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MASS CUSTOMIZATION AS A COMPETITIVE STRATEGY FOR LABOUR INTENSIVE INDUSTRIES

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Abstract:
The concept of personalization and mass customization is becoming one of the key issues in the operations management theory and practice. Customers require an elevated variety of product choice while maintaining the sales price favorable. Therefore, manufacturers need to develop technologies and systems to deliver goods and services that meet individual customers' needs with low or even no price premiums charged. Slovenian highly labour intensive industries such as footwear and textile are facing difficulties of relatively high labour cost compared to other new EU member states which makes these industries less competitive not only in comparison to the Southeast Asia but also to their EU competitors. This paper investigates the application of mass customization in the footwear industry and outlines the development and implementation of this concept by a Slovenian footwear manufacturer.

Key Words: Mass Customization, Footwear Industry, Operations Management, Manufacturing, Product and Process Development, Innovation

1. INTRODUCTION

Traditionally, the objective of individualizing goods and services is to attain increased revenue by the ability to charge premium prices derived from the added value of a solution meeting the specific needs of a customer [1]. However, the present competitive situation is changing because buyers demand relatively high standards of quality, service, variety or functionality even when the sales price is favourable or, vice versa, suppliers have to meet additional requirements in pricing when a product is marketed differentiated [2].

This is where the concept of mass customization takes place. Mass customization can be defined as "the technologies and systems to deliver goods and services that meet individual customers' needs with near mass production efficiency" [3]. This definition implies that the goal is to detect customers' needs first and then to fulfil these needs with efficiency that almost equals that of mass production. Often this definition is supplemented by the requirement that the individualized goods do not carry the price premiums connected traditionally with (craft) customization [4].

Stan Davis, who coined the phrase in 1987, refers to mass customization when »the same large number of customers can be reached as in mass markets of the industrial economy, and simultaneously they can be treated individually as in the customized markets of pre-industrial economies« [5].

Mass customization goal is that of developing, producing, marketing and delivering affordable goods and services with enough variety and customization that nearly everyone finds exactly what s/he wants. Accordingly, the successful pursuit of mass customization requires three essential conditions [6]. A company seeking to achieve mass customization has to be able to understand what the idiosyncratic needs of its customers are. Second, it must be able to offer to its customers what they want, ideally without cost, time, or quality penalties. And third, the company must be able to support each customer in identifying his or her own solution while minimizing the choice complexity for the customer.

The application of mass customization is based on several approaches. One of the most commonly used is form postponement. Form postponement means deferring the time at which the products assume their unique identities along the manufacturing and distribution

process of a product family. Thus, it requires one or more activities specializing the work-in-progress into specific end-items (e.g., painting a car in different colours) be deferred at a later point along the manufacturing and distribution process [6]. Three different types of form postponement can be distinguished based on the relative timing of the product differentiation activity and customer order entry or product delivery. Here we present a case of transition of production system from »To forecast" to »To order«, i.e. transition of a product differentiation activity initially performed in advance of customer order to its performance upon receipt of the order.

This paper investigates the application of mass customization in the footwear industry. A systematic in depth treatment of the peculiarities of the application of this business model and manufacturing paradigm to a footwear industry was EUROShoE (Extended User Oriented Shoe Enterprise) research project [7]. Among the business models they have studied, we can find an introduction to the case of Alpina, a Slovenian footwear producer. Herewith, we present an extensive case study [8, 9]. Alpina in 2003 has introduced a novel concept of shoe design and manufacturing, offering the customer an elevated variety of product choice while maintaining the manufacturing process relatively unaltered by the application of the form postponement concept.

2. A NEED FOR MASS CUSTOMIZATION IN EUROPEAN FOOTWEAR INDUSTRY

Footwear manufacturing, even in the factories of 21st century, requires a lot of manual work, which makes shoemaking a typical labour-intensive activity and reduces the competitive advantage of high-cost traditional European shoe producing countries such as Italy, Spain and Portugal.

A widely adopted cost reduction strategy for European shoe companies to face the competition was to split their production processes into minor phases and to relocate the most labour-intensive phases to lower wage areas. With a further demand for lower prices, an increasing proportion of the processes as far as the entire manufacturing process was being subcontracted. According to the EUROShoE research, in 1989, Europe kept a 28 % share of world footwear production, while in 2003 it has fallen to as less as 6.7 %. On the other side, Asia (foremost China and India) takes 72.3 % of the world production with an average annual growth of 4.9 %. Thus, traditional shoe producing countries keep losing a relevant share of their production, and, at the same time, also their industrial history and their knowledge on both the product and its manufacturing process.

