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Does Mass Customization Enable Sustainability in the Fashion Industry?

D.G.K. Dissanayake

Abstract

Fashion industry evolves today as one of the largest yet among the top of the most polluted industries in the world. Fashion has become cheap and affordable; hence, the consumption has risen to an unsustainable level. Water and energy consumption, hazardous chemical usage, resource depletion, and waste generation are among the key environmental impacts created by the fashion industry. To foster the sustainability in the fashion industry, development of new business models that minimize the environmental damage is urged. This chapter reviews the possibility of a mass customization strategy to become a sustainable business model in the fashion industry. Seven key elements that could possibly enhance sustainability are discussed, and it is concluded that further advancement of technologies and growing consumer desires to purchase sustainable products will make mass customization a viable sustainable business model.

Keywords: fashion industry sustainability, mass customization, personalized fashion, sustainable fashion

1. Introduction to mass customization

In today's fashion market, consumer's desire has been changed from purchasing a mass-produced apparel to a more personalized garment with the right fit and preferred design. This growing desire of product personalization demands apparel manufacturers to move away from mass manufacturing to mass customization [1]. Mass customization in the apparel industry refers to producing a personalized style by adopting individual consumer taste, at the right time and at the right cost. In mass manufacturing, high volumes of identical items are produced, yet in mass customization, unique items are produced for individual customer desires [2, 3] for a relatively large market, yet with efficiency comparable to mass manufacturing [4, 5]. Mass customization is also described as a technology-assisted production process where customers are given the opportunity to modify the traditional mass production process to produce their preferred design and fit [6]. Glimore and Pine define this as a collaborative approach where the manufacturer customizes a product based on customer desires identified through a proper dialog [7]. Davis first brought up the concept of mass customization; emphasizing new technologies will facilitate manufacturing customized products in mass basis [8]. As Nayak et al., argue, apparel purchasing is rapidly moving out of the physical domain into the

virtual domain, and technological advancements in the fashion industry such as virtual prototyping, 3-D body scanning, and computer aided design/ manufacturing (CAD/CAM) have already brought mass customization into a reality [2].

Making personalized garments is not entirely a new concept in apparel manufacturing. In pre-industrialized economy, garments were custom-made, catering individual consumer requirements. Measurements were taken from each consumer and the garments were made as 'one-off' pieces with a preferred style and fabric. Consumers used to make their own clothes at home or obtained the service of a tailor to make their garments with their design choice. However, making personalized garments was time-consuming, incurred high unit cost and was not efficient consumption-wise. Furthermore, when getting the service of a tailor, customer had to wait days or weeks to receive the finished garment.

Industrialization made a massive impact to the way garments were made. Production systems were developed to mass produce standard designs with standard sizes at low unit cost. This mass manufacturing strategy facilitated a cost-effective and efficient way of manufacturing garments in a shorter period of time than manufacturing one-off pieces. This led the customers to move away from making personalized garments to the purchase of mass-produced fashion at affordable prices. This eliminated the customer waiting time, as mass-manufactured fashion clothing was ready available to purchase over the counter. However, in the mass-manufacturing process, continuous production run of high volumes made the customization impossible [8], and therefore customers ended up having only few styles in high volumes and different size ranges. Yet, mass-manufactured fashion clothing rapidly captured the consumer market as customized clothing could not compete with the cost and time.

2. Unsustainability of the fashion industry

Mass production and consumption in the fashion industry brought up numerous sustainability issues along the product life cycle. Mass manufacturing enables fashion clothing at affordable prices, which led to increase the consumption and disposal rates [9]. Increasing world population and ever-changing consumer tastes also fuelled unsustainable production, consumption, and throw-away practices [10]. The fashion industry today is characterized by fast-changing fashion cycles, high volumes of production, overconsumption, and frequent disposal habits [11]. To fulfill the ever-increasing demand for fashion products in today's world, natural resources are being consumed in a fast rate than the time required for them to regenerate. Consumption of natural resources such as massive volumes of water, petroleum-based fiber production, use of hazardous chemical, and energy consumption have already made nonreversible impacts in terms of depletion of resources and creating environmental pollution [12]. Offshore production led to increase the energy consumption, transportation emissions, uncontrolled waste generation, and adverse environmental and social impacts, mostly in the least developed countries where manufacturing plants are located [13, 14]. It is estimated that the fashion industry would contribute to a quarter of world carbon budget by 2050, if the current phase of production and consumption continues [15].

