Executive Summary:

SERVIVE is an EU funded project within the 7th framework and intends to implement Mass Customisation throughout Europe on a wide and large scale. It is resident in the fashion and apparel industry and its main goals are:

- The enlargement of the assortment of customisable items currently on offer;

- The drastic enhancement of all co-design aspects (functionality and fun);

- The development and testing of a new production model based on decentralized networked SME cells.

Many research projects lack the transfer from "scientific research" to "making money in business". After three years, EU funded project SERVIVE now has to prove its promise to build a platform that connects Mass customization suppliers and vendors within the apparel industry. Logging into the SERVIVE community (http://community.servive.eu) offers a world of sites like amazon and facebook combined: Shop mass customized apparel from different suppliers, have your own profile and show your configured products to friends. Besides the fact that you are able to shop mass customized products instead of mass produced ones, you are also able to build up a virtual twin of yourself, have a look at the clothes you desire on your avatar and get advice from experts on your looks.

And what's in there for companies? Joining the SERVIVE portal enables you to address your offer to a huge interested crowd. Instead of developing your coding and every service by yourself, you can use already approved ones that customers know and appreciate. Especially for small and medium sized enterprises this is a chance to reach out to many potential customers and enables SMEs to concentrate on their key capabilities: what do we want to offer and how do we want to produce it? Cross-selling possibilities will raise the amount of purchased goods and a comfortable configuration process with a connected order and stock system smoothes the whole data flow.

The following report will firstly give an introduction into the objectives of the project, before describing the challenges the research was faced with. After pointing out how SERVIVE addressed the challenges step by step, we illustrate the highlights of the SERVIVE achievements. Ensuing we show who can benefit from the SERVIVE results, that are specified later on. Also the availability of our project results will be of topic. Last but not least we respond to the question, what impact in terms of state-of-the-art, societal and economic the results will have. The report will be closed by a short characterization of the whole consortium of partners.

Project Context and Objectives:

The overall project objective was to scale-up the amount of mass customization production systems as well as the amount of consumers using the phenomenon as possibility to shop. To serve both parties of the market, we developed a platform that perfectly connected both sides and fulfilled requirements of customers as well as suppliers. This platform makes it possible to spread the Mass Customization phenomenon out to wider Europe, using a professional system that is able to incorporate every new mass customizer very easily. This is especially of interest for small or medium sized enterprises as they can use the SERVIVE services and platform to reach a high number of potential customers. On the other side consumers are able to easily find and compare mass customized offerings and benefit from the SERVIVE services.

However, the aforementioned business framework can only be considered successful if:

- All target groups (consumers) are motivated to choose from and have easy access to the MC services and MC products offered in the foreseen business framework.

- All other value chain MC actors (retailers, manufacturers, material providers, service providers) are confronted with clear and strong gains from participating in the foreseen business framework.

- The community benefits are significant and can be quantified.

The goal of our business model is to provide trust, choice and service to both consumers and suppliers. While developing a realistic business model and exploitation plan, we therefore had two directions to follow:

1. What are the needs and requirements of a supplier?
2. What are the needs and requirements of a consumer?

Target Group

The target group has been derived by examining the mass customization landscape of the apparel industry. In order to do that, a matrix has been created, which shows the amount of companies already on the market, according to the type of apparel and customization options.

By taking the information gathered in the aforementioned matrix, three bullet points can be highlighted:

- Some product categories are overcrowded with me-too offerings (e.g. shirts), while others are hardly covered at all (e.g. jeans, knitwear).

- Especially clothing for women is not yet fully catered to. This applies in particular to the businesswear segment.

- Triple-play offerings, which combine form, fit and function are almost non-existent but provide huge opportunities to create sustainable value.

Taking these insights into consideration, the three most promising market niches targeted by the SERVIVE consortium are:

- Women's business wear

- Knitwear (male/female)

- Sportswear

Women's business wear offers a great opportunity, because it is still a white spot in the market. However, the vast experience from the men's segment regarding processes, such as sourcing, manufacturing and sales, can be transferred to the women's segment. This leaves the consortium with more scope for developing a service experience suited for women's special while shopping.

Knitwear on the other hand can be produced locally and on demand in micro factories. This provides the opportunity to offer an optimal degree of variety without jeopardizing profitability. Moreover, knitwear appeals to a very wide range of customers from almost every milieu. Therefore, customized knitwear can be used to disseminate the idea of mass customization to a wider public. Last but not least, a local production offers the opportunity to employ workpeople locally.

Regarding sportswear, a competitive advantage can be achieved by making full use of the customization range (from, fit and function). Whereas the concept of mass customization has an inherent focus on costs in most definitions, the SERVIVE consortium believes that differentiation is the key to create a sustainable competitive advantage.

Co-Design Framework

Another focus of the project was to create a Co-design framework. But for this idea to work, success factors have to be identified first. Crucial for the success of the SERVIVE portal are the factors service, choice and trust, which are important to both consumers and suppliers. Retailers, on the other hand, benefit from minimizing risks and costs, which occur because of acting as an intermediary between the two previous mentioned parties. However, previously retailers used about 80% of the buying budget to purchase garments from wholesalers, while saving some proportions of the budget for contingencies. In turn, the biggest share of clothing sold can be regarded as standard offers, which are less profitable. In order to encourage customers to purchase higher priced items, which do not belong to standard clothing, two considerations have to be kept in mind: On the one hand the store has to generate a healthy profit, but on the other hand this implies taking risks. This risk has to be compensated by mire commercial propositions. However, it is often not possible to re-order popular styles in time. In recent years lean production has countered this effect by offering quick response "drops", allowing for budgeting, which was oriented closer to the consumer's demand. This also reduces the amount of overstocks and mark-downs. The introduction of centralised ERP systems and intranets has also helped to move stock across chain stores, when a desired item is not available locally. While EPOS systems are sufficient for short-term solutions, the style advice interface is able to help retailers to note individualised demand, which is an opportunity to satisfy customers by offering fast deliveries.

Since services used online are becoming more integrated into people's lives, it is of interest to understand the benefits, which online communities can offer for both consumers and manufacturers. A strong potential for developing solutions in niche markets is provided by consumption related communities. There, consumers are driven by an urge to search for products or particular information. To those communities, personal control and convenience are driving factors. For companies to exploit such communities, in addition, entertainment and relationship management are important drivers for online consumption. From a well hosted communication environment, companies can reap benefits of good word-of-mouth. This facilitates the creation of groups, in which similar minded people gather. In turn, fashion is the result of a collective intelligence, which shapes norms, and a matter of collective behaviour. This can be used to draw clusters for the underlying recommendation algorithms. For example, the SERVIVE forums encourage its users to rate and discuss clothing, in order to create data for the style advisor.

Because of the aforementioned reasons, virtual society networking should be integrated into a company's marketing and digital framework. This will increase consumer confidence and is way more cost effective in terms of the relation between costs/effort and returns compared to other marketing activities. It can be even argued, that consumers, who are not offered virtual communities will leave and go elsewhere, because they lack the feeling of being valued and understood. Therefore, a virtual community can be seen as a competitive advantage, which will be of even greater importance in the future.

Production Framework

Another goal of the SERVIVE project is the introduction of a new approach of producing garments. To produce customized garments at near mass production efficiency, certain requirements must be met and the production processes have to be adjusted. Mass customization describes a strategy to offer customized products, while producing them at the efficiency of mass production. This approach implies for garments a make-to-order approach, meaning that the production can only begin after all specifications have been made. Those specifications include customer related preferences and characteristics, such as body proportions. Therefore, it is of advantage for companies to produce in close proximity to the customer instead of mass producing in Asia. Customers, who order a piece of clothing, do not want to wait two month till their desired product arrives. To exploit the potential of mass customization in the clothing industry, new production models have been developed, focusing on the coordination of configurable networks. Within these networks there are micro factories, which act as independent entities. Since micro factories are a completely new concept, the whole process chain has to be designed. For this the company UNICATUM has been chosen as a pilot, focusing on automatic knitting. However, the company UNICATUM had to file for bankruptcy, but it was replaced for demonstration purposes by the Institut Français du textile et de l'habillement (IFTH) and Nottingham Trent University (NTU). The goals which were tried to achieve using this new production concept are as follows:

A formal definition of the concept has to be offered regarding:

- Influence of the range of products;

- Range of customization options needed to offer a wide range of co-design options;

- Related production adaptability and flexibility;

- Effect of quality of products;

- Optimal production planning process;

- Requirements for cost efficient production.

