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TECHNOLOGY****STUDY OF MASS CUSTOMISATION APPROACH IN APPAREL AND TEXTILE
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ABSTRACT

There are new designs coming up every day in apparel and textile industries. Therefore, those industries actors had to have a flexible manufacturing system which will take care of these parameters such as mass customisation.

Mass customisation is an innovative concept that does not match any mode of classical production. This study presents a framework, aiming to develop the mass customisation as a design approach in apparel and textile field. First, a review of the mass customisation concept and some key success factors will be presented. Second, questionnaire will be used to study the consumer attitude towards mass customisation for different age categories. Third, modeling the mass customisation level will be proposed, by assessing the mass production level and the co-design experience level and by presenting some scales to classify the mass customisation level. Finally, we propose to decompose the product of elementary modules resulting in different designs for a better mass customisation result.

KEYWORDS: Mass customisation, textile design, industrial design, co-design, mass production

INTRODUCTION

Over the last twenty years, the standardized mass production has gradually changed over the last twenty years, to a more differentiated production.

Mass customisation approach was considered the historical successor to mass production and industrial design approach. The change from standardized mass product to a differentiated offer is a factor that promotes the development of the professional practice of industrial designers.

Individual customer needs are most obviously met in mass customisation. This strategy is designed to specifically respond to two inherently contradictory competitive priorities - low price and high-customisation. It is becoming more established in the textile industry as a response to ever-growing competition from low-cost economies and growth in demand for personalization.

Although the industries that practice mass customisation are not entirely successful in maintaining a low inventory and satisfying all their consumers, modeling and new advancements in manufacturing technology will allow mass customisation to be more ideal for both manufacturers and consumers. So, mass customisation involves customers more than mass production.

By adopting mass customisation approach in the apparel and textile design field, consumers and retailers help in the design process; they select garment details, fabrics or size measurements for clothing items.

To develop those sectors by implementing mass customisation, we need to review this concept, study the consumer attitude towards mass customisation and model the customisation process to develop scales for assessing "mass customisation" aspects of this design strategy.

MATERIALS AND METHODS

The concept of mass customisation was first proposed by Stan Davis in 1989. Davis studied Time, Space and Mass and mentioned about the business strategy that focused on quick response that was the origin of the concept “Any time and Any Place/Anywhere”. Later, this concept was continued by B. Joseph Pine [1] he recommended a concept of perceiving two bipolar things between the large amount of production and the response to particular individuals.

Piller defines mass customisation as, “Customer co-design process of products and services, which meet the needs of each individual customer with regard to certain product features [2]. 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 customisation allow for a price level that does not imply a switch in an upper market Segment.”

Tseng and Jiao define mass customisation as, “technologies and systems that deliver goods and services that meet individual customer’s needs with near mass production efficiencies [3]”.

Two main factors affecting mass customisation, which are the co-design experience and the mass production will be described and reviewed in this part.

The co-design experience

Mass customisation requires an intense dialogue and collaboration between the company and the customer. Mass customisation is characterized by the co-design experience. This is an interaction between the individual and the product during the design process allowing foster the development of solutions for consumers. According to Watcharapanyawong and al., the co-design: development of a product or service with the involvement of the customer or end user in the design process [4].

Mass customisation has advantages for both business and consumers by integrating co-design experience as a factor of innovation. Mass customisation has advantages for both the brand and the consumer. In their work, Merle and al., point out that the consumer pays the value of a product customized, and also to co-design experience [5].

The experience of co-design allows the user to participate in the creation of new models, control the design phase and check predefined range by the brand with the aim to develop creativity and promote primordial use and the attitude of the consumer. The interest to undertake a co-design approach is to take into account all the circumstances of practice for better anticipating the end use before the stage of technical development.

This is a type of Mass Customisation that emphasizes on Co-design, aiming at adding values, exchanging or even problem solving for particular customers. The roles of relationship between firms and consumers belong to the companies themselves [6]. Every section of organizations has to work together in order to help design a model, manage the production process and take responsibilities. According to Noro and Imada, a design for working under the conditions of industrial systems was proposed [7].