On the other side, as many other industries, footwear manufacturing is increasingly confronted with a progressive reduction in the size of production batches and a demand for minimizing delivery times. This results in a push towards diversification, mostly in terms of progressive repositioning in the upper segments of the market and in developing a capability of supplying higher and higher quality products [7]. However, since outsourcing of a large percentage of production abroad tends to be followed by reduction of quality levels, in this case delocalization and outsourcing has to be limited. Thus, the delocalization strategy, which had to be adopted to counterbalance the increasing price pressure from the low labour cost countries, does not prove to be adequate when other competitive assets, such as quality, service and flexibility become relevant [7].

What are the possible solutions for western producers to win back their market positions? It is reported that Chinese shoes are exported at an average price per pair of US$ 2.9, while at the largest EU producer (Italy) the price is higher by as much as 10 times (US$ 27.8) [9]. For western manufacturers, to keep this level of added value, the appropriate measures should include attention to individual consumer needs and product quality; innovation in design and materials; flexibility of response to market demands and provision of services rather than simply goods. Mass customization and product personalization involve most of these aspects and as such seem to be an appropriate response to the abovementioned dilemma.

The footwear available in today's markets can be divided into three major groups:

1. Standard footwear manufactured according to mass production concept;
2. Fully custom-fit footwear, also called orthopaedic footwear, or, in traditional terminology, "bespoke", which is manufactured to measure for every individual customer in a traditional craft production;
3. An intermediate way, exploiting opportunities of both the traditional and mass manufacturing.

Each of the three classes results in different fit and comfort of footwear, as well as its price. Orthopaedic footwear fits perfectly but also reaches prices by 100 % or more than mass produced footwear.

As regards the third one, which is most closely associated with the idea of mass customization, there are three possible vectors along which the customization of a shoe could proceed: style/aesthetics, fit/comfort and function/performance [7].

Fit and comfort have been identified as the most important criteria in the consumer's buying decision regarding shoes. As they build the key added value for consumers, they are considered as most important customization parameters. Other parameters, such as colour, material and, especially for women, heel customization are interesting but not vital for customization [10].

A problem of fit is increased by the fact that a foot is changing its shape with the time of the day, with the nature of daily activities and with aging of the person. Further, significant differences can be observed among nations; even within different regions of Europe, as well as among different professions (e.g. foresters normally wearing protective footwear develop different patterns of foot shape than urban people). All this offers a footwear manufacturer a wide area of opportunities for customization.

In relation to fit/comfort and function, the proper conditions for a development of customized footwear in traditional manufacturing began to emerge already some 15 to 20 years ago when the technological development of optical scanners for foot measurement brought commercially available technical solutions. Later on, in recent years, the direct interaction with customers (i.e. consumers; the term "customer" in footwear industry usually refers to retail chains, rather than the end users) via internet has opened further options of customization, in style and aesthetics.

Customization is possible at different levels [7]:

1. Style Customization - based on standard lasts and sizes consumers can choose style options (colours, fabrics, leather, accessories) within constraints set by the manufacturer. This can be offered as a separate market option or be included in other customization levels.
2. Best-Matched Fit "semibespoke"- the feet of each customer are examined (using foot scanners) and matched to an existing library of lasts, insoles and soles with a much higher granularity than in today's mass production systems.
3. Custom Fit - the feet of each customer are examined and his or her specific habits are analyzed and used to make an individual last, insole and sole. Additionally, some style customization may be possible.

The most promising target groups for customized footwear are comfort oriented customers, individualists, fashion oriented women, business men and younger people in general [10]. So, not surprisingly, two of most elaborated examples of style customization are Adidas (miAdidas) and Nike (NikeID). Based on standard lasts (and sizes) customers can choose options of the style (colours, fabrics, applications) within constraints set by the manufacturer. For a sport shoe model, the customers have the possibility to choose their own colour and material design. The interactive configuration process usually takes the following steps (Figure 1):

1. Selection of model and shoe size,
2. Selection of material and colours of the upper, lining and laces,
3. Possibility to add text, motto, flag or picture in various colours,
4. Confirmation and ordering of the model, upon which the product differentiation activities of the production process are carried out.

