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Innovative approaches on modular apparel design

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Abstract

Within the globalized environment, the competitiveness,which expresses the talents needed for the sustainability of long term financial growth, has a crucial role affected by innovation and makes significant contributions to the development. One of the innovative methods used by enterprises to remain ahead of the game of competitiveness is mass customization(MC). MC is to change,assembleor modification of components of a product or a service according to the desires and needs of the customer. This study aims to determine how to meet the changing desires and demands of clothes with the modularity method of MC.With this respect,common modules which can be applied on different skirts and enables the changes on size&model had been designed,the specialities which models should have were determined and studies on the assembly phase had been performed.This study which was completed with the experimental design method,is important on offering new experiences to the consumers with spare modules applicable to existing clothes and meeting the demand on new products by avoiding the usage of sources on production phase.

Keywords: Mass customization, fashion, innovation, modularity, apparel design

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1. Introduction

It is clear that 21st century brought economic, political, technological, environmental, social and cultural changes to our lives. The changes in question are based on a phenomenon called "globalization". Although the word "global" has a history of 400 years, the term "globalization" started being used in 1960's. And the usage of the term became frequent after 1980's (Icli, 2001,). For instance, State Planning Organization (1991) defines globalization as follow: "Dissemination and development of economic, political and social relations between countries, settlement of ideological conflicts, more welcoming approach to different cultures, beliefs and expectations and move of local experiences to an international level by exceeding the borders" (Quoted by: Karabıcak, 2002). However, it is hard to say that all organizations and researches have similar approaches. Some defend that globalization is a fancy cover of the efforts of international capital and power groups, to occupy the globe in a broader and extensive way, and name it as "new colonization"(Akdemir, 2004).

As a result of globalization, with the increasing competitive environment, enterprises had to face with fast capital movements, swift changes in trade legislations and shortage of product life tendencies. Current situation makes harder for enterprises to compete and survive (Quoted by: Tagraf, 2002). On the other hand with global competitiveness developing technology, changing business environment and difficulty to satisfy consumers put more pressure to the enterprises (Coruh, 2010).

Competitiveness, the term which identifies the skills to enable sustainable economic growth in an international environment, has a role affected by innovation and contributes to development (Isık, Kılınc, 2012). Entrepreneurs can only increase their productivity with innovation and by responding the demands of the market, so that economies can enable the sustainable development (Fan, Li, Zeng, Dong & Peng, 2009).

Innovation, which became a common term in recent years and on which many scientific research have been carried out, means "Usage of new methods in social, cultural and administrative environments" and sourced from the Latin Word "innovatus" (Elci, 2007). On the other hand Schumpeter is the first economist who linked innovation with entrepreneurship and mentioned that innovation is the source of the private sector profits and comes up with economic growth (Unlukaplan, 2009).

Turkish Innovation Development Association defines innovation as; facilitation of the flow of needed information and technologies between people, enterprises and institutions to transfer ideas to products, processes or services in order to make a difference or add an economical value (TTGV, 2013). According to European Union and OECD, as a process innovation is "transfer of an idea to a marketable product, service, new or developed production or dissemination management or a new social service management." (Korkmaz, 2004).

Talking on innovation, first thing comes to mind is a technological discovery or invention. Although this stereotyped thought is partly true, it doesn't reflect the reality. Discoveries are the tools to achieve innovation. The main importance lies behind on doing something with an economic return which have not been done before or differentiate what already exists (Elci, 2007). In order to do that, it is possible to use technology; but technology cannot be seen as the only way to achieve economic success. It is also an important promotion policy to offer different experiences to consumers and make them put more value on the products they are using.

In recent years, mass customization became one of the most frequently used, consumer focused and innovative promotion policy. It is described by Piller as "alterations in the product or service features in accordance with the demands and needs of the customer" (Piller, 2007). Although it involves two opponent phenomena; mass production and individualism, the mass customization is based on protection of the mass productions low costs, while responding the demands and expectations of the customers. Mass customization was first coined by Stan Davis in Future Perfect (1987) and later developed by Pine (1993), which embarks a paradigm shift for the enterprise that offers products and services best fitting to individual customer's needs while still keeping near-mass production efficiency (Tseng & Jiao, 2001).

Many methods had been developed to classify the mass customization such as; Lampel&Mintzberg (1996), Gilmore & Pine (1997), Amaro etc.(1999), Duray etc. (2000), Alford etc. (2000), MacCarthy (2004). Although they appear under different names, all the works of the researchers above shows that the modularity is an important mass customization method.