Mass production concept

The mass principle in the concept of mass customisation then designates the mode of production. Indeed, it is an industrial and organizational strategy of differentiation by placing on the market of unique patterns, serially produced. Mass customisation takes advantage of low unit production costs that characterizes mass production, while adopting a more flexible approach to individual customisation.

The mass customisation need to respect cost, quality, and a manufacturing time aligned to those observed in a mass production.

We will try to assess the mass production and the co-design experience to assess the mass customisation level.

Mass Customisation in textile and apparel industries

One of the first industry sectors to bring mass customisation to the end user is the textile and apparel industry.

Mass Customisation for apparel can be positioned into three main categories including personalization, fit and design. For personalization, products are customized for consumer individual needs. Personalized body measurements and specifications are supplied to the manufacturing process to be individually made to meet the customer selection, e. g. color, fabric, construction, accessories, thread,...

According to Anderson-Connell and al. [8], consumer interests in customizing apparel include changing design options and personal fit with the aid of well-trained assistant which they called co-design. They found fit to be a critical issue in apparel mass customisation. Anderson-Connell and al. [9] created a model of mass customisation for the apparel industry

Lee and Chen [10] described how apparel industries practice mass customisation based on the concept of mass customisation defined by Pine [1]. They discussed technologies such as “smart card”, “body scanner”, and information collection. The precise measurements of individual consumers are required to customize apparel product and a consumer is able to be measured by hand, by body scanner, or by video camera. Then, these measurements are extended into the system which consequently adjusts the size of matching points on the pattern prototype [10]. They explained that apparel found new niche markets for the made-to-measure garment and mass customisation became a broad trend for apparel industry production and retail [10].

Furthermore, mass customisation requires customer interaction and indeed, customer co-design at the time of ordering the product. Thus, a product produced with the mass customisation strategy in place commands a much higher customer satisfaction and, in many cases, happy customers act as ambassadors promoting the company product and practices. We conclude that mass customisation improves a firm’s performance on all five priorities—price, quality, flexibility, delivery, and service—simultaneously.

Lee and Chen [10] described how apparel industries practice mass customisation based on the concept of mass customisation defined by Pine [11]. Lee and Chen, explained that apparel industries with the manufacturing concepts such “Just-in –Time” or “Quick Response” found new niche markets for the made-to-measure garment and mass customisation became a broad trend for apparel industry production and retail [10]. They presented a model explaining the effect of mass customisation on the apparel industry. In clothing companies, mass customisation begins in retail store where a line ready-to-wear is provided along with mass customisation services.

Fiore, and al. [12] described two important options in mass customisation are body scanning for better fit and co-design for a unique design. In co-design the customer, generally with the aid of CAD technology and/or professional assistance, compiles an individualized product design from a company’s style, fabric, color, surface design and size alternatives.

In apparel industries, the customer also has the opportunity to choose the garment design and any style changes from a menu of offerings, along with the fabric and colour. Design simulation and 3D colour mapping all come into play here since they allow the customer to view a virtual copy of the garment before the order is placed.

Besides, testing styles and fabrics with retail customers during the pre-season provides valuable information used to plan (or mass customize) production. Basic styles and styles identified by retailers for which an apparel producer is certain to get orders can be produced early in the season.

The digital information and new technology in the process of manufacturing will develop customized apparel with four options : “expanded selection/search”, “design option”, “co-design”, and “total custom”. In the “expanded search”, a customer is able to access various manufacturers’ product lines through intelligent search capabilities. In the “design option”, the customer is able select from manufacturer/retailer’s designs, sizing, style options, style details, color and fabric. “Co-design” offers additional personal fit through the ad design manager, based on the “design option choices”. Finally in “Total Custom”, the customer communicates his or her own designs to manufacturers or retailers in a digital format [13].

Anderson et al. [8] present a model of the effects of mass customisation in the apparel industry, they indicated that digital information and new technology in the process of manufacturing will develop customised apparel with the four previous options.

