzinger (1995) concluded that in order to be considered mass customization the product must be modularized in a way that it can be assembled into different forms. Chocri's products are clearly modular as they offer a variety of "toppings" out of which, as they advertise on their website, one can assemble 27 billion different combinations. This level of variety in their fixed solution space is assured to provide consumers with enough "freedom built into a given manufacturer's production system" as defined by von Hippel (2001) and Piller (2004). It however presents in itself a challenge in giving consumers just enough without risk of making consumers confused.

The company is looking into cutting down the number of alternatives offered. They have realized that they cannot anymore increase the perceived consumer value by raising the number of offered modules in their fixed solution space. In other words a greater variety only adds value to a certain point. This is also evident in literature, where Pine (1993a) among others discusses in length about minimizing costs while maximizing the level of individual customization. To address this challenge Chocri is building a new approach into modularization management, where the consumer is offered a less comprehensive set of modules consisting of the most popular/high quality ingredients. This standard modularization is then, depending on the season, supported with a limited time offer seasonal modules, such as snowflake-shaped holiday toppings for Christmas.

Functioning value chain

Mass customization is a *value chain*-based concept and since the beginning Chocri has managed the entire production process in house, from receiving orders to production of the customized products to packaging and shipping. Chocri aims to organize this sequence in the most efficient manner possible. Each product is handmade, which makes the production work-intensive, but also allows an increased level of flexibility when there are changes in demand and improved control over the finished products. The literature on this subject indicates that each unit, function and employee needs to be focused on reducing cycle times in order to produce and deliver a customized product. (Pine, 1993)

The literature points out that, in order for mass customization to work, it needs to function near the mass-production efficiencies. The managers must look for an optimal balance between the additional customer value created and the investments required to allow customization on a mass scale (Broekhuizen et al., 2002). Chocri, however, does not believe they are producing "near mass production efficiencies" and estimate that this would be impossible for them. The company does not recognize this to be a factor that hinders their competitiveness as their product carries a consumer accepted price premium. The consumers seem to accept a higher price, as the end product is both customized and handmade.

Technology

The website, which Chocri refers to, as 'configurator', is an important element of the company's success. The configurator is designed in the way that enables customers to view all the available modules (choices) and prevents them from creating combinations that are impossible to execute. Chocri mention the "satisfaction" that they want to provide to their customers in the form of a well functioning website. As the new consumers are invited to make their own creations, the user interface needs to be intuitive and fun. Well-designed platform ensures a positive experience for each user, which in turn brings consumers closer to making a purchase.

There are two sides to technology when the case of Chocri is discussed. There are the requirements of a functioning IT structure, that is capable in managing the complexity of MC order creation, and there is the actual production of mass customized goods. The IT infrastructure needs to be in place and the order creation interface must be user friendly or you will not find customers "no matter how good the product is you are selling".

When entering the market the company started with very limited funds and old production machinery, but managed the growth period partially due to a devotion to a certain degree of craftsmanship. The same devotion remains and, despite an interest in process standardization through the increasing MC know-how and investments, the company highlights that its products will always remain handcrafted.

Knowledge sharing

As previously discussed in this research, knowledge sharing is required for a successful mass customization to take place. The three prerequisites for knowledge sharing were: dynamic networks (Pine et al., 1993), sharing the expertise on manufacturing and engineering (Kotha, 1996) and in-house development of new product and process technologies (Kotha, 1995). Chocri clearly demonstrates that all three are in place.

Mass customized products are "intrinsically knowledge intensive" (Blecker et al., 2006) hence the success of mass customization depends on the company's ability to receive information of consumers needs and share that information with the value chain in order for that to be translated into relevant products and services. Chocri uses its more active consumer base to ensure they answer to a real consumer need. They regularly meet with involved customers and are in the process of setting up a community of "super fans" to ensure that information is shared efficiently and to include loyal customers into the processes of the company. In addition to the dialogue with consumers the company analyzes the consumer behaviour to guarantee that their products are fitting the consumer taste preferences.

As noted by Piller (2004), customer co-design process also equips with financially valuable information. It enables to reduce fixed costs associated with inventory stock and thus allow for a higher level of operational flexibility. Chocri operates on made-to-order model, which means that every order is fulfilled based on pre-existing demand. Knowledge sharing is very much present and utilized in Chocri business model.

Chocri is constantly developing its products and going through rounds of product innovation. In addition to the previously mentioned changes in better managed modularity and the company is looking into using its recently established collaboration with a bigger confectionary manufacturer to improve its manufacturing process and possibly make further investments into the area.

Summary

To summarize the Chocri case, it is evident that the company possesses all of the six identified success factors and has done so since the beginning of their journey. It also seems like the challenges the company has faced and are facing has been in the areas where one of the six success factors has temporarily not been functioning as expected; whether this is complexity through a multitude in product modularity or hiccups in the initial production capacity. The advantages that come by being the first-mover in MC in this sector are also made very clear in this case, as the company was able to secure its initial customer base through the positive publicity in press and managed to, early on, acquire required know-how to attract recognition and beneficial collaborations with more established companies.

4.1.2 Case company: Shoes of Prey

In order to get an in depth understanding of company operations and the presence of success factors identified in academic literature, the founding member and director of operations of Shoes of Prey (SoP) was interviewed. Below is the analysis based on the company interview and literature on the subject of mass customization success factors.

Before we introduce the findings of the interview, we would like the reader to get a better understanding how SoP functions. This brings us to the question: How are their shoes made? On their website, Shoes of Prey provide a 12-step detailed description of their shoe making process:

Table 6. SoP shoe making process

Step	Description
Step 1. Cutting the pattern	Almost every pair of shoes made at Shoes of Prey is unique and thus requires a unique pattern to be cut. The process involves creating the shape of each component of the shoe hence with all possible shoe combinations and each shoe size requiring a new pattern, there are lots of patterns in their studio. An upper is the part of the shoe that sits on top of the foot and every time has a different pattern to be created. The other parts of the shoe that need to have individualized patterns include: the sole (the core bottom of the shoe); the insole (the internal part of the shoe that sits directly under the foot); the outsole (the outer layer that directly touches the ground) and the heel.
Step 2. Tools of the trade	One of the most important tools for making a shoe is the last, which is a foot shaped piece of material over which the shoes are moulded. A different last is used for different size and style of the shoe. The last plays a great importance in determining the fit and feel of the shoe.
Step 3. Edging	Edging is the process of flattening the edge of the pieces of leather that have been cut to the pattern so that it is thinner than the rest of the leather piece. This results in a neat juncture between pieces of leather giving a more comfortable fit as well as the quality finish.