Modularity concept emerged in the 1960's within the computer industrial sector, bringing considerable competitive advantages and benefits. Since this period, modular approach has been applied in many industrial sectors, such as automotive, electronics, furniture and others (Corrêa, Kubota & Miguel, 2012). Ulrich and Eppinger define the product architecture modularity as: utilization of "chunks" (main building blocks or modules) with well-defined few interactions among themselves and with inclusion of "one or few" functional elements in each of them (Quoted by: Can, 2008). And according to Yulugkural (2008) modularity is the term which makes "mass" meaningful within the concept of mass customization.

In order to understand the modularity, it is essential to examine the term module. A module is a component or group of components that can be removed from the product non-destructively as a unit, which provides a unique basic function necessary for the product to operate as desired (Allen & Carlson, 1998).

Marshall, Leaney and Botterell(1998) proposed four characteristics for the modules:

- Modules are cooperative subsystems that form a product, manufacturing system, business, etc.
- Modules have their main functional interactions within rather than between modules.
- Modules have one or more well-defined functions that can be tested in isolation from the system.
- Modules are independent and self-contained and may be combined and configured with similar units to achieve a different overall outcome.

Pine, offers six methods to modularize a product. These are "component sharing modularity", " component swapping modularity", "cut-to-fit modularity", "bus modularity", "sectional modularity" and "mix modularity" (Bardakci, 2004). Modular systems available in Pine's categorization are described and illustrated, as follows;

Component Sharing Modularity: This is the production type in which the same component can be used in more than one product. Different products are designed with the same shape and volume necessary to accommodate the shared component. Example: Battery, cassette, CD-ROM, Disc, etc.

Figure 1. Component Sharing Modularity

Component Swapping Modularity: In this method, components are assembled in order to complete a product. The number of different products which can be made is as much as the number of components those are being used. Selling children's books, Create-A-Book Enterprise stores the books in an electronic environment and restructures the story in the book with the customer's info (name, surname, date of birth, etc.) and then prints and binds the customized copy and delivers it to the customer. Here, the variable component is the personal information of the customer.

Figure 2. Component swapping modularity

Cut-to-Fit Modularity: This method is based on the idea of styling the component with the desired size before its assembly to the other component. It allows for minimal processing before the use of the product according to varying needs. Example: customized eyeglass temples, etc.

Figure 3. Cut to fit modularity

Bus Modularity: This is a modular structure which involves a fixed base and modular components to be installed to this base in combinations. Stage lighting equipment which allows different number and type of luminaires to be mounted on are among the examples of this system.

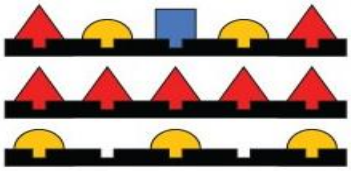

Figure 4. Bus modularity

Sectional Modularity: This system provides products for different purposes with combinations of similar or the same components. Example: Lego® products, picket fences and sectional sofas, etc.

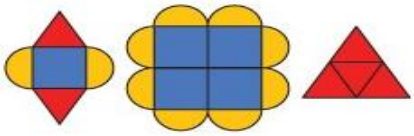

Figure 5.Sectional modularity

Mix Modularity: Allows for a mixture of different modules. The products takes the shape of the final product attached and all the attachments may lose their form. Decorative paints which allow the consumer to find the right color by blending a number of colors is one of the best examples of this approach

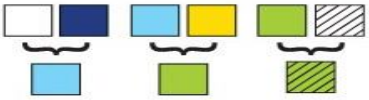

Figure 6. Mix modularity

We are more frequently facing with modular structured mass customization usage in fashion sector in recent years. Many brands who have global serial production such as Nike ID, Adidas, Levi's, Brook Brothers, Burberry, Longchamp, Converse, Vans, Pull & Bear and Bershka are releasing modular designs to the market. Another speciality of the modular production designs which offers different experiences to the user and closest result to their requests is to obtain the products which highly complies with the user. Pine (1993) stated that customization in clothing industry will make a difference and as a reason for this offered the fact that body sizes change irregularly among individuals. Bulgun and Yesilpinar explored the clothing types and cloth sections which proved most problematic for Turkish women of ages between 25 and 55, and reported that only 9.2% of the participants did not experiencing size/fit problems while the remaining majority of 90.8% did (Quoted by Vuruskan, 2010).