In the production process of apparel industries, mass customisation strategies can be used at any of the six following stages as represented in figure 1.

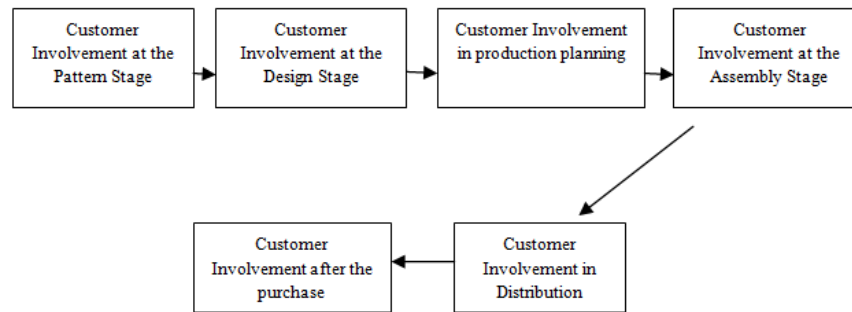


Figure 1. Customer involvement in the stage of the apparel production process

Mass customisation allows the consumer to modify a company product line to meet individualized design tastes or fit requirements.

Finally, post-purchase adjustments can also be built into the product for customers to do it themselves. Higher tech suggests a future for creative post-purchase adjustments that could increase a firm's competitiveness. So, there would be higher degree of mass customisation involved like pocket type, buttons type, designing parameters and new fashion styles.

Finally, many options can be involved in the mass customisation for apparel industries and need to be assessed.

Study of the consumers' attitude towards mass customisation

In order to study the consumer attitude towards mass customisation, an exploratory field study was conducted.

The focus in this research is mainly quantitative. Indeed, we opt for a questionnaire initially highlighting the customer's attitude towards mass customisation, the importance of this experience, the added value of mass customisation and ultimately the most desirable co-design means.

We conducted this survey with 600 men and women of different generations. Indeed, the questionnaire is intended for teenagers (12-19 years), youth (20-27 years), young adults (28-35 years) and adults (over 35 years).

Assessment of the level of mass customisation

In order to assess the level of mass customisation, we will propose a method to evaluate the following two variables: the level of mass production and the level of co-design experience.

Assessment of mass production level

In order to assess the production's process of the customized textile product, we propose to classify the mass production level into the following three main types:

- First Level, 100% completely mass production when we have all process in series.
- Second level, middle mass production level when we have production process including some customized tasks.

- Third Level, low mass production level when production process with several customized tasks.

So the level of mass production decreases as the number of customized operations increases. We propose a scale (figure 2) ranging from 0 to 1, which shows the level of mass production (I PM) as follows:

- If the mode of production in series, with several custom tasks, so I PM tends to 0
- If the mode of production is in series, including some custom tasks so I PM tends to 0.5
- If the mode of production is completely in series, so I PM = 1.

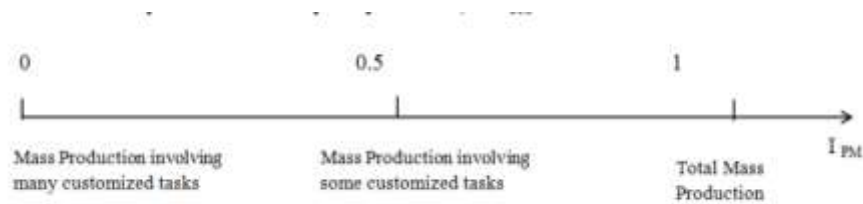


Figure 2. Scale of mass production level in a mass customisation experience

Assessment of the level of co-design experience

The co-design experience depends on the customisations options defined by the company. These customisation options vary depending on the product and customisation means (online customisation or manual). Therefore, we propose below a conceptual map (figure 3), which defines possible customisation options in apparel and textile industries.