Step 4. Stitching	In this step the different parts of the shoe are carefully stitched together.
Step 5. Trimming preparation	At this step the trimming is prepared before it is added to the shoes.
Step 6. Applying trimming	In this step trimming is added to a shoe.
Step 7. Selecting the heel	At this step the customer's selected heel is applied, after it is encased in the chosen leather.
Step 8. Trimming the excess	This step involves carefully putting together and making the finishing touches to the decorative upper for another pair of hand made shoes.
Step 9. Preparing the sole	The core pieces of the sole of the shoe are then covered from both sides by the insole (the piece that sits against one's foot) and the outer-sole (the piece that sits against the ground).
Step 10. Shoes of prey logo	The Shoes of Prey logo is imprinted to the shoes.
Step 11. Affixing the outer sole	The outer-sole is then affixed to the shoe.
Step 12. Finishing	The final cutting, cleaning and polishing of the shoes is performed in the final step.

After the interview, it was identified that two more steps (13 and 14) should be included to the shoe making process. For Shoes of Prey, as a start-up company, quality of their products is of utmost importance, therefore SoP have a process to perform quality control before the shoes are sent to customers. This does not by any means imply that the quality will decline after future years of operations. Finally, to emphasize the impact of personalization and added value, SoP includes a hand-written message and a photo of the finished pair to the box before it is shipped to a

customer. Such approach hopefully creates a positive word of mouth, which plays a key role in the company's marketing tactics.

Step 13. Quality control	After the shoes are finished, the manufacturer then sends the pair to a SoP office, where SoP staff carefully examines it.
Step 14. Transparent customization	If the quality is up for a standard, the pair of shoes is photographed and, with the physical photo, a personal hand-written message is added to the delivery box. The shoes are then shipped to a customer anywhere in the world.

SoP believes that the easy-to-navigate user interface together with the variety of selection offered to consumers will ensure growth in the future. The company is content with the mass customization strategy and they are even looking into expanding its mass customizable portfolio to include accessories like bags and belts.

After introducing the company and its operating techniques, the next step is to empirically verify whether all of the identified conditions for successful mass customization were prevalent when the company entered the market. Below is the analysis based on the SoP interview and literature on the subject of MC success factors. For the most consistent and thorough examination, the analysis is sub-divided based on the earlier identified success factors in Chapters 2.5.2 and 2.5.3.

Customer demand

The need to deal with increasing customer demand for customized products is the fundamental justification for mass customization (Pine et al., 1993; Lau, 1995) but Shoes of Prey did not start their business simply based on this pillar. The decision to start a shoe customization business was born after long hours of brainstorming and was based on one of the co-founder's passion for bespoke shoes. Referring to Michael Fox, no formal surveys or studies were made to analyze the customer demand for customized high-end shoes for women. However, SoP identified there was no one

else at the moment offering such service, and felt there was an opportunity to tap into this market. Their gut feeling proved to be right, and the company is witnessing 25% growth every quarter.

As Kotha (1996) critically notes, the key to MC success is the skill to balance between customer's perception and company's ability to fulfil without a significant price premium and long delivery times. Michael Fox actually claims that SoP products are sold roughly at the same price level as any other high quality shoes that can be purchased at retailers. This seems to be true when one observes the price range of SoP and its competitors.

Market conditions

SoP founders identified other players in shoe customization market (such as Adidas, Nike, Puma) but during the time SoP entered the market none of the high-end shoe manufacturers offered mass customized products. This gave SoP a first mover advantage and a notable amount of positive press and PR, which made it easier to establish business relations and attract the vital initial customer base.

According to SoP the general market conditions were stable during the time the company was established, which was seen as both a benefit and a challenge. Due to the good economic times there were more of the potential customers who had the necessary means to purchase high-end shoes, but on the other hand finding a suitable suppliers proved out to be more difficult during a time when the consumption of mass produced shoes were at its highest. The small start-up with a more demanding product, as every shoe has to be produced individually, had to compete for suppliers against established shoemakers with larger bulk orders. Had the economic times been more challenging there had been more suppliers available for cooperation, SoP believes.

Even though SoP claims that they do not spend a lot of resources in competitor analysis, they are well aware of whom their competition is. They are competing for the same customers as traditional online shoe retailers and rely on their ability to claim competitive advantage through a differentiated product offer. As the company

is fairly new in the market most of their customers are new, but there are several cases of returning customers. SoP wants to offer its consumers an opportunity to buy shoes without having to make compromises and they have successfully managed to answer the customers' needs, even in unexpected growth areas such as wedding shoes and ankle boots which have proved to be in high demand amongst their customers. SoP claims that as they are supplying their products globally they are not really affected by seasonal changes in demand.

Product modularity

The SoP products are modular by nature and they offer a nearly endless combination of shapes, sizes and materials available to their customers. The company cooperated with its suppliers when it designed the *fixed solution space* available to its consumers. This was done to assure that all combinations of modules are in fact feasible to produce and all orders made can be delivered. In the current system the consumer is prompted if they are attempting to create an impossible combination of materials and elements.

SoP operates with a model that combines both *collaborative* and *transparent* levels of mass customization. The actual product design phase is collaborative, as the consumer can influence the final product within the preset fixed solution space, and works as the main point of differentiation from the competition. In addition the company operates on transparent level of mass customization, when it includes a hand written note and a photograph into each finished shipment. This unsuspected addition is done in order to increase the likelihood of positive word of mouth, which is identified as a crucial element in attracting new consumers.

Functioning value chain

SoP does not manufacture the shoes itself. The company is in a close cooperation with a selected supplier that manufactures shoes for multiple retailers and is capable of answering to the complex production needs that SoP requires. In addition to the actual production the supplier is also responsible for much of the total value chain including maintaining a sufficient level of raw materials, having to source raw materials (i.e.

leather from Italy and Spain), and meeting the agreed duration of production. Through the close cooperation with its suppliers, SoP has been able to improve its manufacturing processes and better leverage the economies of scope that have been connected to successful mass customization in our literature review (Pine, 1993). This is however identified to be a continuous process as the company is experiencing growth and needs to ensure that the value chain is running at maximum efficiency.

The value chain works so that once the customer has ordered a pair of personally designed footwear on SoP website the order is first received by SoP. The orders are then emailed to the supplier where the actual manufacturing of the shoes takes place. The finished product is then shipped to the SoP office, where the SoP employees perform a final quality check and personalize the shipment with a hand-written note and a physical photo of the pair of shoes in question. After this the products are shipped to their designers all over the world. A step-by-step description of SoP shoe making process is presented in Table 6.