To facilitate a mass production strategy, customers also have to get acquainted to this offer. Therefore, a tool has been developed, which helps customers cope with the paradox of choice, while being confronted with a wide range of possible customization options. This tool, the Intelligent Pattern Configurator (IPC) is an essential part of the SERVIVE control mechanisms. Within the Supply Network Infrastructure (SNI), web based services, such as the IPC, create customized block patterns. In a following step, together with CAD software, a final version of pattern is generated, which includes technical details like seam allowances. The data for this process will be integrated into other SERVIVE services and be available online. The interaction between those services enables companies to control the process of producing customized garments.

The reason for developing the IPC is to offer every actor in the network the opportunity to generate pattern blocks in an easy way. This includes personal body measurements, which are integrated within the customized pattern blocks. The main features offered by this service are:

- Achievement of good fit;

- Compatibility with different garment styles;

- Adaption to the target group;

- Data format compatibility;

- Compatibility with modern software.

Project Results:

1 The SERVIVE Challenge

As projects - and especially research projects - are always faced with challenges, this next chapter deals with these ones we had to consider. But we rather saw these challenges as opportunities to improve the achievements deduced from the aforementioned project objectives.

To boost the Mass Customization phenomenon within the fashion industry leads to challenges in two main domains: A market one with decisions that mainly affect the customer as well as a more company one that affects internal processes. Of course both parts are strongly interconnected. We split the following chapter into five parts that deal with:

- the strategic decision of the "right" business model,

- the development of an appropriate solution space,

- the therefore arising product configuration paradigm,

- connected with recommendation and help services for the customer,

- closing with the challenges arising by a micro factory production model.

1.1 Sustainable Business Model

Besides the choice of target groups (see chapter 1) and before deciding on product ranges, we had to think of the best distribution model regarding our ideas. Along with that we had to consider that most distribution models, which will be listed below, are linked to a specific business model.

- Manufacturer/supplier centric model: In this model the products of a single manufacturer/supplier are distributed in a closed system opposed to an open system, in which products and services of a group of manufacturers are distributed. However, this system is suited best to promote the products and services of a single manufacturer in the best possible way.

- Retailer/seller centric model: The distribution of mass customized products of many manufacturers or suppliers using retailers/sellers is the focus of this model. This model is suited best to present the assortment of a single retailer in the best possible way, because they can operate e-stores and physical outlets or a combination of both.

- Consumer centric model: The consumer centric model focuses on distributing the mass customized products directly to consumers. In this model products and services of many manufacturers are presented to the customer. Therefore, it is suited best to present the assortments of many manufacturers in the best possible way.

- "All inclusive" portal model: This model uses an "open system" approach, in which a standardized way is used in order to distribute mass customized assortments of many manufacturers. This approach offers both consumers and retailers access to the offered products and services.

The above mentioned business models lead to the following conclusions:

- The above mentioned models offer lots of variations to implement them. For example, home sales or "personal experts" can be used as a distribution channel.

- Depending on the product type, specific issues of each distribution model have to be taken into consideration

- The most suitable model for the SERVIVE project appears to be the "all inclusive" model, because products are manufactured, which enter all areas of the distribution chain. The integrated solution will offer the most benefit, because on this basis new value added services and other innovations can be developed.

- Companies already active in the industry can be individually supported by using some SERVIVE results.

Of course, the sustainability of the business models is of high importance. In order to stay competitive, enough income has to be generated to stay in business. Previous research investigated how income would be created using the necessary activities/services needed to produce and distribute the mass customized products. The result showed that the most appropriate way was to use a premium to the product price, which would either be hidden from the customer or made transparently. On the other hand, a transaction fee suits the "all inclusive" model as well. This can be done either per transaction or periodically, if companies exploit independent SERVIVE results. Since the SERVIVE project is coordinated like a network, the income should be treasured by a single entity, which allocates the money to each service provider.

1.2 Choice of Customization Options

Mass customization as strategy can be split into two dimensions: an internal one, concerning the complexity in fulfilment, sales and distribution and an external one, concerning the opportunity to profit from market heterogeneity. The internal dimension relates to the degree of variety, namely the solution space, which defines the number of options offered. The external dimension varies from partial customization, which involves the possibility to customize form, fit or function, to complete customization, which enables the customer to customize all three options.

The idea behind this separation is to highlight the idea to fulfil consumer needs perfectly. By customizing fit, form and function, every customer has the opportunity to get a product, which perfectly matches the preferences of a customer. However, the internal dimension alludes to the degree of variety per option. An increase in the degree of variety can results in a higher fit between need and fulfilment. In turn, the complexity of internal processes, such as sales and distribution, increases accordingly. Therefore, it has to be taken into consideration where to place a company in the mass customization profit matrix.

There are numerous ways to position a company but there are currently two white spots: on the one hand there are no companies that offer customization regarding all three options with a high degree of variety at the same time. On the other hand there is no company offering the same set of customization options with a very low degree of variety in order to reduce complexity. This means that the decision on the solution space of our products is a rather critical one with regard to the internal complexity of processes as well as the external dimension of offered customization options.

As it is SERVIVE's goal to create a template for new business entrants, which want to adopt to the mass customization strategy, the development of our business model is a crucial one also with regard to quantity and quality of offered custtomization options. The function of the blueprint is to act as guidance for adopting, implementing and accelerating business for new entrants in the field of mass customization in the fashion industry.

For the SERVIVE project to work, a critical mass has to be reached in order to guarantee sustainability and efficient use of production capacities. In order to achieve the main goals of SERVIVE, which are to realize a spanning and all inclusive mass customization eco system for the masses that leads to a high degree of market acceptance and market penetration resulting in large order volumes, some critical criteria have to be considered.

- It is a requirement that products are suitable for large order volumes and offer high market penetration. This must be applicable within a short timeframe. Therefore, products have been chosen, which are already past the research and development stage and have shown, that they are suitable for a mass customization environment. This implies that the products are already in an exploitation stage, which is still on a small scale, but offer potential for scaling up.

- The whole SERVIVE approach must fit to the product groups (meaning the mass customization eco system).

- Furthermore, the industry partners must support the selected products, which create for each product group extensive expertise both from market and a research perspective.

Following this and remembering the project objectives described in chapter 2, the product categories below have been chosen:

- Women's business and smart casual wear

- Women's sportswear

- Women's woven wear and knitwear for both

Using these types of products as a start, the project tries to offer guidance for companies, which want to embark into the field of mass customization, regardless of the type of fashion product. Therefore, the way, in which the customization options for the products are chosen, is documented as well as the range of options as these are challenges that every mass customization company is faced with at the very beginning - as well as again and again over time. In the following an exemplary list of products with their description of customization options is offered:

- Representing women's business and smart casual wear, there is a customised 3-piece suit with trousers made by the company Matteo Dosso. This type of product offer many possibilities for customization with a made-to-measure approach. Furthermore, buttons, linings and fabric can be chosen from a wide range of options for this product.

- Women's sportswear is represented by a customisable netball kit, which consists of either dresses of a skirt and top combination. Team Colours is the industry partner specialise in this type of products.

- Knitwear was supposed to be produced by UNICATUM, a company applying the micro-factory production concept, which had to file for bankruptcy. Since micro factories have the potential to boost the SERVIVE project, because of its high innovative potential, the tasks is taken on by IFTH and NTU.

With regard to the chosen business model another industry partner - CustoMax - was needed to integrate these companies into the SERVIVE Business Community - the overall goal of the project. CustoMax offers consultancy regarding development, implementation and exploitation of mass customization systems. In the course of the project, CustoMax supported relevant commercial, logistical and procurement aspects from a consumer perspective. Therefore, tools directly used for order creation and sales, such as sourcing, quoting and product configuration tools have been adopted from CustoMax.