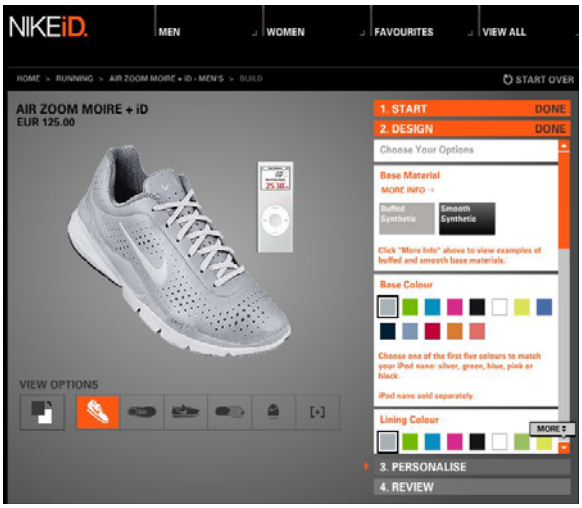

Figure 1: Step 2 of "NikeID" configuration process: choosing material and colour (source: www.nike.com).

An example of mass produced shoes but with an extensive selection of options is consisted of the companies offering standard models, but manufactured in different widths for customers having narrower and wider foot (with Clarks and Rockport as typical representatives). In traditional mass production, one width covers perfectly approximately 35 % of population; three widths reach about 70 %. Both Clarks in Rockport produce some shoe types in three or even five widths, covering perfectly almost any potential customer.

3. A CASE STUDY: ALPINA CUSTOMIZATION SYSTEM

Alpina d.d. is one of the major Slovenian shoe producers, manufacturing fashion shoes, cross-country boots and ski boots. It was funded in 1947 and has grown by now to € 65 million of yearly sales and approx. 1700 employees. It is located in Žiri, Slovenia, with further production plants in Bosnia and Herzegovina, Rumania and China. Alpina produces approx. 2 million pairs of shoes per year. In the field of fashion shoes this is an insignificant world market share, although, it actually sells most of this type of shoes. On the other hand, it is the leading manufacturer of cross-country boots with the world market share of approximately 35%. Several champions have won the Olympic Games and world championships using Alpina boots. The company plays a significant role also in the field of ski boots with the world market share of approximately 3%.

In the beginning of the decade, Alpina purchased an optical measuring device and started investigating differences in its customers' feet sizes in a systematic way. In 2003, the company launched its first collection of customized footwear.

The 3D scanner of the foot, yielding a three-dimensional outline of the client's foot after more than one hundred basic measurements, can find the best fitting boot for the left and right foot separately (Figures 2 and 3). Based on feet measurements, the company designed new lasts to which the internal boot shape is determined and the highest comfort is assured. Anatomically shaped lasts that differ in the width of toes and heel and in the instep height can fit to the actual shape of the human foot better than before. This is how they can achieve the best fit according to the length, width and height and furthermore, assure of a more comfortable and safer walk and exclude possible side effects of a shoe that is too broad or

too tight (e.g. blisters, difficulties to take off). The feedback information and new measurements are taken into account in further re-shaping of the lasts and designing new models.

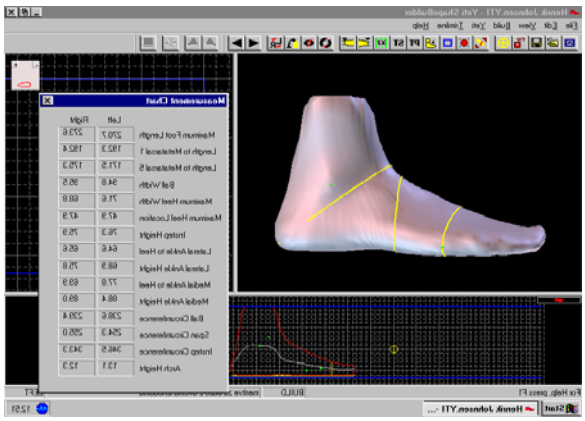

Figure 2: Information from foot scanner (source: Alpina).