Fashion industry today is listed as one of the most polluting industries in the world, therefore experiencing an increasing pressure to integrate sustainability into its supply chain [16, 17]. Industry is already working on adopting sustainability concepts and strategies, yet the integration of new sustainable business models is urged

as one promising path to enhance sustainability. In this scenario, mass customization has been identified as one such viable strategy that carries the potential to create both economically and environmentally sustainable business models [18, 19].

3. Enabling sustainable fashion through mass customization

A growing number of apparel manufacturing companies have shown their interest to adopt a mass customization strategy [20, 21]. This is a promising approach in overcoming some of the sustainability challenges inherited in the mass manufactured business model, yet the producers still show their interests only from an economic viewpoint. However, careful analysis of the characteristics of mass customization provides positive insights into reducing excess production, overconsumption, extending product life, and minimizing waste generation. Therefore, it is vital for the manufacturers and retailers to look into this strategy not only in an economic perspective, but also in environmental and social perspectives as well. The following section briefly discusses several possibilities that mass customization may foster sustainability in the fashion industry.

3.1 Improved relationship with the product

Several authors have highlighted the requirement of improving customer attachment to the product, in order to slow down unsustainable consumption and disposal habits [22–24]. Mass customization offers an improved customer relationship to the product and the producer. Each customer is personally treated, which helps to retain a customer long term through the development of trust and relationship between the supplier and the customer. In the mass manufacturing process, the customer is not directly connected with the manufacturer, and their products are made based on general market research and trend information [25]. Nevertheless, in the process of customization, the customer becomes the co-designer, who actively involves in the product development process [26]. This offers the customer a sense of belongingness and attachment to the product and process, even before purchasing the product. This process of involvement could probably replace the joy of customer shopping experience and provides a higher level of satisfaction with the total experience of creating and purchasing personalized fashion clothing. Customer builds up a positive relationship with the product, which ultimately keeps the customer attached to the product for a longer period of time than a mass-produced garment, in which the time between purchasing and disposal has become just a matter of weeks.

The mass customization strategy creates an online platform for the customers to visualize while creating the design and make changes until they are satisfied with the final look. One drawback of online purchasing of clothing in general is highlighted as the inability to confirm the fit before the purchasing decision is made. Digital advancement in the customization process allows overcoming this issue by facilitating the customer to view the design and fit of the garment before making the purchasing decision. 3-D body scanning and virtual prototyping technologies enable online fit sessions even before the garment is physically being made; thus, customer satisfaction is ensured as early as the product development stage. The advancement of technology embedded with the mass customization process is such that the customer can try out few different style changes virtually and observe the fit and style, before making the purchasing decision. This experience indeed brings higher customer satisfaction than visiting a shop and trying out a garment where

there is no opportunity to alter based on customer desires. Therefore, the mass customization strategy promotes a better relationship between the customer and the product, starting from the design stage itself. This relationship ultimately keeps the customers happy about their purchasing decision and the product.

3.2 Extended user phase

The time period a garment is used by the consumer depends on various complex factors; yet the degree of consumer attachment to the product is definitely a one key factor, as discussed in Section 3.1. During the customization process, unlike in mass manufacturing, customer attachment to the product is already built up with the involvement of the customer as a co-designer. This sense of ownership and belongingness, together with the uniqueness of the product, make the consumer keeps the garment for a longer period than a mass-manufactured garment with a standard design.

Moreover, mass-manufactured cheap clothing has increasingly become disposable commodities over the last decade. Herein, fashion clothing is meant to be bought, worn once or twice, and quickly disposed of. Availability of clothing in mass scale at affordable prices pushed consumers for unsustainable purchasing and consumption behaviors and invited them to become a part of a throw-away culture. Fast cycle fashion products tend to be manufactured in such a way that the consumers are pushed for short product life cycles, where the quality is compromised for low cost. This led to create high volumes of waste generated in monthly or even weekly basis, posing environmental threats. Even though it has been emphasized that improving the product quality and increasing selling prices would slow down the damage, growing competition among retailers to increase the sale volumes pushed them for a price competition, where clothing has become cheaper and affordable across consumer segments than ever before. Consumption has become a habit, and clothing is bought for fun, entertainment, and even for single use; thus, long term attachment to the product appears to be impossible to achieve [27].