In the following, we will exemplarily show certain difficulties in getting information on and implementing of the range of customization options of Matteo Dosso. A detailed description of the whole solution space of all manufacturing project partners would go beyond the scope of this report.

1.3 Product Configuration Paradigms

The different pilots of the SERVIVE project, namely UNICATUM, Matteo Dosso and Team Colours, offered different backgrounds and, therefore, needed different approaches to be implemented into the SERVIVE project. Hence, each pilot is suited well in order to focus on different aspects of the goals of the project. Whereas UNICATUM was mainly focused on implementing new production strategies, such as micro factories, Matteo Dosso's focus was to develop an appropriate solution space, which is described above. In the case of Team Colours, however, the challenge of scaling up SMEs to the field of mass customization is documented. This will be presented below.

1.3.1 Matteo Dosso pilot

Matteo Dosso GmbH & Co. KG is responsible for the target group ladies' wear, made-to-measure clothing and corporate fashion and its core business includes:

- Made-to-measure ladies' wear on mass customization principles

The assortment of Matteo Dosso offers a fashionable variety, which takes individual preferences of customers into account. Pieces of clothing available within the assortment are: skirts, trousers, jackets, waistcoats, overcoats, blouses and tops. The distribution channel of Matteo Dosso includes a range of different retailers, ranging from high-quality specialist's shops over large retailers to retailers with special alignments. As can be seen in the range of different retailers, the company does not sell directly to consumers.

- Corporate fashion on made-to-order and mix & match principles

To cover this range of products, Matteo Dosso offers individual business fashion collections, which aim at expressing the company philosophy of the customer. In this category two options are available to the customer: designing an own collection or choosing from a mix & match collection. This service is offered both to companies directly or to retailers.

The pieces of clothing available from Matteo Dosso are offered either using the Matteo Dosso brand or a private label. However, the company takes care of all necessary steps within the supply chain itself. This includes the creation of the design, procurement of materials, cutting and product and quality management. In addition, the company owns all rights regarding the designs and patterns.

During the pilot of the SERVIVE project a 3-piece-suit from the Matteo Dosso catalogue has been selected for demonstration purposes. This piece of clothing consists of a jacket, trousers and a skirt.

Taking the example chosen above, Matteo Dosso offers customization options stated below:

- More than 70 customization options to choose from for each product. This includes buttons, pockets, linings, stitching, embroidery etc. Regarding those options, there usually is a wide range of different colours and styles available.

- For fabrics, there is a base collection, consisting of about 300 high-quality fabrics from renowned weavers. However, customers can also choose fabrics, which are not in the base collection but are still offered by the weavers cooperating with Matteo Dosso. This leaves room for thousands of different fabrics.

- Measurement adjustments can be applied to the widest possible range to achieve a perfect fit.

- The list of customization options is updated continuously by Matteo Dosso each season.

In the following some of the customization options are described in a more detailed way, to offer insights on the company's product catalogue.

Matteo Dosso offers its products using the partnership with CustoMax, in order to reach the market both with products of their own or a private label. Retailers use a product configurator on the CustoMax Portal to configure a product with the help of the product catalogue of Matteo Dosso. This configurator offers real-time information on the availability of fabrics and prices for fabrics are shown in real-time as well depending on the region and client group. If a product is finally customized, Matteo Dosso receives the orders via XML-files and the information is processed automatically for Stock- and CAD-systems. Besides this way of receiving orders, it is also possible for the company to accept orders sent by fax, by email or files sent by a 3D body scanner via order software.

As an example, the customization options of the aforementioned 3-piece-suit will be listed in the Annex to offer insights on the complexity of the customization process.

Besides the customization options related to the design of the product, there is also a wide range of options available regarding the fit of a product, which is mandatory for made-to-measure products. For the exemplary 3-piece-suit the measurements required will also be listed in the annex. However, in order to gain all necessary information, a test piece is offered, on the basis of which all changes are carried out. Even if a 3D- scanner is used, a test piece is still necessary to take individual fit preferences of the customer into consideration. This difference between the body of the customer and the test piece is then indicated on the master pattern. Taken the measurements of the test piece and the posture assessment of the 3D scanner, small alterations can be made to include the fit preferences of the customer, however, the changes should not exceed a value of 0.1 to guarantee a decent fit.

Special note: the measurements mostly required are the ones indicating the difference between the test piece (or the master pattern) and real customer body measurements. Therefore, they are of a differential nature. The measurement and customization options shown in the Annex apply to most other products of the Matteo Dosso catalogue and, therefore, are not listed in detail.

With regard to the product configuration paradigm, cultural and regional aspects have to be considered, which mean challenges of important manner in our case - a European wide approach.

Whereas in cases of customizable products within standard e-environments, database structures and pricing information are straightforward, the structure within the SERVIVE project cannot be realized in the same way. This project works as a single-piece multi-enterprise structure and is implanted into the CustoMax Platform. This highlights the need for a more complex workflow management. In a multi-enterprise mass customization environment, the special requirements in terms of multi-enterprise databases, pricing tables and multi-product catalogues become apparent and issues related to these topics are presented.

Whereas in a standardized e-environment product information entities are generated using a range of direct attributes according to a predefined structure, in the SERVIVE project, the attributes are created dynamically. This implies that the resulting price for a customized product is strictly dependent on the unique set of attributes.

For instance, the direct attributes offered by the company Matteo Dosso and the pricelists, which are generated using a complex set of variables, can be seen below:

- Country/region

- Client classification

- Model selected

- Materials used

- Style and options selected

- Site

- Special services

Taking the attributes above into consideration, the pricing rules of Matteo Dosso can be regarded as complex. This complexity is labelled "the Product Configuration Paradigm" by CustoMax and is characterized by:

- Single-piece workflow management in a multi-enterprise environment;

- A single product can be sold in different countries, to different clients at different prices;

- Depending on the country and the client different options and measurements are available for a product.

Another feature offered by the CustoMax platform, which further increases the complexity of the project, is the option for clients to dynamically configure the product catalogues of the multi-enterprise environment. For example, a BtoB customer of Matteo Dosso is Harrods of London. For this specific customer, Matteo Dosso can activate a certain price list for this customer, but at the same time, the customer has the opportunity to activate or deactivate customization options in the product catalogue for consumers. Furthermore, Harrods could fix sales prices by configuring the pricing module regardless of the customization options chosen by the consumer.

1.3.2 The Team Colours pilot

Team Colours is another pilot of the SERVIVE project, which was established in 2002. Run as a family business serving the clothing needs of the elderly, it refocused its target group to women's sportswear. Similar to the other SERVIVE pilots, they offer bespoke clothing for both individual customers as well as customer groups, such as corporate clients or teams. Within this segment, outfits for netball and football, including shirts, shorts and netball dresses etc., are the core products. Due to the growth and focus on unique styles, the company realized an increased need for flexibility, which led to the switch to local manufacturing from out-sourcing abroad. In doing so, the company also replaced its catalogue with e-commerce, using a transactional website. This website already offered services, which helped customers to co-design products with a configurator. This opportunity addressed a keener sense of style and, moreover, increased the consumer satisfaction of the predominantly female target group, which was confronted with rather functional than fashionable products from other competitors.

The assistance of the SERVIVE project focused on scaling up mass customization for this SME. Therefore, different aspects, which were influenced by the project will be described, highlighting management, workspace and new technologies.

The main impact of the project on the management of Team Colours was related to the response of the management team to an "Agile Design" ethos. Hence, the impact focused on design and manufacture. This led to decreased stock because of a printing-to-order approach, which is able to change the appearance of basic materials completely. Another impact on management can be seen in the increased staff, which amounts to 20 employees by now. In the course of this growth, new ways of acquiring new employees were chosen, such as the Knowledge Transfer Partnership scheme. However, at first no suitable candidates could be found, that offered training in CAD/CAM fashion design and methodological knowledge to implement the Vertigraph system at the same time. However, other graduates were found, whose knowledge and web-based skills complemented the use of CAD. With this development the company is well prepared for the future, by having the opportunity to implement new trends, such as mobile applications, for example.