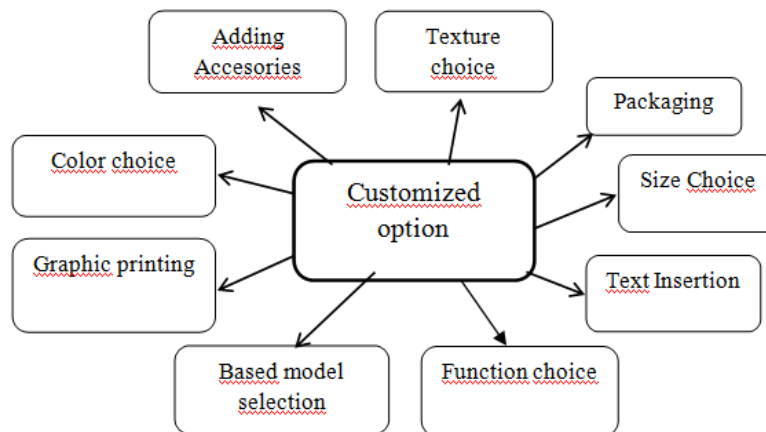


Figure 3: Conceptual map with diverse customisation options

To assess the level of co-design experience we can propose a scale ($I_{co-design}$) according to the number of customisation options (figure 4).

- If the customisation options are limited, so $I_{co-design}$ tends to 0

- If the customisation options are diverse, so $I_{co-design}$ tends to 1

Therefore, if the number of customisation options increases, the level of co-design experience also increases.

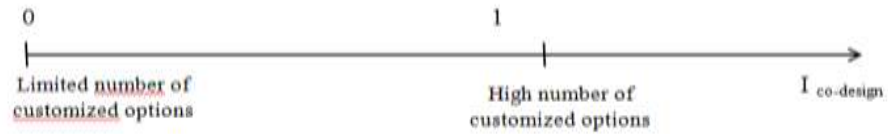


Figure 4. Scale of Level of co-design experience

Assessment of the level of mass customisation

Having defined a scale of the mass production level and an assessment of the level of co-design experience, we then deduce an overview of the level of mass customisation, shown in the figure 5, combining the two following variables: the level of co-design experience (x-axis) and the level of mass production (y-axis).

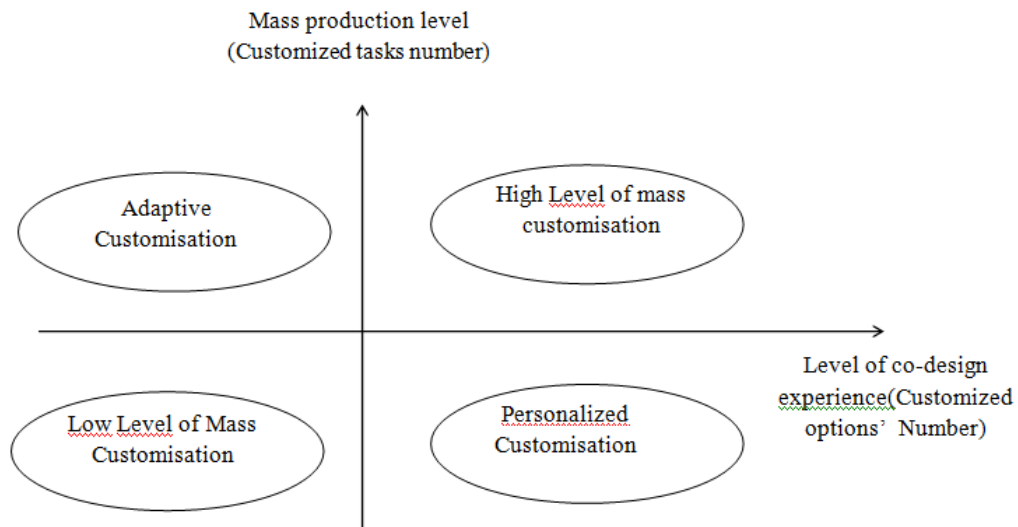


Figure 5. The level of mass customisation

From the figure 5, we can define different situation of mass customisation according to the level of mass production and the level of co-design experience.