The process of making a pair of high-end leather shoes is highly labour-intensive and most of the production is done by hand. This is a fact that applies to both mass produced and mass customized shoes, and it makes it possible for MC to reach a level of efficiency near that of mass production. SoP acknowledges that they are still far from that goal, but they do think it is possible as their supplier becomes more experienced with their manufacturing needs.

Outside of the actual production SoP is responsible for providing its consumers the user-friendly platform on which to design its shoes, but also for arranging and coordinating the packaging and delivery of the finished shoes. In the beginning of their operation SoP faced an issue with a reckless shipping agent and some of their products got delivered in a sub-par condition as the shipping agent took proactive efforts to save money. This issue was eventually fixed and SoP now operates with renowned global shipping agents only.

Technology

SoP highlight the "enjoyment" that they want to provide to their customers in the form of a well functioning website. As the new consumers are invited to create their own designs the interface needs to be intuitive and fun. The well-designed platform ensures a positive experience for each user, which in turn brings consumers closer to making a purchase.

SoP points out that even though some consumers request for a broader fixed solution space for the co-design phase they might not eventually want it. Limiting the selection in order to avoid complexity, and improve the usability of the service, avoids SoP from falling into the "mass confusion" pitfall that was discussed earlier in this study (Piller et al., 1995).

SoP has obviously limited the required investments made, by choosing to embark on a cooperation with a supplier rather than producing the footwear by itself, but in order to be the first one to establish a well functioning high-end mass customized shoe production line, it has had to support its supplier in making the necessary investments to cater to its special needs.

Knowledge sharing

There are two levels of knowledge sharing that take place at SoP. Firstly there is the dialogue that takes place on the SoP website, where the consumer contributes to the company's value creation process. SoP gathers a multitude of data from its consumers during the three-step design process that allows SoP to reap the benefits from allowing consumers to provide first hand consumer knowledge directly into the manufacturing process (as described by Wikstrom, 1996).

Secondly, there is a need for a continuous exchange of information between SoP and the selected supplier. This discourse ensures that correct products are manufactured in time and that learning's are shared amongst the supplier and SoP, so both parties can improve their efficiencies. The significant growth the company has experienced has not come without lessons learned. SoP admits to having had to struggle with its

manufacturing arrangements during the initial growth period. The mass customized nature of the product requires the supplier to reset production before every manufactured pair of shoes. This makes keeping up the pace challenging and requires continuous active cooperation between SoP and the supplier.

Summary

All six prerequisites of successful mass customization can be identified in the case of Shoes of Prey. The company is likely to experience growth as long as they manage to maintain all identified success factors and mitigate the challenges that arise effectively. It should be pointed out that both of the major challenges that arose from the interview (challenges with setting up the manufacturing and the problems experienced with the initial distributor) were of the kind that, if left unattended, would have influenced one of the identified success factors and severely harmed the potential for growth.

4.2 Proposition 2 – Customer integration and added value

Another objective of this research is to assess Proposition 2, which links higher customer integration with higher consumer added value.

The perceived added value through mass customization, which can be defined as the improved worth that can be attributed to the products and services as the result of introducing an aspect of mass customization, may be considerable when executed successfully, but the product still needs to remain affordable to maintain competitiveness against its mass-produced alternatives.

A truly mass customized product should not require a consumer price that would place it into the upper market segment. Acknowledging this, there are examples when suitable market conditions together with a unique product offer allow companies to demand for a higher price premium; simply due to the value the customization has added to the product. Such market conditions could be attainable if the company, for

example, benefits from being the first one to offer such a product/service to the market or manages to harness higher value through a successful marketing campaign or relevant celebrity endorsement. Another accepted justification for a price premium could be the use of well-known brand (like in the example of MiAdidas). This leads us to two types of drivers that add value in mass customization:

1. **Brand driven** mass customization (such as MiAdidas). Here added value primarily comes from being able to delivering a unique combination where brand and personality get interlinked.

2. **Product driven** mass customization (such as Shoes of Prey). Here added value primarily comes from being able to deliver a product with higher ability to serve a functional purpose/preference than a mass produced item.

The product driven mass customization seems to works as a technology that allows new market entrants to compete against well-established players in the market. Where in the traditional mass production environment the barriers to enter the market would be considerable higher, the novelty of an affordable customized product make the new market entrants a viable substitute for the consumer. Mass customization also generally takes place online, which allows it to reap from a much larger consumer base, than would be attainable through the traditional distribution networks. This, third driver adding value to mass customized products, contributes into making mass customization an especially attractive strategy for new market entrants:

3. **Opportunity driven** mass customization (such as MyMuesli). Here added value primarily comes from being able to deliver a unique product/service that was impossible to achieve before the introduction of the mass customization technologies, and thus create an entirely new market niche.

Another aspect that increases the consumer added value, but is little discussed in the existing literature, becomes apparent when the consumer uses the service to personalize a product intended as a gift. During the Chocri interview a point was raised in mass customized product being more suitable as a present than its mass-produced substitutes. Even if MC setup is often designed to address the *level of*

customer sacrifice (Pine et al., 2000) to provide consumers a better fitting personal product offer, the consumers can also use the MC setup to design a gift that is able to tell a more accurate story; not only through the item itself but also through the way it has been customized to fit the recipients preferences. In the case of Chocri, and many other successful mass customizers, the products themselves are fairly inexpensive when they are compared to other products traditionally given as gifts. This increases their competitiveness in this sector. This allows us to add the fourth and final driver adding value in mass customization:

4. **Novelty driven** mass customization (such as Chocri). Here added value comes from being able to deliver a product with an aspect of personalization that allows consumers to better express themselves.

When the consumer is faced with a new MC proposition he/she needs to use an existing (mass produced) product as a reference to evaluate what the proposition is capable of. This leads us to conclude that the level of perceived added value in MC is linked to how well the company is able to deliver a clear advantage against the common mass produced alternative. The identified value drivers are not exclusive to each other and in many instances the total value perception of the consumer is a combination of at least two of the different drivers.