In order to adjust the workspace to the growth of the company, the SERVIVE project also made changes to the layout. Team Coulours is located in a SME business complex in Hertfordshire. Typically for this kind of buildings, it offers a charmingly characterful atmosphere but lack the comfort associated with modern enterprises. Since Team Colours occupies the ground and first floor premises of the building, it is clearly hard to efficiently use the workspace. This is emphasized by the lack of good lifts and narrow stairs, which link the floors with each other. Naturally, the company is well aware of its own priorities and needs, but in order to evaluate changes and to consider benefits of moving areas, the management consultant Dr. Claire Hussey was asked for advice. After gaining insights to different issues, such as work flow models, data methods used or personnel needs, layout reports, timescales and a process map was delivered and changes to technologies or the enhancement of space were proposed. Team Colours gradually adopted suggestions, which mainly added flexibility to the infrastructure and smoothened workflows by altering areas.

The changes suggested by the SERVIVE project resulted in an increase of approximately 50% of the office and production space. Also, the organizational management is more effective and efficient than before. The additional space available was used to introduce a showroom and a reception area. This offered the opportunity to host visits, which boosts the potential for wholesale business by offering interaction with companies. Furthermore, plans for acquiring additional office and storage space are already created, which can be executed once adjoining accommodation will be available for lease.

At the start of the SERVIVE project, Team Colours had already implemented a computerised LAN set-up in order to link purchase, sales and accounting. Furthermore, a popular website with transactional capacity was already developed in-house. However, automated reporting and the interoperability regarding these functions were not fully used at that point of time. For example, orders placed on the website had to be confirmed via telephone, manufacturing dockets and other processes were still paper-based and patterns as well as lay plans were generated manually. Moreover, surface decoration was often outsourced to other companies, which caused addition delay. With the additional expertise, Team Colours became aware of technologies available to complement their needs. Accordingly plans for implementation were created and, hence, machinery was gradually introduced during the second year.

With special regard to the introduction of CAD/CAM pattern development software/hardware, a major increase of efficiency could be observed. Before, all necessary steps, especially for small orders, were done manually. Taking the wide range of sizes and style options into consideration a manual approach did not seem too inefficient at first, but even if only disparate sizes were ordered by a team, each pattern piece had to be hand-graded according to "rules". For this process it was necessary to plot all incremental sizes, which sometimes resulted in unwanted styles or sizes. Occasionally, this process was outsourced but this proved to be very costly. Hence, CAD/CAM pattern design systems were needed. This led to the acquisition of a Vertigraph CAD/CAM software, which enabled the company to operate highly space efficient drafting and storage of styles. The time taken for grading is also reduced from several days to a single day. Furthermore, it is now possible to reuse elements to leverage the design process.

The introduction of modern CAD/CAM pattern development software and hardware suggested new ways of printing to be deployed to further boost the efficiency gain. Therefore, digital inkjet printing and sublimation printing were introduced. The new printing machines enable Team Colours to print lengths of one metre and to produce quality digital print reproductions in-house. This greatly influenced time-to-market and the need for outsourcing positively. This new printing equipment is supported by new laser-cutting technology, which enables the new staff to create new aesthetics and an even wider range of design options to offer more customized clothing lines. This helps Team Colours to attract an extended customer base.

Another way to increase efficiency was the improvement of the website. Before the SERVIVE project, Team Colours had a B2C website targeting young sports-oriented customers. However, most

of the customer became aware of the website either by word of mouth or SEO. The website already offered lots of details regarding the wide range of products but the major drawback was that it was not dynamic. Hence, all products had to be entered manually and no instant quotations were possible. Order could not be placed online as well and had to be re-written manually, which was a source of errors and very time consuming. Therefore, the flow of orders was an area worthy of reconstructing. With the implementation of Click Innovation and content and database management systems, the stage of each enquiry could be monitored. Now, data synchronisation can easily be applied with the ERP database and with all information on orders available in real time, clients can be invoiced automatically. Invoicing is done via e-mail, and payments from customers are stored as well in order to create a historical account ledger. This information is directly available for the accounting software, which saves time and avoids double entries. With this new approach Team Colours is able to deal with over 600 new leads a week.

1.4 Customer Support Functions

Additional challenges regarding the structure of SERVIVE project occur when integrating different services and features into the whole network. Since the SERVIVE Portal will act as a repository or a wide range of European brands, companies can benefit from support regarding different issues. For example, research has shown that crucial components for an online shopping experience are entertainment features. Even though the online environment offers lots of technical features for fashion companies, only few are able to present themselves in an appropriate way to appeal to customers. Instead a strong focus is often put on technical features and a poor web design is offered to the consumer, which usually deters them. Falsely, this approach addresses the utilitarian needs of the customer instead of offering a hedonistic shopping experience.

To counter those false assumptions, challenges related to innovative interface design, co-design, style advice and social networking are identified and possible solutions are presented.

Another common problem is related to the overwhelming variety of customization options available, which can cause confusion and inertia among consumers. This problem is related to as mass confusion.

Moreover, consumers are more likely to take longer time in order to come to a decision while shopping for clothing. This can be observed by the shopping behaviour of customers, when they visit additional stores and ask shop personnel for advice. Online shopping offers the benefit of making different offers comparable with little effort. While some of this shopping behaviour can be considered as normal, both in online and offline shopping, there are other sources of frustration.

This leads to the conclusion, that key information has to be offered at an early stage to the consumers in order to prevent frustration. This key information could be, for example, colour availability or price. While a help function is usually available to customers, it deals with issues related to navigation and processes. In the process of buying apparel, however, the help required is personalized and context specific. Therefore, successful style advice can be the required element, which turns overwhelming into satisfactory choice.

A satisfactory solution will foster the relationship between suppliers and stores by helping customers browse a rather complex catalogue. Within this context a challenge is to identify relations bettwen somatotype, product groups and consumer profiles in order to offer appropriate style advice based on style rules.

Another challege is the fact that people like to see themselves wearing the chosen product before deciding to buy it. This could be possible even for mass customized apprel before manufacturing it by providing a simulation system to offer interactive customization. In this context, various poses based on a 3D model of the consumer wearing a customized garment is shown. This feature has to be sharable with other members, friends in the style community, for example.

1.5 Micro Factory Approach

Additional challenges occur because of the chosen production form of Micro Factories, especially concerning required data and corresponding data format. A special feature of decentralized production networks is the use of micro factories. This enables the member of the SERVIVE project to share their production capacity. In this case, an order can be transferred to a micro factory, but detailed information regarding sizes, pattern etc. from the ordering party is necessary. To ensure constant quality, each micro factory has to be able to produce a prototype of each type of product.

The type of information required is depending on the type of micro factory within the network. However, the way in which the data is exchanged may vary, namely depending on different scenarios or the connection to POS, but the required data itself must be precise. The degree of co-design options or the degree of the customization does not have an influence on the information exchange. The product customization solely takes place using the product configurator. For this procedure the MC garment distributor/developer is responsible and predefines any options. The micro factory starts working at the point of time, when the order acquisition has been finished.

For each micro factory data related to customers, orders, production and products has to be provided, in order to guarantee efficient production. In the special case of global orders micro factory related factors, such as skills, have no influence on the required data either. However, to match appropriate

micro factories with each order, the type of production data and its content depends on the process scenario of micro factories as well as its organisation and productions capabilities.

In this context, order data consists of additional information, such as information about delivery conditions and order identification. Product data includes besides descriptions of each step of workmanship also a detailed visual presentation of the customized garment. Influenced by the process scenario and micro factory-related technical facilities is the content and type of customer data. Besides this additional information, production data, consisting of work plan and production instructions, is required and influenced by the technical equipment of the micro factory as well as specifications made by the customer.

Hence, a major challenge can be seen in the availability of order specific work plans in order to individually organize the workflow according to the abilities of each micro factory. To achieve that, work plans are created as flexible modules, which can be combined freely according to the type of customized product.

Even if most of the approaches how to address the described challenges where already mentioned, the following chapter will go a bit deeper into detail.

2 Addressing the Challenge

In order to cope with the challenges described in above, the modules in the following list are integrated into the SERVIVE project.