With this regard, in the study of innovative fashion products were developed by using modularity as one of the methods of mass customization which is able to respond different demands and expectation of each user. Size differences between individuals being an important parameter for customization and the size problems in ready to wear products that consumers face with are two main reasons of the determination of the research topic. On the other hand, the continuous increase to the mass customization products leads the assimilation of the results of the research by the consumers.

According to the reasons mentioned above and the research work examined, it is expected that the customization processes related to the sizes in the clothes will contribute to the solution of consumers' compatibility problems. With this respect, taking into account Pine's (1993) "the existence of a parameter for clothing products which is varied depending on the body size along with components such as color and form which are also available in other industries as a distinctive feature" argument, in the research experimental studies were made on modular skirt designs, which can transfer into new models and sizes of which are capable of being enlarged and tightened.

1. Objective

General aim of the research is to design skirts of which size and model can be changed by using modules. With this respect, the specialities of the module which enables the change of size and model were determined, models were designed in accordance with developed module and materials, methods were specified which assemble module with different skirt models used as main part.

- What are the technical requirements of the common module which can be used in clothes that have different model specialities and that allow size and model change?
- What are the technical and methodical specialities of skirts that would be embedded with the module?
- How should the usage the size and body shape differences in the module be?

2. Method

In this research, skirt was chosen as a sample clothing for the experiments on clothes that are transferable to different sizes and models. Experimental Development method was used while designing the skirt model. OECD describes experimental Development in "Frascati Manual, Proposed Standard Practice for Surveys on Research and Experimental Development" (2002) as follow; "Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed."

With this respect, as a first step, the proportion of measure differences researched in order to design different skirt models of which sizes and models can be changed by using common module. The specialities of module were determined. In size changes, the sample was implemented by taking into consideration the esthetical concerns and ergonomic factors in one bigger and smaller sizes. The skirt models were designed according to the results and technical analysis were made for each model. Between the skirt models, 5 skirt designs were chosen in parallel with the aim of the research. As a second step, experiments were made in order to determine the most suitable technique, method and materials to assemble the middle module and zipper was chosen as the most suitable material. As the last step technical and detailed drawings were made and model analyses were reported.

3. Findings

It is expected that the findings of the research respond the questions mentioned in the objective part. With this respect, studies show that according to the technical necessities of the module;

- Common model which would be used to change size and model, should have the specialities to be use them both the front and back skirt,
- Non-cursor zip gear should be used in the right and left side of the module in order to assemble the module with the main skirt.
- It is determined that cups which passes through waist and hips should be placed in the design and the area which settled between the cups should be used as the common module area.

According to the technical specialities of the skirts which are planned to be assembled with the module;

- Designed skirt models should be in the same length,
- The skirts which would be used as the main part should be worked in 40 size,
- Zipline cursor should be placed in the area where main skirt assembles wit hmodule,

According to the usage of the proportion differences in the module:

The module which enables the size changes should be prepared by taking intoaccount the proportion differences between sizes. Researches were mad etodetermine the proportion differences between sizes. According to the results of the researches made by TS EN (2006), İTKİB (2006), Muller, Shon (1997) and Cooklin (1990) the proportion differences between successive size is 4 cm. With this regard;

- Proportion differences between sizes should be divided equally in right and left side of the back and front module.

According to the decision taken, the skirts of which size and model can be changed by using common module were designed and technical drawings, module analysis and alternative usage visuals of modules assembly to different skirt modules of 5 chosen designs were reported.

3.1. Model Developments:

Model 1: In design, module assembled in front and back of A-line skirt with pockets, and pileuschacet. On the other hand principles and results of a possible other modules assembly was also shown.

Figure 7.Technical and detailed drawings for model 1

Model 2**:** In this design, assembly analysis of a module which enables change were proposed for a draped pencil skirt. On the other hand another implementations image with different texture module was shown.