4.3 Proposition 3 – Collaborative approach in MC

In this chapter we consider Proposition 3 – the collaborative approach is most commonly used in mass customization to achieve the higher level of perceived added value. The purpose of this proposition is to propose that most mass customizers want to include the customer to the customization process as early as possible and to provide as extensive co-creation experience as possible. We do not intend to establish new scientific theories, but rather provide our observations and build a stepping-stone towards possible future research. We assume that collaborative approach will be most commonly used among mass customizers and we will test this assumption with our resources at hand. As mentioned in methodology section, we limited our research to

an online database www.milkorsugar.com that contains all mass customizers that operate online.

As discussed earlier, this study refers to Gilmore and Pine's (1997) proposed four approaches of mass customization: adaptive, cosmetic, collaborative and transparent. In order to test Proposition 3, all mass customization companies available at www.milkorsugar.com are overviewed and categorized according to these mass customization approaches. The descriptions of the approaches are available at section 2.3.1, but for the sake of clarity, are presented below in Table 7.

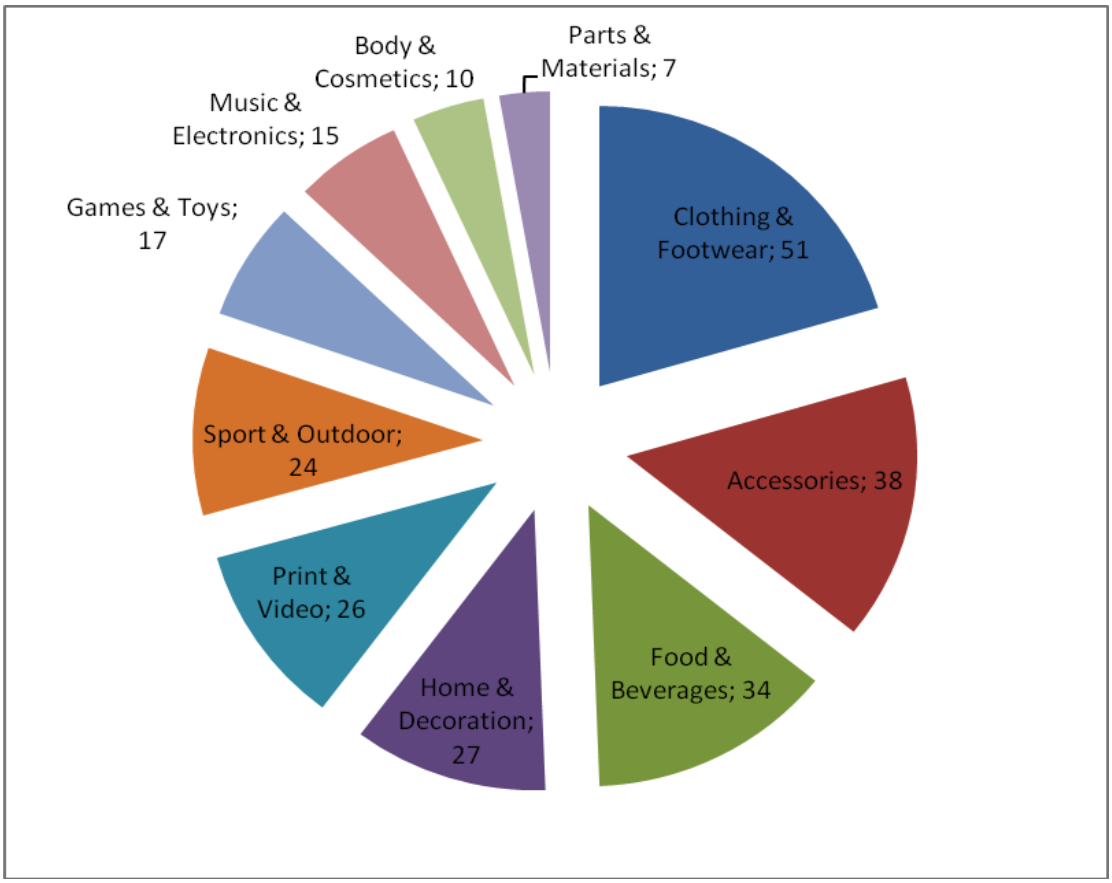
Table 7. Criteria for MC approaches

Approach	Adaptive	Cosmetic	Collaborative	Transparent
Criteria	Completely standardized product with capabilities to be individualized by end user through application. Customization is through use, after the purchase. Dialogue is between the end user and the product, not the producer.	Standard product, used same way by all end users. Only outward appearance is customized, eg. packaging. Only presentation of the product is individualized. Happens at the end of the value chain process, after product assembly.	Customized product and sometimes packaging by each end user. Co-creation process between customer and MC company must occur. Essential product features (modules) can be designed or combined by the customer. Happens in the beginning of the value chain.	No dialogue between the MC company and the customer. Customer does not want to be part of the co-creation process. The mass customizer tailor-makes end solutions without customer integration.
Examples	Nudie Jeans	'Your Heineken'	Chocri, mi Adidas	Ritz-Carlton Hotels

The definition of criteria will allow maximising the objectivity of evaluating the mass customizers and their customization approach. The website has already categorized MC companies based on the product/service sector that they operate in. These

categories will be used as guidance, and will be further developed to include MC approach criteria for cross checking. Figure 8 provides a visual overview of MC product categories and number of MC companies, offering their services in respective categories at www.milkorsugar.com.

Figure 7. Categories of MC companies at Milkorsugar.com



Clothing & footwear represent the biggest category, meaning that mass customization companies find it most attractive to penetrate this business segment. The customizable nature of clothing and footwear products permit a high number of customization permutations. In addition, customers are willing to spend additional amount of time and money for an individualized piece of apparel or footwear, because these customized products have superior added value as compared to standard ones.

Accessories is the second biggest category on MilkorSugar. This category, which includes bags, jewelry and watches, also permits endless possibilities for mass

customizers, because consumers can express their individuality and trendiness through customized accessories. Food & Beverages is a new and surprisingly vast category in mass customization. Now one can customize many products, normally bought standard in the store – ranging from cereal, to energy bars to beef jerky to chocolate. It is notable that most of these mass cystomizers are start-ups, with an exception of Dove, M&Ms and unsuccessful attempt of General Mills. Other categories represent fewer companies, but still indicates that a vast number of mass customization possibilities are currently available for customers worldwide.

For the most thorough analysis, each category is analyzed separately, by reviewing companies within the category and by applying criteria from Table 7. As mentioned earlier, information is critically evaluated, hence each website is cheched whether it still exists and in order to evaluate the customization level. Eleven company websites, included into MilkorSugar, had to be excluded from the research, due to the following reasons: 1) not functioning during the time of the reseach; 2) business model not fulfilling the definition of MC. Table 8 summarizes the number of companies in each category, after elimination.