SERVIVE Principal Modules (PM)

- Virtual Try-On Services (VTO Service)

- Virtual Try-On Web Application (VTO Web app)

- Personalisation Server (PServer)

- Recommendation Engine (RecomEng)

- Micro-Factory Network Coordinator (MFNC)

- Intelligent Pattern Configurator (IPC)

SERVIVE Integration Platforms (IP)

- SERVIVE Portal incl. Style Community (SPO)

- SERVIVE Transaction platform (SPL)

As most of these modules are described in the highlighted achievements in the next chapter or the overall results in the chapter thereafter, we decided to enlarge on the elementary challenges within this chapter.

2.1 Body Measurements

The major challenge of determining the body shapes of the target group was solved by using various successive methods.

Although the challenges of choosing the important measurements and the way to measure them was been discussed before, in this structure, a precise process is established, which covers the challenges by defining clusters and measurements.

2.2 Work and Data Flow Micro Factory

Regarding the challenges occurring while establishing the complex micro factory production network, a knowledge base for production knowledge has been created. This includes working steps, production organisation and work plans. This is of importance especially in the field of mass customization because a large amount of experience about production with its variations is required. This is supported by the two different ways of producing garments used in the project, namely sewn and knitted garments. In either case garment production has to be regarded as production of lot sizes of one. This implies that each order needs an individual production plan.

Due to the nature of the mass customization approach, the costs and complexity of production organization are influenced by different factors, which can cause additional costs and production time:

- Size of factory/number of workers

- Skill of personnel

- Technical equipment

- Production method- sewing, knitting

However, planning of production is independent from the factors listed above. The effort is related to the customization of the ordered product. In the case of micro factories, the complexity of work plans is closely related to the skill of and the number of workers. Since micro factories usually employ a rather small amount of workers, work plans can be regarded as more rudimentary, because experienced and skilled personnel can interpret orders on their own. Nevertheless, in the case of sewn garments, production processes can vary even if the same type of garments is produced. A reason for this can be seen in different influencing factors. For instance, the garment customization and the micro factory profile have a direct influence on the production process.

2.3 Knowledge Architecture

In order to cope with this challenge, an integrated knowledge architecture has been developed. Since information from various sources is input for the SERVIVE network, it has to be managed efficiently. Sources of information are, for example, human morphology or the manufacturing domain. Taking the style advice service as an example the chain of information till a suggestion can be made will be:

- Body type, style, human style color, trend, occasion -> garment suggestion

As can be seen in the simple example above, information of different sources have to be processed in order to make the style advice service work. Therefore, different rules have to be applied to take the needed information from different domains:

Style advice rules are stored in the PServer in the form of stereotypes. Whereas the left side of the rule shown above consists of customer attributes the right side can be seen as the output of the rule. The Pserver will act as a personalization tool and stores user models and stereotypes. Hence, the Pserver can produce stereotypes using data mining algorithms and assigns users to appropriate stereotypes.

- Attribute rules regarding the acquisition of the required data are specified in the SERVIVE OWL ontologies.

Information from different domain sources is integrated into the SERVIVE ontology. This structure of the architecture is supported by integrated knowledge repositories.

The structure of the flow of information is as follows. The repository of basic information, which is needed to define the customization options is located in the domain of the garment developers.

Accordingly, they define, which information is needed regarding the customization options and provide retailers with this knowledge. With this knowledge, retailers are able to market the garments. In turn, the preferences of the customers are gathered by using the product configuration process.

Depending on the different scenarios studied within the SERVIVE project, the content and workflow of information differs. This is related to the relationship between the different actors in the network, namely garment developers, manufacturers and retailers. Therefore, the precision and the volume of required information may vary. In the following brief descriptions of the different scenarios are offered:

Scenario 1 - Team Colours and UNICATUM: current scenario

Team Colours and UNICATUM occupy nearly all types of roles within the SERVIVE network, namely developers, suppliers, retailers and manufacturers. However, it has to be noted, that UNICATUM filed for bankruptcy, but to prove the feasibility of the model its tasks were taken by IFTH and NTU. Still for this report, the pilot concept to produce knitwear etc. will be referred to as UNICATUM. In the case of Etui-dresses, all relevant information used are defined, generated and used in-house. Therefore, there is no need for order specific production information. Only information regarding the style variant, workmanship and body measurements are needed in order to start production. Four production patterns are generated based on the body measurements and the personnel is able to manufacture the rest of the garment according to the customer's preferences. In order to minimize production and organization costs within the micro factory, an automated generation of customized work plans is chosen.

Scenario 2 - Matteo Dosso: current scenario

Matteo Dosso takes the role of a garment developer and supplier within the SNI platform, while production is located in factories of partner companies. However, the company offers detailed information regarding permitted customization options to retailers. The needed information on customization preferences of customers is gathered by retailers, using try-on pieces. There, design options are noted and pattern alterations are created using adjustments of the try-on piece. Once this information is forwarded to Matteo Dosso, work patterns are created, which are sent to a factory chosen by the company. Furthermore, factories are chosen, which work for Matteo Dosso for a longer period, which facilitates quick processing and reduces the complexity of the information required to produce the customized product.

Scenario 3 - UNICATUM: future scenario

In this scenario UNICATUM wants to offer its products using the SNI platform in addition to its other roles as garments developer, supplier and producer. In order to offer those products on the SNI platform, detailed descriptions of the customization options has to be provided. In turn, retailers forward the customization preferences of customers to the SNI. The remaining processes are comparable to scenario 1.

Scenario 4 - Matteo Dosso and UNICATUM: future scenario

Matteo Dosso and UNICATUM are companies, which also offer the opportunity to outsource the production of garments to other micro factories within the SERVIVE network. While the information exchange between Matteo Dosso/UNICATUM and retailers stays the same as in scenario 2, the production information required by the micro factories has to be more complex, because it is possible, that the micro factory is producing this type of clothing for the first time. This is also dependent on the equipment of the chosen micro factory. For example, if the chosen micro factory does not possess a CAD system or a plotter, a hard copy of the pattern has to be sent to it. Accordingly, if different interfaces regarding the machines are used, appropriate file formats have to be exchanged.

2.4 Production Organization (automatic knitting)

In the following are the main processes for sown garment assembly presented:

Provider of mass customized garments

- Development of sample assortment

- Visual product presentation

- Automatic pattern generation or grading and alterations of samples

- Production of try-on pieces

- Definition of offered customization range

- Creation of patterns for 3D VTO

- Description of workmanship and modular technical product sheets

- Modular work plans

POS

- Product presentation

- Collection of customer data

- Product configuration

- Virtual product presentation (3D VTO)

Pricing

- Production request

- Coordination of delivery conditions

- Customer order confirmation

- Order placement

- Data transfer

Micro factory selection (SERVIVE micro factory coordinator)

- Appropriate selection of micro factories according to order requirements

- Order placement

- Request of order or pattern data

- Distribution of order or pattern data

- Distribution of shipping address of the chosen micro factory to the garment provider

Provider of mass customized garments

- Calculation of material demand

- Construction of customer specific pattern data

- Creation of technical product specification sheet

- Creation of work plan modules

- Checking material availability

- Distribution of product data/pattern

SERVIVE Data transfer service - material procurement service

- Organisation and monitoring of material and data exchange

Micro factory

- Order check
- Check of data provided
- Production planning
- Work planning
- Production preparation
- Pre-assembling
- Assembling
- Quality check
- Product delivery
- Complaint processing

SERVIVE production organisation - order management service

- Monitoring of the whole process

POS/Customer

- Product check
- Complains
- Product acceptance
- Payment

As can be seen by taking a look at the list above, a wide range of tasks has to be covered by the actors within the SEVIVE network. Therefore, monitoring of all processes by the SERVIVE platform will be advantageous. A reason for this can be seen, for example, in the opportunity to save time using continuous order tracking in order to avoid requests regarding order status.

2.5 Platform Services

Development and offer of sample assortments: The foundation of the value chain can be seen in the creation of sample assortments. This includes not only the creation of designs and patterns, but also the preparation for 3D VTO. Furthermore, work plans and technical product sheets have to be created for each customization option. For the distribution of the related data SERVIVE will act as a market place or more specifically as a data transmission engine for the involved actors.