In contrast, many researchers highlighted the customers' growing desires to pay a premium price for a long-lasting, personalized product [28, 29]. This is mostly associated with the consumers' willingness to express their individuality through what they wear. When a customer pays a premium price for such a personalized product, it is no longer fallen under the category of disposable commodity. Moreover, the product is carefully thought through in the design stage and the price reflects the design and quality, and thus customer satisfaction regarding the product becomes high. This satisfaction motivates the consumer to pay additional price, keep the garment for a longer time than usual, and avoids frequent purchasing of cheap, mass-produced and low-quality clothing. Therefore, through the mass customization strategy, there is a possibility of extending the use phase of the garment life and reducing the environmental burden created by ever-increasing resource extraction for fast phase production.

3.3 Waste minimization

Cheap, industrialized mass production converted fashion into a fast and disposable commodity. The concept of fast fashion is described as a quick response system that caters ever changing, yet uncertain market demands, by offering highly fashionable yet cheap, low-quality clothing with short life cycles [22, 23]. While this drives the profitability of the fashion business, ever-increasing consumption and disposal of clothing poses environmental challenges. In fast fashion phenomena,

clothing is made for single use and then thrown away; thus, the use of low-quality materials avoids the possibility of reuse or recycling. Moreover, due to the increasing use of synthetic materials with fiber blends, clothing wastes become neither biodegradable nor recyclable.

Even though frequent purchasing of new clothing keeps the customer emotionally satisfied for some time, the attachment to the product fades away soon due to fit, quality issues, and also the fact that new fashion items are available to purchase almost every week. Moreover, wide availability of similar styles in mass-manufactured system does not bring the consumer the emotional satisfaction of having a unique product. Therefore, the garment is thrown away as new or after single use, generating significant volumes of clothing waste. Global production of clothing has doubled over last 15 years, yet half of the purchased items were thrown away within less than a year [15].

There is a growing desire for customized apparel due to customer dissatisfaction of purchasing mass-produced garments due to fit, quality, or design issues. Mostly the customer has to compromise between fit and style, which results in the garment hanging in the wardrobe without any use or throwing away within a shorter time period than that was intended to keep. Mass customization could dramatically reduce purchasing of apparel that customer is not fully satisfied with. As discussed above in Sections 3.1 and 3.2, personalized styles with right fit and quality would extend the use phase of the product. Customer desire to follow fast fashion trend and throw away culture will be reduced due to customization option. Slowing down the rate of purchase of mass-produced apparel will reduce the demand for fast fashion.

Nevertheless, by actively engaging in the customization process, the customer could engage in a different level of thinking process and also gain a design experience, which may provide better satisfaction than a time-consuming, wasteful, and sometimes an unhappy shopping experience. Once the customers start enjoying the engagement in the customization process, their random purchase of mass-manufactured apparel will be reduced. Reduction in the purchase of unwanted apparel or less fitted apparel means the reduction in disposal and waste generation. In mass production, quantities are based on predicted market demand, and therefore forecasted sales figures are not 100% accurate. This causes overproduction and unsold stocks in the sales store, resulting in waste generation. In mass customization, production is based on actual demand, and therefore, unnecessary production and unsold stocks can be eliminated. This strategy facilitates minimizing wasteful resource consumption and excess production, which in turn reduces the environmental burden.

In mass manufacturing, stock holding cost is high as goods are produced few months in advance and also distribution inventories are added up to the total stock-holding cost. Yet, mass customization offers on-demand production where goods are produced after the order has been placed [26]. Therefore, raw material inventories, post-production, and distribution inventories could be kept to a minimum. Moreover, unsold stock can be eliminated as production is based on actual orders from the end consumer. This helps to reduce high inventory cost and store space.