Table 8. MC approaches of all companies

MC Approach	Number of Companies	Percentage
Collaborative	230	92%
Cosmetic	19	8%
Adaptive	0	0%
Transparent	0	0%

Out of 249 companies listed on *MilkorSugar*, the greatest majority applies *collaborative* approach to their customization. This conclusion was reached after visiting every company website and applying the criteria from Table 7. The immediate question is why the greatest majority of online customizers pursue this approach. As mentioned in literature review, collaborative approach, also known as co-creation, represents the key essence of mass customization (Kumar, 2007), therefore companies pursue this approach to create the highest level of consumer added value. Through customer integration a dialogue is created between the

manufacturer and the end user, thus helping customers to articulate their needs and influence the outcome of the product based on the possibilities available to them (Gilmore and Pine, 1997). In addition, the reasoning relates back to Broekhuizen and Alsem's (2002) claims on perceived added value and co-creation. They claim that customers also experience hedonic and instrumental benefits when customizing their selection. Once critical factor for the creation of perceived value is the shopping experience (Broekhuizen and Alsem, 2002). Hence the possibility, offered by collaborative customization, to configure one's own product can be pleasant (eg., creating customized pair of shoes at Shoes of Prey) because of the entertainment value and the enhanced control. In addition, customers will be more satisfied obtained something that fits exactly what they want. One important point to make is that we only observe and analyze online mass customization start-ups who base their business model on customer co-creation and customization wanting to please customers' individual needs and wants. It makes much more sense for a mass customizing start-up to offer a collaborative customization approach rather than cosmetic, because they need to make their mark and distinguish themselves from mass-producing companies.

However, it must be noted that after a quick glance at the companies' business models, not all engage into the same level of consumer intergration. Customization, which allows for customers to print own photo to a T-Shirt involves co-creation and is considered as collaborative, does not involve the same level of co-creation as designing one's own pair of shoes.

Cosmetic mass customization approach is utilized by only 8% of all identified companies. According to Gilmore and Pine (1997), cosmetic approach is adopted when a standard product satisfies a customer and only its outward appearance or the way it is presented, needs to be customized. For instance, a simple tailoring process of including a customer's name to the product packaging creates customization without a dialogue associated with co-creation. Rather than a product being customized, a standard offering is packaged individually for each customer. In order to understand why such a small number of companies have been identified as using cosmetic MC approach, we look in more detail to those companies. Table 9 classfies mass customization approach by company category, outlined in the order of category size.

Table 9. MC approach by category

	MC Approach			
Category	**Collaborative**	**Cosmetic**	**Adaptive**	**Transparent**
Clothing & Footwear	50	1	0	0
Accessories	37	1	0	0
Food & Beverages	25	9	0	0
Home & Decoration	26	1	0	0
Print & Video	26	0	0	0
Sport & Outdoor	23	1	0	0
Games & Toys	17	0	0	0
Music & Electronics	12	3	0	0
Body & Cosmetics	7	3	0	0
Parts & Materials	7	0	0	0
Total All Categories	**230**	**19**	**0**	**0**

From the table above it is apparent that cosmetic customization is mostly prevalent in companies operating in the Food & Beverages category. It logically supports Gilmore and Pine's (2004) description of cosmetic customization, because in this category the product itself can remain the same, and only customizing its outward appearance can add value. Examples of these products include: chocolate with customized selection and packaging; candies with customized wrappers; beer or wine with customized labels. Other cases of cosmetic mass customization in *MilkorSugar* are from companies in body & cosmetic categories. The character of these products also conveniently serve the nature of cosmetic customization. Examples are customized labels to perfume, and customized engraving to a soap bar. It is neither possible nor appealing for a mass customizer who sells shoes or furniture to pursue a cosmetic customization approach. To sum up, the nature of the product dictates the pursued level and thus approach of customization.

As Table 9 indicates, none of the companies enlisted in *MilkorSugar* online database fit the criteria for adaptive or transparent customization. The reason for this outcome is related to the profiles of companies available in *MilkorSugar*. These are mass customizers, primarily targeting B-2-C market and specialized on online distribution channel for the technology-savvy and customization craving customers. The criteria

for a transparent customizer indicate there is no dialogue between the MC company and the customer, the customer does not want to be part of the co-creation process and the mass customizer tailor-makes end solutions without customer integration. There are fundamental differences between the types of companies on the online database and the typical profile of transparent mass customizers. It is believed that transparent customizers are more suitable in the service industry and even more so in the B-2-B market. We claim so because transparent customizers track preferences of their customers over time and specialize their offering to match customers' preferred habits. The adaptive customization happens after the purchase of the product through its product. The nature of such customization makes it very marginal among companies, even more so among MC start-ups, because only very few products can be customized in such manner. In this study a few examples of adaptive customization were provided earlier – Nudie jeans and Gillette shaver – however no more indication of the adoption of this approach was found among the companies present in milkorsugar.com database.

5 CONCLUSIONS

This study attempted to use theoretical background and empirical analysis to attain four research objectives and investigate three research propositions. From the perspective of management practice, our research contributes to a better understanding of the success factors in mass customization following a customer-centric business strategy. From the perspective of management research, the paper provides an extensive literature review on the subject matter and a starting point for further research on MC approaches. In this section we will discuss the outcome of the objectives and will draw conclusion with regard to each proposition. Our goal is to address the "so what" question and make sure that each proposition proves a clear point.

The first two objectives were to identify the key success factors of a mass customization process and to empirically verify whether all success factors need to be present for a successful mass customization start-up. The third objective was to determine the relationship between customer integration in MC and perceived added value. The fourth objective was to empirically verify which mass customization approach is most commonly used among mass customization companies.

As discussed in theoretical framework, the research objectives were formulated and achieved through three research propositions, which were the drivers behind the empirical research and which will be examined here one by one to formulate a conclusion for this research.

Proposition 1: All of the identified success factors need to be present for a successful implementation of mass customization strategy.

Since mass customization companies greatly value customer profiles and outreach, we choose to touch upon the success of MC from the perspective of added consumer value. We refer to an approach by Broekhuizen and Alsem (2002), who suggest that ultimately the success of mass customization depends on the perceived added value from buying mass customized solutions as opposed to mass-produced ones.