Order management: Order management in the SERVIVE context includes more complex tasks than just managing of order data. Additionally, requirements, such as data of customers' bodies, pattern data and customization preferences have to be transferred. Especially with regards to the 3D VTO the garment developers have to create patterns for demonstration purposes, but also they have to create rules, which determine variant of the garment, that is chosen and matches the customer's preferences and body type as close as possible. This knowledge is difficult to transfer and, furthermore, it is sensitive data as well.

For the aforementioned scenarios to work, the 3D VTO has to have continuous access to the required data, in order to work in real-time at the POS. Therefore, the garment developer has to agree to constant monitoring of order requests. However, the 3D VTO can also work with a small range of standard sizes with different variations of patterns from the real sample assortment. This can make the whole process of offering a preview of the desired garment easier, but on the other hand it will result only in an approximation of the customer's customization preferences. Accordingly, depending on the choice of the garment developer, the 3D VTO tool has to be configured.

Data- and information transmission: As mentioned before, there is a wide range of data to be transferred, including order data or pattern data etc. Since compatibility problems can occur regarding the data format depending on the equipment of a micro factory, for example, a standard format could be established within the SERVIVE network. In order to achieve this, structure and content of the data have to be harmonised. However, this effort only makes sense if both recipient and sender do not already use a compatible format.

Material procurement process: The provider of the garment stocks the material and could be a bottleneck if he is not able to deliver. By implementation of the SERVIVE project, request for materials, availability checks and transmissions can be managed using a single system. If a material supplier is integrated into the system even ordering of materials could take place within the platform.

This can be achieved in two ways: on the one hand the SERVIVE project provides a database to handle material stocks and on the other hand SERVIVE acts as an order transmitter, which generates links to databases of the corresponding company.

Production organisation: As mentioned before, the required data for production organisation depends on the scenario chosen in order to assemble the modular work plans and technical product descriptions. The SERVIVE platform can acts as a data provider, if the assembling process was done by the garment developer. In this case the key factors are completeness and the data format regarding the transfer process. In the other case, in which the modular data sheets are assembled on the SERVIVE platform, standardized forms, content and structure is required. Furthermore, universal rules have to be developed, which define criteria for micro factory specific assembling of orders.

Shipment: The SERVIVE platform can offer support for the shipment process by monitoring the whole process and by transferring the address to the according recipient. For this, interfaces have to be created to provide members of the SERVIVE network with access to the required data.

Evaluation: As a concluding step in the value chain, the product and the process flow should be evaluated. This is important, because this way, micro factories can be assessed according to quality, abilities and customer service. Therefore, appropriate questionnaires have to be developed to properly evaluate product acceptance depending on the type of product.

Shared VTO Web Service final prototype - requirements: In the following requirements for proper functionality of the VTO web service will be discussed. Since the VTO web service works based on a web application, there is no interaction with other components of the SERVIVE platform. Therefore, the requirements listed below are related to data preparation. To generate 3D garments for simulation purposes, there is a pipeline of processes and input data to create content. The process is initiated by using digitalized pattern data of the garments as input for the 3D CAD system to generate a prototype of the 3D garments. This approach offers the opportunity to interactively create 3D garments using pattern data, fabric texture data and fabric information. In a following step, the created garments are combined with a template body. During the testing of this combination eventual problems can be corrected. To conclude this process, all results are stored in a database, which is used by both web service and web application.

In order to offer customizable products, the developer or supplier of mass customized garments has to define the solution space first. This set of variables is forwarded to the retailers as a basis for the customer's individualization process. The information, which the mass customization producer requires is generated within product configuration process. For the customer to initiate the customization process superordinate customization options have to be offered. They classify to which degree a product is customizable, such as material assortment or body dimensions. Furthermore, possible customization options regarding the workmanship of garments have to be included into the general information.

The information required can be further subdivided into two groups: information regarding pattern development and information regarding production. Both types are generated by the options chosen by the customer using the product configurator. The difficult task to transform this information in

required production data, which is usually CAD data, work plans and technical product descriptions, is within the responsibility of the mc garment supplier.

In the following the required information to generate pattern blocks will be listed:

Alteration of size specific pattern blocks

- Size of try-on piece

- Changes on the try-on piece

- Modifications of design elements

- Slected basic style

- Chosen style elements

- Chosen materials

Automatic pattern generation (based on the UNICATUM scenario, including a try-on piece in combination with body measurements)

- Size of try-on piece

- Body measurements

- Modifications of design elements

- Chosen materials

Information required generating production data (based on the UNICATUM scenario by sewing garments)

- Information about selection of workmanship

Garments produced by knitting robots (based on the UNICATUM scenario for knit wear products)

- Information about global workmanship, such as type of pattern of the neckband

- Information on modifications of knitting patterns

The approach of an "all inclusive" model can only be feasible, if the project offers a unique selling point with additional value for the customer. One of the core USPs can be seen in the Co-design

framework. The Co-design framework of the SERVIVE project offers great potential to provide greater value by matching to the customer's individual characteristics. For instance, magazines or poorly trained shop assistants either do not address the customer directly or offer inappropriate advices. With the combined services of virtual clothing, personal avatar and the 3D model the preferences of each individual can be fully considered. For example, personal preferences, such as discomfort displaying one's arms, collaborative filters narrow down the number of potential choices offered. However, the number of potential choices offered can also be increased by a recommendation engine, which works similar to amazon.com. CRM and opportunities for personalization will be increased because of the artificial intelligence learning about consumer's preferences. Once a critical mass is reached, choices will be clustered in order to offer the best possible "fit" regarding the clothing ranges and customers. Taking these thoughts further, the goal of the recommendation engine is to be regarded as a guide that every customer value as appropriate. In addition, previous purchases of enlisted customers can be archived in order to offer future ranges and styles.

A core element of the SERVIVE Portal, the SERVIVE Style Community, will act as a Facebook-like community and include the free tools, such as VTO, style advice and co-design functionalities, which have been described above. Further features are catalogues and personal blogs etc. This approach promises to make customers familiar with mass customization and to create awareness for this kind of products as well as to stimulate demand. We provide screenshots of single functions of the Style Community (Style Advice/ Showroom/ Lounge) in the Annex.

Regarding the feasibility of the SERVIVE project, a SWOT analysis has been conducted, in order to see, whether the results of the project are of a sustainable nature. Therefore, a feasibility study is presented, which is focusing on two aspects:

- Technical feasibility.

- Economic feasibility.

Taking the advantage of an existing platform, CustoMax, the SERVIVE project can be regarded as an extension of that platform. Both technical and economic feasibility is given, because experience has already been gathered regarding implementation and exploitation and there already exists a user base for the CustoMax platform. Especially during the early phases the Supply Network Integration and the SPL benefit from the knowledge of CustoMax but are also funded using EC subsidies. Focusing on the economical point of view, the new SNI has to focus on achieving a critical mass in terms of orders within the system to cover the running costs. For this, the knowledge and commitment of CustoMax can be used, especially regarding further investments and successful exploitation.

2.5.1 Style Advice

One main feature of the project is the development of the style advice service for customers. The Intelligent Style Advisor is a recommendation system, which responds to the customer's appearance and needs. This service utilizes a set of diagnostic tools, which have access to a large database of users and products. Using this, information profiles of users can be generated by using tags, which are matched. "Collaborative filtering" systems enable the style advice service to work in three different ways. On the one hand, generic recommendations aimed at stereotypes can be offered and on the other hand individual guidance is possible as well. The individual guidance is separated into product specific style advice and dynamic style advice. The generic recommendations aim at customers, who wish to use a "self-style diagnosis", to help them choose between a set of basic choices. The individual guidance is a service based on a subscription and matches the user to product lines, which suit them in the most favourable way, instead of showing a wider range of products. These features do not simply "pick" a style from a set of options, but also refine the customer's sense of identity. The SERVIVE transaction platform, therefore, enables "match-to-order" services to the customer by using the product specific style advisor.