3.4 Enabling eco-friendly printing technologies

Traditional printing techniques in the mass manufacturing process are time consuming, resource-intensive, polluting, and wasteful [2, 30]. Yet the digital printing technology has the potential to reverse the trend to a more eco-friendly printing solution [30]. With the mass customization strategy, there is a possibility to replace conventional industrial printing with digital printing technologies.

Digital printing facilitates printing individual and unique designs, only according to the order. Digital printing technologies such as inkjet or sublimation printing are less time-consuming, flexible, and offer a cost-effective solution for customized printing. Gupta highlighted the benefits of inkjet printing as personalization and quick response, ability to copy the original design fast, ability to print already made products, environmentally friendly production process, and cost saving due to short fabric lengths and reduced stocks [30].

Digital printing offers the customization in the printing stage where completely new prints can be incorporated for each individual garment. Thus, the customer gets two stages to personalize the product, first in design stage and then in printing. This is a better way to customize the product while minimizing the environmental impact of printing. This option saves significant amounts of energy, water, and chemicals, compared to mass-scale industrial printing such as rotary or screen printing.

3.5 Enabling repair, reuse, or recycling models

As the mass customization process builds up a close relationship with the consumer, implementation of product service systems and product take back systems would be a possibility. There is a growing emphasis on extending the use phase of clothing by offering after sales services such as repairing, where a consumer can bring the product to a service center for repairing or upgrading. When the consumer is no longer interested about the product and wants to dispose, this can be done through a product take back system with some incentive given to the consumer for returning the product, such as discounts over the next purchase. Benefits of product take back systems can be gained by convincing the consumer during the product design stage to use the materials that can be recycled. Returned products can be reused or recycled to minimize the product's end of life environmental burden. With the mass customization strategy, all those sustainable end-of-life product options that are being extensively discussed in general mass production system, and viewed as challenges so far, can come into a reality.

3.6 Enhancing consumer awareness of sustainable fashion

When customer becomes the co-designer of the product, environmental impacts of their product decisions can be easily and effectively communicated during the design stage. This can create a platform for discussion on developing an environmentally responsible product through an effective dialog among the producer and customer. The producer can make the consumer mindful about product sustainability and influence on how to become an environmentally responsible consumer by selecting sustainable production, consumption, and disposal strategies.

Integrating sustainability into the fashion design process has been identified as the most effective way of making a sustainable fashion product [31, 32]. In the mass customization process, this can be facilitated through an integrated sustainability indicator tool within the collaborative design process. Integrating a user friendly simple software tool to indicate the sustainability impact of their choice of material, design, colors, and recycling options can influence the consumer to make sustainable choices in the design stage. This type of an interface would bring benefits to the producer and consumer as the sustainability choices are made through a mutual understanding among both parties. This results in an effective collaborative sustainable design exercise, rather than producer making a sustainable fashion piece and trying to convince the customer to purchase that without understanding the sustainability impacts of their purchasing decision.

3.7 Moving from global to local production

Mass customization is characterized by customer-centric production, competitive cost of manufacturing, and timely delivery of finished goods. In this scenario, to facilitate maximum flexibility in production and short product development cycles, manufacturing base has to be moved away from mass-scale offshore production centers to more local-based manufacturing [33]. The current offshore production system brings not only an environmental cost, but also a social cost. Cheap labor, poor working conditions, low wages, and extended working hours are among the key social impacts of the current system. The absence of environmental regulations allows these developing nations to use hazardous chemicals which are banned in EU countries and to continue water and land pollution by releasing both effluent and solid waste to the environment without proper treatments.

Shifting manufacturing operations back to the countries where majority of the consumption is taking place can reduce the extensive environmental and social damage caused by the global supply chain. Local production has to be adhered to the country-specific environmental regulations and labor laws. This helps the consumer to understand the impact of their consumption behaviors to their environment and the society. Moreover, local production facilitates better control of production and quality, better working conditions, short lead times, and local employment opportunities and reduces the cost and emissions associated with global scale transportation.