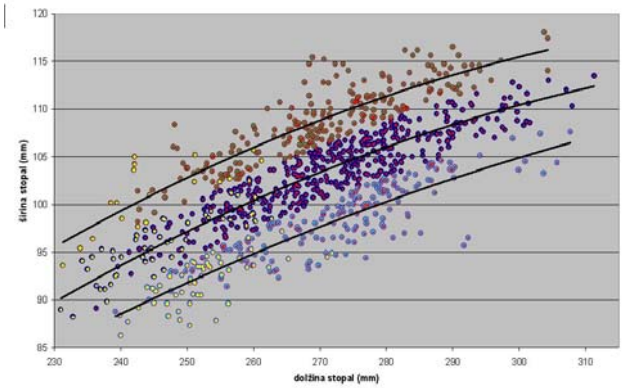

Figure 3: Relation foot length/width as acquired from a number of scans (source: Alpina).

However, based on the scans, a further conclusion was drawn; namely that one single shoe size fits only two thirds of customers. The remaining one third should wear two different sizes for left and right foot. Compared to the French scale (37, 38, 39 …) with the span between two sizes of 6.66 mm, the British scale (4, 4 ½, 5, 5 ½ …) span is even smaller. So, in this case, the number of customers constrained to opt between two sizes further increases. The differences in foot width are less present than in length, however, 16 % of customers are forced to make compromises.

A parallel market research has shown that as much as 84 % of customers consider shoe comfort as the first criterion when purchasing shoes.

Upon these data Alpina came to a decision of offering customized footwear, but with a slightly different approach regarding other companies with customized shoes in their sales program. For 6 different shoe models (2 fashion shoes, 2 trekking shoes and 2 ski boots), the sample shoe size was chosen and then graded up and down to the rest of “standard” sizes. Each size was added a wider and a narrower option. So, an assortment of three different widths was made.

Optical scanners have been set up in six major Alpina outlets in Slovenia. Before buying a pair of ACS (Alpina Customization System) shoes/boots, the measurements are taken to determine the length and width of the feet. The customer is then asked to enter a desired footwear type and software suggests him/her an optimal length and width. Afterwards, the customer is offered to try a model of the suggested pair. S/he usually tests the second closest pair as well, in spite of the fact that normally the suggested one proves to fit best.

Every shop has one pair of the entire assortment of ACS footwear on stock, so the customer can always test the selected pair. After his final decision, the sales personnel put an order to the central warehouse and the customer receives his pair in one week time.

A radical change in supply chain emerged with the application of form postponement concept. Up to now, the finished products (i.e. a packed pair of shoes) were manufactured to stock, on the basis of sales plans that often lack reliability. With the new batch of shoes, only semi-manufactures (i.e. individual shoes) are produced on the basis of the sales forecast. It is only after receiving the specification of the customer's order that the final assembly of such a left and right boot combination (length, width) that best fits the customer is done. The customer-tailored men's recreational ski boot X8 is the only boot in the world that is worked out in three different volume variants for one particular size.

As the customization in terms of different shoe widths leads to reduction of production batches, part standardization issues in the process of product design needed to be carefully considered. An overly dispersed production of small or even single-unit batches would rapidly increase manufacturing costs. Thus, Alpina focused on standardization of components used in manufacturing process. For trekking and fashion shoes, a decision was made to produce the upper part and the heel of the same size for every shoe width. Only the internal part and the sole are made separately for every width. Since some of the products chosen for ACS were previously available as standard mass production products, it was necessary to develop only a larger and a narrower boot size which is a comparatively rapid process given that boots are CAD-modelled (in fact, product modularity has been introduced, as another mass customization concept). A different approach to standardization has been chosen for ski boots. Here, a tooling for plastic moulding represents even a larger problem in terms of costs as in the case of trekking and fashion shoes. Thus, a standard boot is customized in width only by application of differently shaped foam inserts.

So, as regards additional costs that have emerged in customization, the highest cost sticks in the lasts, given that every width requires its own last. Since the shoe sole and internal part are produced individually for each width, additional tool development costs resulted here as well.

The production process has undergone a major change – the transition from »To forecast" to »To order«. If the basic unit of the finished product previously used to be a pair of shoes / boots packed in a box, now each shoe stands for one module. By combining these modules, an essentially wider range of products can be produced than to date. A further consequence of this reflection led Alpina managers to split the unique product code for a box of 2 shoes into 2 codes for each shoe separately.