This system is of a dynamic nature, because the knowledge base, which offers accumulation and retrieval of information, is established using acquired expert knowledge. At the same time the artificial intelligence adapts continuously to the changing preferences of customers according to different seasons and trends. This allows for the creation of user models using different criteria, such as age groups, stereotypes and other kinds of expert knowledge. The purpose of this feature is to minimize the "paradox of choice" and to help the customer find a satisfactory design, without having to browse the whole catalogue. It has to be kept in mind that the Style Advisor only recommends. The user is still the one to make a choice. However, if no suitable product is found the user is invited to co-design products. Additional benefits of the style advice features are listed below:

- Imitation/ replacement of traditional sales advice

- Address of different types of customers (ranging from inexperienced to experienced online shoppers)

- Recommendation based on personal attributes (such as size or hair colour)

- Consideration of season, country and occasion

- Attention to fabric performance in case of sports activities

- Offering of visual and textual information on the garments as well as advice on how to wear them

- Development of customer trust within the style mix and match process as well as the co-design and make-to-measure process

Another feature of the project is the interactive product configuration process, on which the style advisor will have an impact as well.

In order to cope with the wide range of different customers, a stereotype learning tool has been developed, which can be regarded as another highlight of the project. The intended stereotypes for this project are generalised user models, which aggregate users, who have similar preferences and attributes, to a group of users. In this context, user attributes are given characteristics, by which each user is determined, such as gender, age or body type. Preferences, on the other hand, are features of users regarding garment types or styles of clothing.

This data was procured by CustoMax and 828 customers were extracted from it. In total, there were 5 measurements per customer, describing attributes, and there are 22 products, from which features are derived from by using product purchases. The basic assumption to create stereotypes using this information is to create "if-then rules". This implies that people of certain measurements usually prefer set range of products. The goal of this task was to find out, if a connection between those groups of data exists. To prove, such a relation the PLSA and Gas methods have been used.

For the aforementioned stereotype learning tool, special methods have been developed, on which the tool is based and which offer interaction with other services. On the PServer, a general purpose personalization server, the recommendation engine has been developed. This client application, like other applications concurrently as well, can interact with the server. This structure offers a data model, which is domain independent and flexible, while supporting personalization of existing applications. This structure is based on four entities:

- Users, who are represented by an identifier

- Attributes, which represent persistent user-depended characteristics

- Features, which are application-dependent characteristics

- User models

Regarding user models, there are three different types offered by the PServer: personal, communities and stereotypes. The recommendation engine utilizes the last type of user models. Implemented as a Web service, it can tap into the SPO for dynamic or generic style advices or into the SPL for product specific ones.

2.5.2 Virtual Try On

Another highlight of the project is the virtual try-on. The purpose of this web service is to provide the customers with the opportunity to evaluate chosen garments on a 3D representation of them in real time. While the result is presented in 3D a 2D snapshot can be taken of a particular view for

comparison with other garments. As the name suggests the VTO is a web application, which consumer can interact with. This service was developed by Digital Humans, a consortium partner.

The VTO is based on two separate components: a garment simulation module and a body sizing module. With these two components a real-time platform is created, which has direct access to a VTO Core, a library. Compared to other online platforms, the VTO is unique, because it offers dynamic 3D imaging, whereas other platforms only offer 2D images or static 3D images at best.

This service is dynamic due to its ability to show a sizeable 3D virtual avatar. Furthermore, the simulation is based on accurate fabric information as well as pattern data of the garments. The fact that this service is a web application highlights the user friendliness, since nearly all hardware requirements are on the server side. The user solely needs a client, which has been scaled down to use only a minimum of hardware requirements, and a stable internet connection.

In conclusion, the interaction of the services mentioned above, can be regarded as a highlight itself. Therefore, in the following the integration is briefly described by showing the communication between the services.

Users of the SPL are offered the services of the Product Configurator, which enables them to customize a selected product. Furthermore, the customized product can be reviewed in real time. This process is supported by a "true 3D" representation of the consumer wearing the customized garment. The Product Configurator is an application, which is connected to other SERVIVE systems, and based on modern web technologies. This allows for the SNI integration services of the SPO-SPL in order to offer both a proper look and functionality.

Potential Impact:

1 Who can benefit from SERVIVE?

In this chapter will be described, which parties benefit in different ways from the SERVIVE project.

One group of beneficiaries of the SERVIVE projects are the customers, of course. To identify the target group the following thoughts were taken into account. Considering the expert knowledge of the consortium members, it was agreed on, that some fields of the mass customization landscape in the apparel industry are already well developed, such as men's formal business wear. Therefore, garments for women have been in the focus of the project. However, SERVIVE does not try to compete with high priced bespoke labels but there is significant demand below this level. On the other hand, young consumers, below 25 years, do not have enough money at their disposal. This highlights the target group of "affluent greys" ranging from 50 to 60+ years of age. This target group offers high spending power combined with the need for a fashionable and smart look. Over- weighted people have been identified as another target group, since there is a fast-growing market in this segment. For this target group, there is a rising demand for customized products, because the need for fashionable products, which also fit, is rising. Furthermore, over-weighted people do not want to be treated like exceptional cases. The same applies to the elderly and disabled people. The latter target group has a stronger need for fitting clothes, which many clothing companies do not consider. This is a big opportunity for SERVIVE, due to the morphological evolution, especially regarding the main girths.

This implies that customers with a high expectation regarding the fit of their clothing are of interest for the project. Taking this into consideration four criteria to differentiate customer segments have been developed.

- Lifestyle segmentation: Modern, conservative, traditional, ...

- Age group

- Body types: Pear, Rectangular, Hourglass, ...

- Fit preferences: Fitted, semi-fitted, ...

This argument is further supported taking a look at the default sizes of manufacturers, which still date from the 1970s. Surveys have shown that there is a gap between body shapes of today and the default sizes, which leads to problems covering diversity in human morphology for manufacturers.

The aforementioned target groups can be split into two categories depending on the distribution channel preferred: online and offline channels.

While consumers, who shop online, are most likely below 40 years of age and are better educated look for clothing in order to express themselves, the other target group is up to 60 years old. This group consists of individualists, who look for exclusive clothing. For example, surveys have shown that the targeted customers are characterized by:

- Part of the ABC1-socio-economic group;

- Work part time or full time, resulting in a need for work garments and an existence of disposable income;

- Make up 11.4% of the population, while providing 15.4% of the spending in a market;

- Present the largest average annual spend of 944 pounds in 2005;

- Willing to pay more for quality;

- Prefer classic styles with a fashion "twist".

Another party benefiting from the project are the companies taking part. They are highlighted below. Companies benefit from the SERVIVE project by a better understanding of market segments, a clearer recognition and more knowledge of buyer behaviour. This knowledge cannot only be used by companies but is also applied in order to create stereotypes for style advice purposes. With this an initial set of customization options can be offered depending on the type of customer. Style advice depends on more than just generic data.

Furthermore, the insights gained can also be applied to the understanding of the customer behaviour in general, which is important, if the SERVIVE project is expected to work across Europe. In order to achieve that, the knowledge about customers and the expectations regarding their buying behaviour have to be matched for all countries but also matched among all participating companies

The two main groups, which can benefit from the SERVIVE project, consumers and retailers (manufacturers), as mentioned above, have additional ways of benefiting from the project. In general, customization available on a broader scale offers new opportunities for companies. The creation of networks, involving both retailers and manufacturers, is a successful model to capitalize the trend of individualization and exploit the proximity advantage at the same time.

Consumers

The market for produced-on-demand apparel has seen a rapid growth during the last years within several European countries, including Scandinavia, Germany and the Netherlands. While this trend was given only small attention in the beginning, a few visionary SME actors have adopted to this trend, proving the large market potential.

Produced-on-demand fashion products have evolved from a niche market to an opportunity to revive the European clothing industry.

Retailers

The group of retailers is very heterogeneous ranging from a single owner/employee to a chain of geographically dispersed fashion stores. This also applies to the distribution channels, in which both traveling tailors and retailers, that mix internet shops and bricks-and-mortar shops in their business model, appear. The assortment can vary as well, which can be seen collections focusing either on men or women.