First we start with the first case: When the level of co-design experience increases and the level of mass production decrease, in this case we talk about personalized customisation. Indeed, increased customisation options, such as inserting images and texts, mass production level is low and product cost increases consequently.

For the adaptive customisation, the situation is achieved when the level of mass production increases and the number of customisation options decreases. In this situation, the co-design experience is limited by the combination of the various components of the product.

The third case, we see a customisation that tends towards a high level. Thus, in order to converge to a high level of mass customisation we need to increase both the level of mass production and the level of co-design experience.

The last case is observed when mass production and co-design experience levels are low, so we cannot talk about mass customisation.

The increase in the production level mass is achievable through the restriction custom tasks performed, in order to benefit fully from a production series. Thus, the increase in the level of co-design experience translates into increased customisation options

However, and in order to satisfy a wide social spectrum, we propose to combine the internet customisation, the choice we offer several customisation options with manual customisation. In this approach, we propose to divide the co-design experience into two parts: the first part is the one with mass production, hence the choice of color, texture, functions and design will made by Web site. The second part, with customized tasks, we propose to set them manually by providing the necessary tools to perform these tasks (product kit).

RESULTS AND DISCUSSION

Questionnaire analyses

At the beginning of the questionnaire, we asked respondents if they prefer to buy standard or customized products. We have learned from this survey that at teenagers, 82% voted for customized products. In terms of youth, young adults and adults, 92% on average are for customized products (Figure 6).

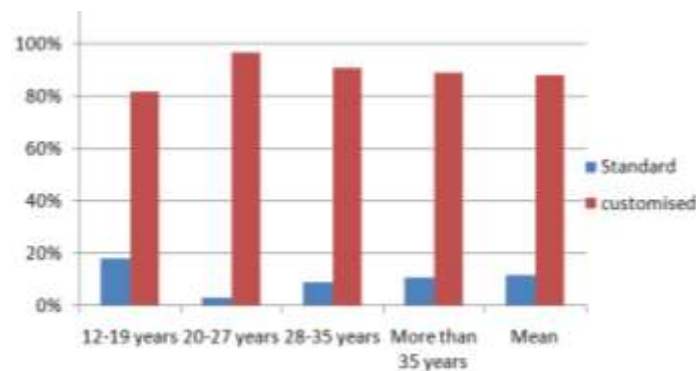


Figure 6. Question 1: Do you prefer buying products that are: customized or standard.

Then we asked whether they have made changes to a standard product purchased; 55% of teenagers responded negatively. In terms of youth, young adults and adults, 89% on average have made changes to their standard products (Figure 7).

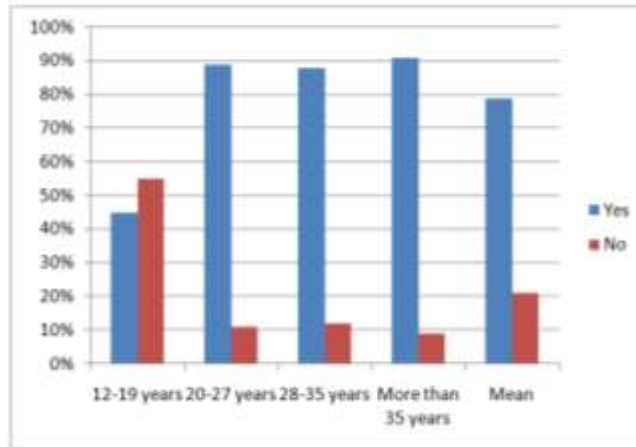


Figure 7. Question 2: Did you perform an operation on a standard product acquired by adding or eliminating elements that are part of this product?

Subsequently, we asked respondents if they agree on the added value to a customized product. The majority, 97% responded positively (figure 8).