4. Discussion

Analysis of the mass customization strategy in environmental and social perspectives highlighted some positive facts towards supporting sustainability efforts of the fashion industry. This strategy facilitates user-maker connection, and therefore builds a close customer relationship with the producer and a deep satisfaction with the product. This helps to extend the garment life and to consume products more responsibly than now in the case, while reducing the need for frequent purchasing, thus slowing down the consumption. Manufacturers move away from product-centric to customer-centric approach, where customer plays an important role in the decision-making in the product development process. The best place to integrate sustainability into any product is the design stage, rather than looking to resolve environmental burdens at the end of pipe line. A collaborative dialog among the customer and the producer during the design development stage can lead to create an environmentally conscious product. Apart from environmental and social benefits, mass customization brings profit to the business in long run through minimizing excess production, reducing inventories and waste generation. Satisfied customers with a particular producer continue their purchasing with the same company; thus loyalty builds up and customer switching between companies will be minimized. Shifting manufacturing base to local plants can dramatically cut down the cost associated with global supply chains and also lead times.

The mass customization strategy is already being adopted by various manufacturing industries such as automotive, computer, electronics, and clothing. Profitability in adopting mass customization is promising as many companies are reported to have double digit sales growth [34]. Similarly, fashion companies have shown their desire on shifting from mass manufacturing to the mass customization strategy. For example, companies such as Levi Strauss, Second Skin Swimwear, Nike, Addidas, and Puma have successfully incorporated mass customization into their businesses [2, 20]. Levi Strauss started offering customized jeans in 1995, and

now expanded to a broader range of styles, colors, and fabrics. Nike ID program allows the consumer to customize a pair of shoes using thousands of color combinations and own embroidery designs [2]. Proper Cloth, a US-based apparel company, offers customized men's shirts with the choice of fabric, color, and component design. Famous fashion brands such as JC Penney, Ralph Lauren, and Land's End already offer a variety of customized products with a choice of fabric, color, and design while maintaining order to delivery time of 4–5 weeks [35].

Various consumer studies have reported a positive trend towards purchasing customized apparels. According to the group consumer survey conducted by Taieb and Cheikhrouhou [36], 82% of the teenagers and 92% of the youth and adults have voted for customized products over mass manufactured products. Deloitte consumer review [37] conducted in the UK shows that 41% of the consumers have expressed their interest in purchasing customized clothing, and 19% of the respondents have already bought customized clothing. According to YouGov consumer survey conducted in the US for internet users, 29% of the respondents indicated that they have already purchased customized apparel or footwear [38]. Those studies discovered the growing awareness among consumers regarding customized products and the related benefits. They are also willing to pay a premium price for a customized product. According to the consumer research conducted by Deloitte, 88% of the survey participants are willing to pay an extra price for customized clothing [37]. A total of 67% of the YouGov survey respondents indicated their willingness to pay a premium price for a customized fashion [38]. Most importantly, consumers will benefit through price customization as the price of the product is dependent upon the degree of customization [26]. These consumer researches indicate that price is not a barrier to adopt mass customization into the fashion business.

Mass customization is so far viewed by researchers and practitioners through economic and consumer perspectives, and the literature provides little evidence on environmental or social benefits of the strategy. It is expected that this foundation study would provide a platform for the academia and industry to view mass customization from a sustainability viewpoint. A full life cycle analysis would be useful in quantifying the environmental impact of a customized product against a mass manufactured product, by considering the seven key sustainability factors discovered in this chapter.

5. Conclusion

This chapter offers an insight into the sustainability aspects of the mass customization strategy. Mass customization is becoming a growing trend in the fashion industry due to the changing consumer desires; yet the strategy is already proven to bring profit and sustainability into the business. Digital technologies associated with mass customization facilitated an effective dialog between the producer and the customer while completely cutting down the human travelling or sample transportation during the product development process. Major sustainability benefits of the strategy are identified as improved relationship between the product and the consumer, extended user phase of clothing, waste minimization, enabling eco-friendly printing technologies, enabling repair, reuse, or recycling models, enhancing consumer awareness regarding sustainable fashion, and moving from global to local production. Even though mass customization still offers challenges to the producer in the operational phase, further advancement of technologies and growing consumer desires on personalized products would make this a viable business model that brings positive impacts to the business in economic, environmental, and social perspectives.

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