Proposition 1 was addressed through an empirical research of two case companies, who are, under our definition, successful mass customization star-ups. Table 10 provides a quick visual overview of success factors that we identified in literature review and whether they were identified after interviewing the case companies. A customized chocolate manufacturer *Chocri* demonstrates a strong existence of all six success factors. A customized shoe manufacturer *Shoes of Prey* has a strong presence of all success factors except for a functioning value chain. After the interview we can conclude that the value chain needs improvement before it can be labelled as near mass-production efficient. However, the company management is well aware of the improvement areas and has established an action plan for proper mitigation.

Based on the case studies we could see indications towards the claim that the identified success factors should be present in a successful implementation of a mass customization business. This is also supported by Blecker and Abdelkafi (2006) who believe that if necessary conditions are satisfied, the implementation of mass customization strategy has great chances of success. Before a company decides to shift to or start with mass customization, it is important to investigate those conditions and see if they can be met. However, in case of Shoes of Prey, the founders did not put an emphasis on investigating market conditions but rather went with their drive and 'gut feeling'. The company followed the 'learning by doing' philosophy hence it can be concluded that extensive preparations are not always a prerequisite for success, but they need to be worked on during the process. In order to further investigate if all success factors are equally important, one should find and analyze ventures that failed (see suggestions for further research).

Table 10. Success factors in case companies

	Customer demand	Market conditions	Customizable product	Value chain	Technological feasibility	Knowledge sharing
Chocri	Yes	Yes	Yes	Yes	Yes	Yes
Shoes of Prey	Yes	Yes	Yes	Yes, but in a development phase	Yes	Yes

Now that it has been established that the success factors are indeed identified in case companies, it is possible to make conclusions to the second proposition.

Proposition 2. Customer integration is positively related to perceived added value, which is positively related to success.

It appears that increasing the level of customer integration positively correlates to the perceived level of value of the product/service. Both of the case companies explored in this study seem to have experienced lower pressures in pricing than their mass-produced competitors. This seems to validate the direction of the existing literature that was reviewed in section two of this study.

In addition to this we were able to identify four types of drivers that add value in mass customization. It appears to us that the added value in mass customization can be:

1. Brand driven
2. Product driven
3. Opportunity driven
4. Novelty driven

We also concluded that these drivers are not mutually exclusive and the total perceived added value arises as a combination of few rather than manifestation of one. It is fascinating to see how an introduction of a new technology (or a group of technologies in the instance of mass customization) together with evolving consumer trends and purchasing behaviour, clearly lead into a levelling of the competitive playing field, as new previously unattainable niches and growth areas open in the market.

Proposition 3. The collaborative approach is most commonly used in mass customization to achieve the higher level of perceived added value.

This proposition was tackled by analyzing an online database of mass customization companies that are currently offering their customizable products or services through an online channel. With reference to the theoretical framework (Figure 7), we proposed that out of the four MC approaches (collaborative, adaptive, cosmetic, and transparent), collaborative approach will be adopted by most of the online mass

customizers. Collaborative approach means that the customer is an integral co-creator in the customization process. After a thorough analysis of the online database, it was concluded that most mass customizers indeed choose collaborative approach. Hence Proposition 3 is supported but we would like to provide some answers as to why collaborative approach is most commonly adopted by online MC companies.

As mentioned in literature review, collaborative approach, also known as co-creation, represents the key essence of mass customization, therefore companies pursue this approach to create the highest level of consumer added value. Customers also experience hedonic and instrumental benefits when customizing their selection, thus the possibility to configure one's own product can be pleasant (eg., creating customized pair of shoes at Shoes of Prey) because of the entertainment value and the enhanced control. We believe this is especially true in the light of our research because we focused on companies that offer customization through an online channel. For online mass customizers it is easiest and most cost efficient to interact with a consumer through an online platform, as opposed to retail customizers.

Secondly, the companies that we analyzed in the online database were mainly start-ups and we believe that the nature of start-up companies dictates the rules of the game. Start-ups are typical young ventures with little operating history or resources, and a goal to make their mark on the map. These companies will base their business model on customer co-creation and customization because they want to please customers' individual needs and wants. It makes much more business sense for a MC start-up to offer a collaborative customization approach rather than anything less of it, because they need to make their mark and distinguish themselves from mass producing companies. As a result, 'young' mass customizers are likely to include the customer to the customization process as early as possible to make them feel in charge and to provide as extensive co-creation experience as possible. This is especially true to the companies that have the first mover advantage in their own respective markets, as this will increase the barriers for entry for any potential competitors.

Third, the nature of the product dictates the mass customization approach. Clothing and Footwear and Accessories were the main product categories where mass

customizers chose to apply collaborative approach, given that these categories also had the highest number represented in the sample. These are products that enable people to express their individuality through style and appearance, therefore it makes all the logical sence for mass customizers to build their operations that enable the highest level of customer co-creation.

5.1 Managerial implications

This section summarizes the implications this research can provide into practical management. The first part of this research offers an overview of the existing literature and discussion around the topic of mass customization. It provides an exhaustive summary of all relevant definitions and current commanding theories in mass customization strategy and makes a distinction between the different levels of customer integration in mass customization. The case studies provide insight into real life examples of two new successful mass customization ventures and the struggle they needed to go through in setting up the required conditions. The research summarizes these examples and draws links between the literature (theory) and the examples (practice).

The literature review covers the topic in enough detail to be able to support the decision making of an existing company that desires to venture into mass customization, and guide start-up's to consider all areas that are required in order to be successful. New ventures appear to believe they can improve their ability to be successful by embarking on a strategy with a highest level of customer integration (*collaborative approach*), as this seems to allow them to better differentiate themselves from the existing competition, maximize value perception and thus allow a more favourable price positioning. This is especially true to the companies that have the first mover advantage in their own respective markets, as this will increase the barriers for entry for any potential competitors.

The primary proposition of this research: all six identified success factors of mass customization need to be in place in order for the venture to remain successful, is

supported by the empirical research that was carried out. The case studies show a clear link between the success factors and the issues that were identified by the case companies. Both companies were trying to reach a state of having solved the *basic* issues, hindering production and growth potential, in order to be able to concentrate on improvements enhancing productivity and profitability.

5.2 Suggestions for further research

As mass customization still is a fairly new area of research, and as technological advancements quickly pave way to new alterations and modifications of existing business models, there are various paths of research that could be worth exploring further. Here we have discussed some of the ideas that arose during our research but that we were unable to explore due to our limited resources.