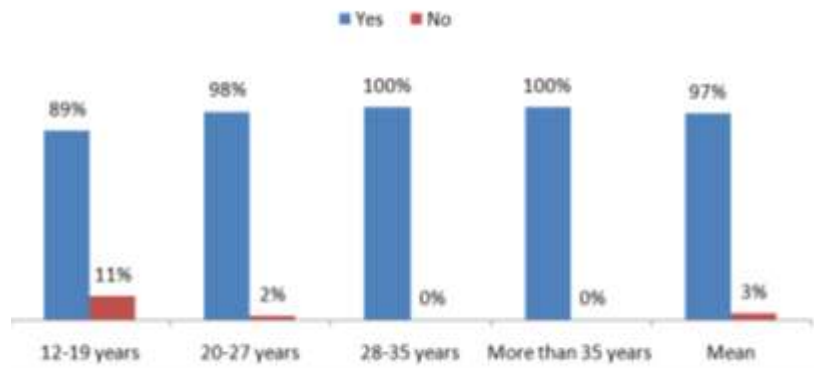


Figure 8. Question 3 : Do you think mass customisation offers significant added value to the product?

The survey shows that 47% of respondents give value to the co-design experience, 43% of respondents give value to the differentiation from others, against 10% of respondents give value to the mass production of customized product. We note that adolescents attach more value to the differentiation over other with a percentage of 87% (Figure 9).

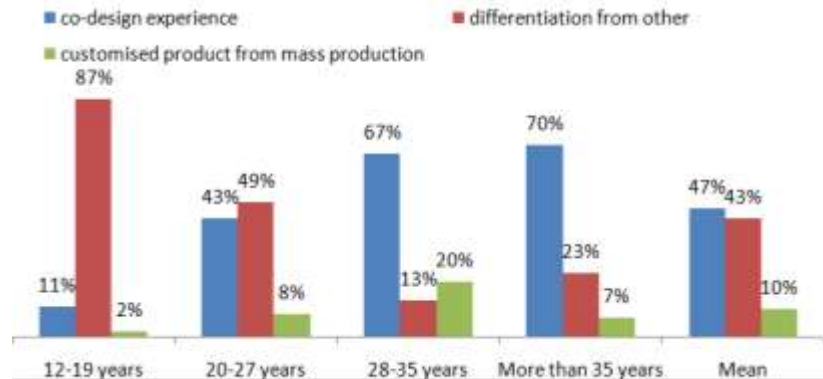


Figure 9. Question 4 : What is the perceived value of mass customization that you find most important

At the end of the questionnaire, we asked consumers about mass customisation approach to better live the co-design experience. This led us to the result that 79% of teenagers vote for customisation via online website. As against 85% of young people, 75% of young adults and 93% of adults are voting for manual at home customization (figure 10).

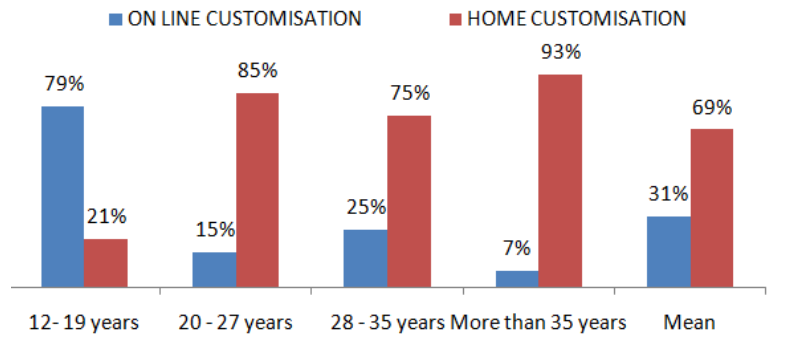


Figure 10. Question 5 : What is the mass customisation approach that gives the best co-design experience ?

We deduct following the survey according to age group, the following results:

- First age category of 12-19 years

This group prefers standard products and does not provide added value to customized products. For this age group the advantage of mass customisation is to differentiate from the others. Therefore, the majority of adolescents do not give importance to co-design experience and prefer as a means of customisation, customisation via online website.