To illustrate the increase in customer choice and the resulting increase of variety of semi-finished items on stock (i.e. single boots), let us look at a slightly simplified case. Let us disregard various volume variants in each particular size of the X8 ski-boot. So, the 11 different sizes remain, i.e. 22 different shoes in total. In the conventional way, these can be combined into 11 pairs. If we can combine two different sizes and presume that these two sizes may only differ by one size only (it is very rare that both feet differ more than one size), we get 20 additional combinations. So, by combining two sizes together, we can offer 31 combinations instead of 11. As the final assembly is completed to order, the volume of inventories has not changed. From the viewpoint of assembling the finished product, the procedure has remained unchanged (pairing the shoes and final packaging is done manually, as before), and so has the components manufacturing process. The production costs have remained roughly the same, but the range of products has tripled.

So, combining form postponement and product modularity enabled Alpina a considerable increase in product mix, however, without increasing stock level and keeping delivery times acceptable.

To sum up, footwear tailored to customer offers Alpina a number of advantages [8]. First, the customer can choose from several variants of boots/shoes that differ in the volume within one size and for the left and right foot separately. Thanks to optimal fitting, the comfort is increased and functional properties of the shoe are better utilized.

Second, the consumer becomes an active link in designing and selling of footwear. In traditional economic theories, consumers are “value destroyers”; they annihilate the “added value” that the company has put in the creation of the product by the act of purchasing and using it. When a traditional pair of shoes is sold to anonymous consumers, its life cycle, at least from the perspective of the manufacturing company, is over, and there are no more value returns to the company during the “use” phase of the product life. What mass customization returns to footwear companies is the direct contact with their final consumers [7]. Continual dialogue with the customer and computer-aided buying helps in designing the shapes, colour and size of the footwear. This information is used in the development of new products (e.g. due to anatomically-shaped interior, the shoe fit is further optimized).

Even if the customer does not decide to buy an ACS pair, he may print the scanned data or save his profile to be used for on-line purchase later. This enables the introduction of internet-based selling of shoes which traditionally faced obstacles concerning fit and comfort of shoes not previously tested and a high rate of products returned to shops by customers not being satisfied with their comfort.

Some negative effects have been perceived by the company after implementing a MC strategy. Selling two different shoe sizes may lead to incomplete pairs remaining on stock. Since footwear can quickly be overrun by fashion it is hard to replenish and sell incomplete pairs. Completion of such pairs requires additional time (sometimes also elevated costs because of small batches in production). In leather shoes, a further problem of incomplete pairs may occur. Every delivery of leather may have a slightly different cast, even every skin san be slightly different from another. As a consequence, it is hard or even impossible to make a pair if both shoes are of different casts. However, these negative effects are outweighed by the advantage ACS offers to its customers and the additional price they are willing to pay for it (30-40 % more in comparison to standardized products).

4. CONCLUSIONS

According to Alpina market research, their MC approach to shoe design, manufacturing and retail has only rarely been used in footwear industry before, while in the field of ski boots this is a world premiere and an opportunity for Alpina to find its market niche. Based on some years’ experience, the ACS is being upgraded in 2008. The assortment of shoes as well as the number of ACS outlets will be enlarged. Since the foot scanners available in the market were relatively expensive for general use, Alpina R&D department in collaboration with the Faculty of Mechanical Engineering in Ljubljana (experienced in optical measurements of human body) has developed a new low-cost foot scanner and software (the price sunk from €150.000 for the first scanner purchased by the company to €2-3000 for the recent model). The first aim is to put a scanner to every shop with an e-catalogue of the entire Alpina collection, not only of customized models. So a customer will be offered to scan his/her foot and the software will suggest which model will fit him/her best. This will not only minimize the complexity of the customer’s choice and assist the sales personnel but also generate valuable information for development of new collections. Beside that, a further option of making only two different width of each model and changing the inside volume of the shoe by changing of insock with different thickness is to be introduced, leading to further standardization of product components without renouncing the elevated customer choice.

The concept of mass customization has become one of the key issues in the operations management theory and practice in the recent years and footwear industry is one of the initiators of these changes in consumer goods sector. Through MC, the industry approaches the ideals of craft production expressed through modern industrial technology. Due to the rapid development of the concept, being a mass customizer in this sector is increasingly becoming not a competitive advantage, but a requirement for a company willing to keep its today’s market positions, at least for EU countries, which long ago have lost the battle in the segment of mass produced footwear. Alpina, as a traditional manufacturer in a traditional labour intensive industry located in a high labour cost country, has proven that even under such circumstances a proper approach to product and process development, investment in

technology and innovation competences as well as cooperation with external research institutions may lead to sustainable growth and development.

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