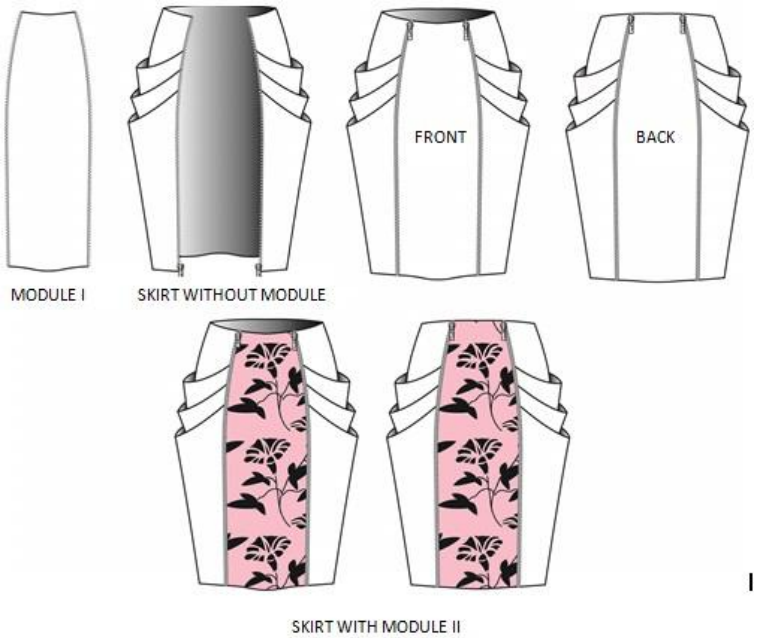

Figure 8.Technical and detailed drawings for model 2

Model 3: In design, assembly principles and implementation of an a-line skirt made with two different fabrics were shown.

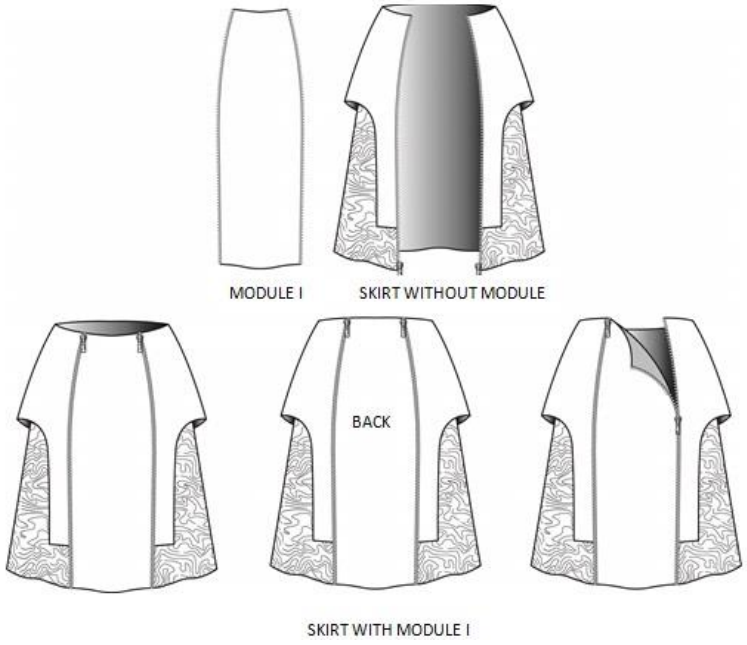

Figure 9.

Model 4: The design which assembles front and back skirt with a band passes under hips, the principles of a module assembly to a skirt which has different touching fabrics.

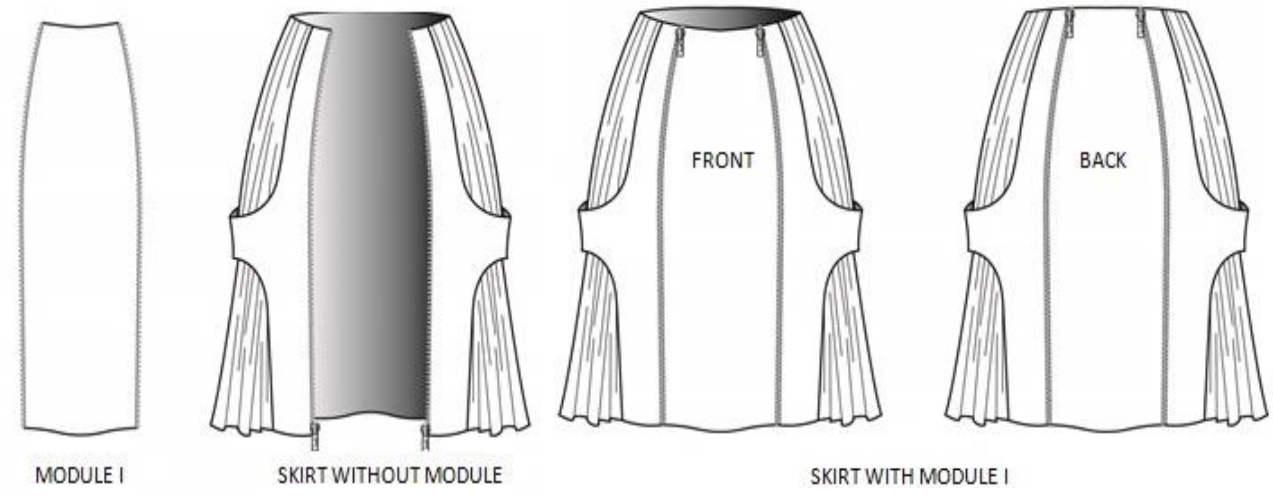

Figure 10.Technical and detailed drawings for model 4

Model 5: In this design, the implementation of a module assembly of a skirt model which has cuts in bodice area was shown from front and back.