- Second age category: 20 years and more

We grouped the three last age categories because of the big similarities between them; these consumers, prefer customized products to experience the co-design experience. Even if they have not experienced the mass customisation experience, these consumers make their own changes to their standard products. The preferred customisation means by this category is the manual customisation done at home.

According to the results of the previous questionnaire, we need to more inform consumers about the importance of mass customisation concept for more distinction and customisation.

In order to satisfy a wide social spectrum, we propose to combine the internet with customisation (interesting choice particularly adolescents), the choice offers several customisation options with manual customisation. In this approach, we propose to divide the co-design experience into two parts: the first part is that which has mass production, hence the choice of color, texture, function and design will be made by website. The second part, presenting customized tasks, we propose to set them manually by providing the necessary tools to perform these tasks.

Design of mass customisation zone

The result of the modeling of mass customization concept is used to conceive a mass customisation level zone to inform the consumer of mass customisation level of each product.

We can define four "mass-customisation zones" as follows:

1. An " Adaptive Customisation zone ", this zone is defined by a Level of co-design experience less than 0.5 and an Mass production level greater than 0.5.
2. " Personalized Customisation zone ", this zone is defined by a Level of co-design experience greater than 0.5 and Mass production level lower than 0.5.
3. " High performance mass customisation zone" this zone is defined by Level of co-design experience and Mass production level superior to 0.5.
4. " Low Mass Customisation zone" is defined by Level of co-design experience and Mass production level below 0.5.

These four "mass customisation zones" are shown in the figure 11.

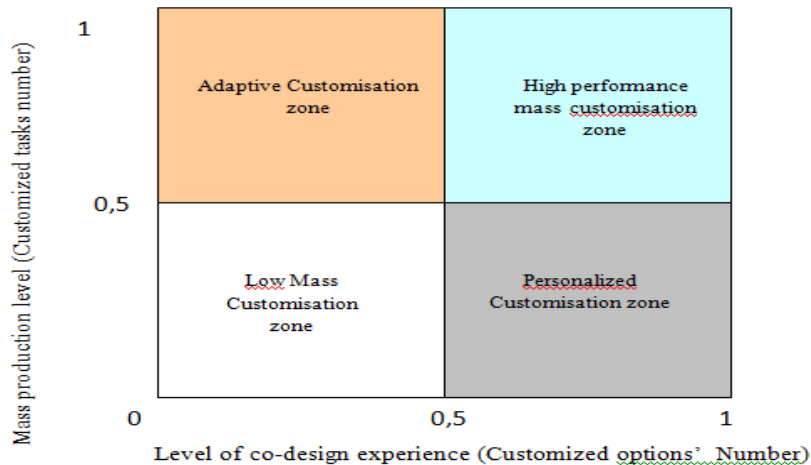


Figure 11. Designed Mass customisation zones

Thus, this method is based on the diagrams of the "mass customisation zone" is used to graphically represent the mass customisation level taking into account the co-design experience level and the mass production level. So we can classify each product in the corresponding mass-customisation zone according to the level of co-design experience and the mass production level.

Then, we propose to decompose the product of elementary modules resulting in different designs. The advantage of this decomposition process is beneficial both for the company and the customer.

CONCLUSION

There are new designs coming up every day in apparel and textile industries. Therefore, those industries actors had to have a flexible manufacturing system which will take care of these parameters such as mass customisation.

The demands of the co-design experience as well as the mass customization process vary from one customer to another. We noted from the survey conducted that adolescents show a different attitude compared to other age groups. Therefore, market segmentation by age is required to develop the business side of a customized product.

We propose to decompose the product of elementary modules resulting in different designs. The advantage of this decomposition operation is beneficial for both the company and the customer. Indeed, on one hand it allows the company to get rid of some manufacturing phases such as assemblies of various components of the product. On the other side and parallel to this idea, the customer will feel in this option, both freer and more creative: First freer choosing himself and preference assembly that suits him.

We believe that despite huge potential of the mass customisation strategy to enhance a firm's competitiveness, the research on the subject much remains to be done.

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