Most importantly, closely studying successful ventures provide enough data to make simple conclusions into what could be the underlying reasons behind their success. In order to really understand what are the true conditions that need to be met in successful mass customization strategy one would have to find examples where the venture failed due to the lack of one or more of these required conditions. This research concentrates to MC companies that use online interface to interact with their customers. It would be interesting to investigate ventures that do not use online distribution channel in executing a mass customization strategy. These businesses (such as local bicycle shops) are presumably more susceptible to changes in the required conditions (lacking success factors) and could therefore offer an interesting environment to study what can go wrong.

Secondly, concentrating to one industry only, and thus limiting the variables influencing the research, could also offer an interesting viewpoint to mass customization. As we highlighted before in this study we decided to concentrate to B2C ventures, as the data was more readily attainable, but B2B enterprises could offer an equally attractive alternative. MC seems to be less exploited in B2B environment, and could therefore be interesting to observe if one wanted to analyze the emergence

of a new industry (consider the opportunities in corporate gift sector for example, as it is currently dominated by logo-printing ventures (low level customization) but would clearly benefit from being able to offer mass customized alternatives (high level customization). Also an extensive research study, including all mass customizers (not only operating online), would be a valuable contribution to empirical research in Mass customization.

Thirdly, due to the fact that MC appears to increase the value perception of the physical product, it would be extremely interesting to study the impact of applying mass customization to industries, which are struggling to grow in today's increasingly digital world. Such areas as music industry or news and printed media industries, which are relentlessly looking for a new business model to replace the existing out-dated ones, could find mass customization to provide the necessary tools that keep consumers wanting for the physical instead of the electronic.

Finally, we see great value in researching how increasing customer integration influences the consumer price threshold; the price after which the consumer is not willing to complete the purchase. To what extent will increasing customer integration justify the increased price? How do these dynamics differ from one industry to another?

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Online resources:

Art Re-Thought Blog: http://www.art-rethought.com/blog/lingo-of-the-new-industrialism/

E-Commerce blog: http://ecommerce.hostip.info/pages/718/Mass-Customization-COMPANY.html

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7 APPENDICES

Appendix I: Interview guide – Critical success factors in Mass Customization

This interview guide has been prepared for the empirical research on critical success factors in Mass Customization, as part of a Master's Thesis for Aalto University.

The data is planned to be collected through a series of semi-structured interviews. To ensure all necessary topics and questions are covered in the interviews, and their results, this interview guide was created. It is essentially designed into a matrix form to allow the interviews to maintain their natural flow as different topics are discussed. In this manner we can also ensure that the data between different interviews remain comparable to an acceptable degree. Interviewee should use the matrix approach to tailor questions during the interviews, if an opportunity to probe a theme more closely presents itself.

Through the semi-structure interview we can:

- Obtain specific qualitative information from the case companies
- Obtain general information relevant to our research objective
  (in other words: to probe for what is currently not known)
- Obtain specific insights and depth by not restricting the discussion

The interview essentially aims to only answer the following questions, but given the free structure of the research method, the outcome of each interview can yield much more. The purpose of this interview guide is to ensure that the subject matter remains the same in all conducted interviews, whereas questions to different respondents may vary. With regard to this study, semi-structured interviews are revolving around research objectives, but at the same time allow them to be conducted as guided conversations, flexible enough for the interviewee to elaborate on the topic.

Interview questions – Shoes of Prey
Contact person: Michael Fox

This questionnaire has been prepared for the empirical research on critical success factors in Mass Customization, as part of a Masters Thesis for Aalto University School of Economics.

Part I – Identification of success factors

Customer demand for mass customization

Q How did you identify the demand for mass customization in your sector?

Q Are the needs and wants of your customers changing constantly? What do you do to understand/map them (the needs) better?

Q What kind of challenges you had to overcome, during the initial steps of implementing mass customization, in order to meet the (rising) customer demand?

Market conditions

Q How is your business affected by economic cycles, such as recession, recovery and expansion? Does MC make you more resistant?

Q When you started MC, would you describe the prevailing market conditions as turbulent or stable?

Q Would you say that you were the first mover for MC in your respective sector?

- If so, can you identify what kind of advantages it has provided to you?
- If not, has the first mover maintained the initial advantages over time?

Q What is the competitive landscape in your market sector? Is competition more based on product differentiation or on price competition? Are your products vulnerable to being replaced by substitute products that different but essentially provide similar functions?

Q Can your growth be credited to repeating customers or a steady flow of new consumers? Has this changed since the beginning?

Q How do you see the future of your sector in terms of MC?

Customizable nature of the product

Q To what extent are your products/services customized to satisfy individual customers' needs?

Q "Continuous customization" means that products can be infinitely customized; whereas "discontinuous customization" means there are distinct steps taken towards MC. Into which category do your products fall?

Q Do you ever need to decline the preferred combination, because it is technically impossible to combine them? If yes, what are they?

Functioning value chain

Q Briefly describe your value chain network. Are you operating all functions by yourself or have you outsourced different areas of these operations?

Q Where do you source the raw materials?

Q Do you hold inventory? Does it affect costs?

Q Who designs the shoe modules?

Q Do you only sell online? Delivery issues?

Q Which parts of your value chain are standardized in a way that they are not adaptive to each customer order?

Q What kind of challenges, if any, you had with the value chain when you started? Has your VC been able to address growth?

Q Would you say MC has an increased complexity for supply chain versus mass production, and if so how is that evident?

Q Would you say the production process for your mass customized products functions near mass production efficiencies?

Technological feasibility

Q What kind of technologies are you most dependent on in pursuit of MC? Website? Manufacturing?

Q What kind of production system do you utilize? Any machinery, or purely hand-made?

Q Would you describe MC as more investment intensive strategy as opposed to mass production?

Q What kind of importance does website usability and interface development play to your company?

Q Can you identify technologies that would improve your operations? Are you planning to invest into something new?

Knowledge sharing

Q Would you describe your products to be "knowledge intensive"?

Q In your opinion, does the level of pre- and post-sale service influence your customers in their decisions to buy?

Q How do you utilize the fact that consumers are willing to put a significant amount of time to ensure they get a product that fits their need? Do you gather and reuse this information?

Part 2 - Customer Integration

Q Through an interactive website, your customers can influence the features, size, design and price of the end product. Is this context, would you say that customization has a higher perceived added value to your customers as opposed to mass production, or if customers were offered less integration into customization?

Q Would you say that consumers are willing to pay more for a customized product in your sector; and can you give a rough estimate on how much (%)?

Q Do your customers request for more interaction and possibilities to even more customize the end product?

Q Have you ever received negative feedback from customers about over-abundance of choices offered when selecting their shoes?