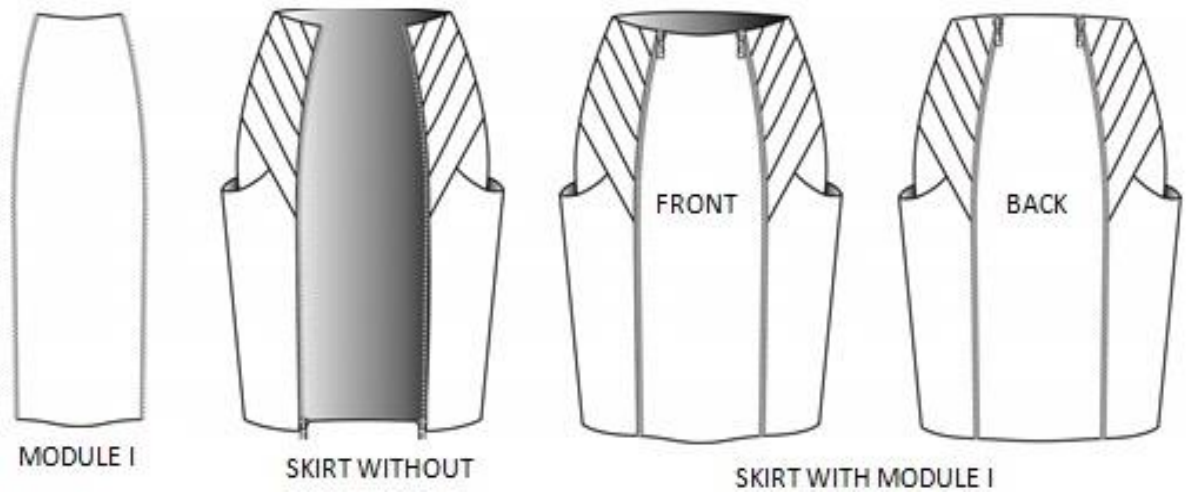

Figure 11.Technical and detailed drawings for model 5

4. Result

The relation between the fashion which is completely based on novelty and variations and the innovation arises from the nature of the first. Sorger and Udale expressed the openness of the fashion to the novelties in an expressive way in their book called Fundamentals of Fashion Design (2013) as follows: “Designers are like magpies, always on the lookout for something to use or steal! Fashion moves incredibly fast compared to other creative industries and it can feel like there is constant pressure reinvent the wheel each season.”

Astonishing results are appearing when swift changes which beneath under fashions nature unifies with competitive environment in global market. Achieving success, turning opportunities to gains, overcoming the difficulties in such an open environment to destructive results can only be made by realization of innovative ideas. Like in the past, today designers and brands who are capable of complying to the demands of clients, facilitate their lives, create differences with innovative ideas will leave marks to the future.

With this respect, in the research, innovative fashion products were developed by using modularity as being one of the methods of mass customization which has the capability to respond each users different request and expectations. The topic was chosen as a result of the consumer problems on the mismatch of the ready to wear products and sizes. On the other hand the growing interest in customized mass products open the way for consumers to internalize the results of the research.

Results and recommendations were summarized below;

- The module which enables main size to reach a larger or smaller size was reported to adopt technically and visualy to models.
- Module, with its visual and technical adaptation specialities, can be produced in different color, pattern and model and assembled to the main skirt. With this implementation skirts will not only fit more than one size, but also transform into many other models according to consumers changing desire and needs.
- Designs have the capability to stop the production of one-size one-skirt. With this respect it is expected that the sources used to produce different sizes will be limited and this can have a significant contribution to the sustainability of sources. This will also enable the decrease of the necessary stock storages of retail stores.
- Designs which give the opportunity to have different models with one clothe will strengthen the link between the product and consumer and prolong the usage duration of the product.
- Existence of fashion products which can be shaped by consumer preferences will increase the number of the consumers who are able to express themselves with different clothes.
- Consumers' attachment to brands and designers who are capable to offer experiences with various services and products will increase. This situation will contribute to brands and designers who want to increase their competitiveness.

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