Q What would be your next step if your task were to further increase the added value you are offering to consumers? Would you make changes in customer integration?

Appendix II: Questionnaire for Chocri

This questionnaire has been prepared for the empirical research on critical success factors in Mass Customization, as part of a Masters Thesis for Aalto University School of Economics.

Part 1 – Identification of success factors

Customer demand for mass customization

Q How did you find out about the demand for mass customization in your sector?

Q Are the needs and wants of your customers changing constantly? What do you do to understand them (the needs) better?

Q What kind of challenges you had to overcome, during the initial steps of implementing mass customization, in order to meet customer demand?

Market conditions

Q Is your business affected by economic cycles, such as recession, recovery and expansion?

Q When you started MC, would you describe the prevailing market conditions as turbulent or stable?

Q Being the first mover in this sector, can you identify what kind of advantages it has provided?

Q What is the competitive landscape in your market sector? Is competition more based on product differentiation or on price competition?

Q Can your growth be credited to repeating customers or a steady flow of new consumers?

Q How do you see the future of your sector in terms of MC?

Customizable nature of the product

Q To what extent are your products/services customizable to match individual orders? To what extent do you utilize this potential?

Q "Continuous customization" means that products can be infinitely customized; whereas "discontinuous customization" means there are distinct steps taken towards MC. Into which category do your products fall?

Q What kind of innovation initiatives are you running? Is your product portfolio supported by rapid product development?

Functioning value chain

Q Briefly describe your value chain network. Are you operating all functions by yourself or have you outsourced different areas of these operations?

Q Which parts of your company are standardized in a way that they are not adaptive to each customer order?

Q What kind of challenges, if any, did you have with the value chain?

Q Would you say MC has an increased complexity for supply chain versus mass production, and if so how is that evident?

Q Would you say the production process for your mass customized products functions near mass production efficiencies?

Technological feasibility

Q What kind of technologies are you dependent on in pursuit of MC?

Q What kind of production system do you utilize? Any machinery, or purely hand-made?

Q Would you describe MC as more investment intensive strategy as opposed to mass production?

Q What kind of importance does usability and interface development play to your company?

Q Can you identify technologies that would improve your operations? Are you planning to invest into something new?

Knowledge sharing

Q Would you describe your products to be “knowledge intensive”?

Q In your opinion, does the level of pre- and post-sale service influence your customers in their decisions to buy?

Q How do you utilize the fact that consumers are willing to put a significant amount of time to ensure they get a product that fits their need? Do you gather and reuse this information?

Part 2 - Customer Integration

Q Through an interactive website, your customers can influence the features, size, packaging and price of the end product. Is this context, would you say that customization has a higher perceived added value to your customers as opposed to mass production?

Q Would you say that consumers are willing to pay more for a customized product in your sector; and can you give a rough estimate on how much (%)?

Q Do your customers request for more interaction and possibilities to even more customize the end product?

Q Have you ever received negative feedback from customers about over-abundance of choices offered when selecting the muesli?

Q What would be your next step if your task were to further increase the added value you are offering to consumers? Would you make changes in customer integration?

Appendix III: Request for Interview

The following request for interview was sent to the managers of case companies Chocri Gmbh and Shoes of Prey:

Dear _____ team,

This is an invitation to participate in a research being conducted by Aisté Altonen and Kalle Altonen as part of their Master's Thesis, under the supervision of professor Elizabeth Rose at the Aalto University School of Economics in Helsinki, Finland. The study explores the critical success factors in Mass Customization, with an emphasis on start-up companies and new market entry strategies.

Participation in the study involves either a round of semi-structured interview or a completion of a questionnaire, supported by a provision of some background information. The interview/questionnaire is designed to answer questions around such

areas as market conditions, demand, knowledge sharing, value chain to name a few key topics. If possible we prefer the interview approach, as it provides us a better opportunity to derive case-related information trough dynamic discussion and follow-up questions. If you do not have the opportunity to participate to an interview (in person or trough Skype/telephone) we would appreciate your input trough a questionnaire.

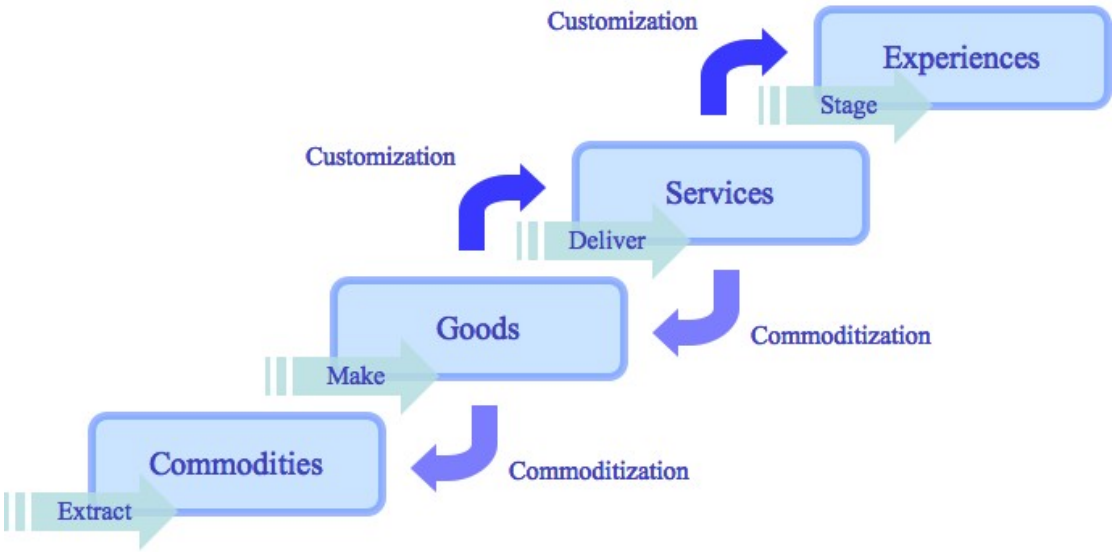
Participation in the study is entirely voluntary, but due to the nature of our research and the limited amount of suitable case companies, we are extremely grateful if you choose to take part in the study. If you have any concerns or questions during or after the completion of the questionnaires, you are encouraged to discuss these at any time with either of the researchers.

Detailed summary of the results will be available in the first half of 2011, and if so requested will be delivered to you.

Thank you for your time and consideration in participating in the study.

Sincerely,
Aisté Altonen and Kalle Altonen

Appendix IV: From Commodities to Experiences



Customization is the antidote to commoditization (Pine, 2004)