To benefit from these opportunities, the exploitation has to be approached in the following ways:

- Sell the results;

- Use them internally to develop new results for sale;

- License them to 3rd parties;

- Use them to provide services, such as consultancy.

A motivated exploitation will help to create a sustainable business community with the involvement of the following actors:

- SME manufacturers, which already produce mass customized garments. They will use the MFNC service.

- SME manufacturers, which want to enter the market of mass customized garments. For them, the business community services are of interest.

- Retailers, both active in or trying to enter the market for mass customized products, using web shops or bricks-and-mortar POS.

- Institutes focusing on R&D related to production organisation and planning of mass customized products. This task of the project is taken by the Hohenstein Institute. Providing the business community with technical information will be the main purpose of those actors.

- Designers, focusing on designing mass customized garments regarding fit and comfort issues. The project partners IFTH and NTU, who developed a prototype (Intelligent Pattern Configurator), will offer concepts to guide designers and provide the business community with technical information.

- As of now, material providers have no pilot company within the SERVIVE project. However, it is expected, that they will be able to advertise their products.

- The owners and operators of the business community will offer their web services to communities and receive income in the form of membership fees.

2 SERVIVE Impact

In this chapter, the impact of the SERVIVE project on the state-of-the-art of the fashion industry, on science and its sociological and economic impact will be outlined.

2.1 Contribution to the State-of-the-Art

One of the main impacts of SERVIVE is the ability to provide innovative or enhanced services able to scale-up the existing processes and business models in the mass customized fashion industry. The aforementioned impacts are accomplished by creating new business enablers, knowledge and/or service applications, which bring even more benefit to the industry.

- Style advice services

This achievement is aimed at end customers but also a useful tool for sales consultants. However, there are two versions: one "generic style advisor" which is aimed at style communities, where users can discuss style preferences in general and a "product specific style advisor" which offers more detailed and enhanced capabilities regarding a specific product or product type. This will improve sales activities by adding new customized products to the assortment of retailers and by attracting more customers to the market.

- Co-design services

This is a tool used to expand mass customization related business models by increasing customer awareness, interest and confidence in buying customized fashion products.

- Distributed Virtual Try On Services

Using this tool, customers can visualize the customized products even before they are manufactured. This will support their willingness to buy a customized product, which they can already see. Furthermore, lower return/refuse rates will occur.

- Style communities

Increased customer awareness regarding certain products and services results from this modern marketing tool. This trendy concept offers very high marketing potential in the online environment.

- SERVIVE integration platform

An integration of SERVIVE results and an exchange of information between services and applications is possible using the platform.

- CustoMax services

This is a platform, which offers supply chain network integration regarding all actors. However, this service basically exists already without SERVIVE but it hasbeen significantly enhanced with SERVIVE.

2.2 Scientific Impact

The SERVIVE project has produced a considerable amount of results within its duration of 36 months. In total there have been 21 dissemination events, which focused on research results within Europe and the USA. These events include academic conferences as well as company presentations and retailer workshops. Those activities are of great importance, because the lack of awareness for mass customization among both practitioners and customers can be regarded as one of the main obstacles to scaling up the market for customized apparel. Furthermore, ten exploitable results, such as Virtual Try-on, have been developed and key performance indicators like market readiness could be derived. This can be used in order to keep track of future progress.

2.3 Societal and Economic Impact

While during the last two decades consumers witnessed a concentration of market share towards fewer, large national or international companies in the clothing industry. This applies especially to industrialised countries, whereas this trend is most prominent in Northern and Western Europe, where less than 20% of the market share is possessed by independent retail stores. Eastern Europe follows the same trend, which started recently.

General retailers became major forces, which led to global sourcing opportunities, due to the accumulated purchasing power. A result of this is access to remote low-cost manufacturing, which offers potential for even greater purchasing power, because of the reduced costs. However, this trend only appears on the distribution side of the market and is not matched by the manufacturing side. This unequally distributed power leads to disproportionally distributed economic value.

A result of this trend has been business closures, constantly shrinking margins and job losses (Institut Francais de la Mode, 2007). Nevertheless, 2.5 million people were still employed in about 160,000 companies within Europe during 2007. The turnover generated exceeded 210 billion Euros. However, to remain competitive modernisation processes and continuous restructuring had to be applied by companies (EMCC, 2008). This development led to an accelerated productivity growth, because this trend was usually accompanied with investments in new technology, innovation capacities, ventures into higher added value markets (Euratex, 2006).

In turn, the trend of global sourcing has not only reduced costs by shifting manufacturing to low labour cost countries, but also increases complexities and risks because of the distance between point of sale and manufacturing. To name some of these additional risks, these operations are sometimes accompanied by long lead times, quality assurance procedures, political or social instability or IPR infringements. This development of risks and costs is shared by distributors and manufacturers alike and has an impact on their adoption of new business models:

- Fast response to customer demands;

- Interactive value creation;

- Value creation in flexible networks;

- Latest b2c and b2b e-business technologies.

Business cases have proven, that those new models have the potential to create significant economic value, even though end markets, which become increasingly fragmented and fast moving. However, for some companies, which focused on "outdated" paradigms, focusing on mass production at low labour cost locations, it is hard to tap into this fast moving market.

Even though most companies recognize the potential of this market, industrial reality lacks application of such concepts. This state is the result of limiting factors, whereas a lack of financial resources can be seen as the most important one. A reason for this is the fragmentation of the industry into a majority of SMEs. Besides other factors, such as the inability to translate research into innovations, key factors stand out, which support a shift to mass customization.

- A stronger demand than ever for individualized goods;

- Focus on capturing complex orders;

- Customer-centric product configuration is the key force for differentiating from competitors.

Product configuration is a feature that enables companies to remain strong, even in difficult economic conditions, because it is the foundation for multi-channel selling. Accordingly, the SERVIVE concept with its decentralized production offers new opportunities for innovative SMEs. This is supported by the possibility of multi-channel retailing, which is achieved due to the web delivered services, such as the style advisor, for example.

In the following careful predictions are made, which can serve to evaluate the project's impact in the following years:

- Market coverage: initialize a market growth of 50% for the European custom apparel industry

Measurement: As of now, there is no reliable data is available to depict the European custom apparel market. Based on estimations of the SERVIVE partners, annual sales of 500.000 items are estimated. However, a potential growth to 1 million items is to be expected.

- Extension of custom manufacturing in Europe

Measurement: 10 additional SMEs, which use the SERVIVE production models together with at least one large company for producing custom goods in Europe.

- Business creation by new segments

Measurement: the creation of more than five companies that address other markets, than the established ones, such as custom-fit men's suits. Additionally, an increase of the scope of custom offerings by 70% within the SERVIVE network.

- Business creation by growth in established segments

Measurement: an increase of 50% regarding the number of retail locations within the SERVIVE networks, which offer custom apparel. Furthermore, five additional European countries should be served by the SERVIVE offering.

- Design and assortment-related indicators

Measurement: Introduction of fit, form and function as customization options for at least two new assortments for women's wear. The same should be applied to at least one assortment in the sports apparel section.

- Assortment flexibility

Measurement: Flexibility of the mass customization offering with regard to local consumer demands for less than 50% premium within less than one week. This includes adding new customization options.

- Manufacturing related indicators

Measurement: Reduction of waste in the fashion industry by 10%.

- Demonstrator

Measurement: Implementation of another demonstration model of the SERVIVE network with two additional decentralized scaled-down versions in order to display network interaction.

- Marketing related indicators

Measurement: Increased mass customization awareness, which is increased by 23% for internet-based concepts and increased by 13% for retail-based concepts.

- Willingness-to-pay for custom apparel
- Measure for customer satisfaction: willingness to pay for a custom item has to be increased by 25%

The expected market growth, which is another goal of the project, will have an effect on the value chain configuration of the industry. A comprehensive financial model has been created in order to support the consortium in allocating resources and in decision making processes. Another aspect of this model is to quantify the results of the project. This way benefits for the European Community can be measured, such as the number of new jobs created or increased customer satisfaction. This model

is built in a modular and dynamic way to ensure that newly acquired information can be incorporated easily. Four interlinked data sheets are the basis for this model:

- Input sheet (Market view): market value (# items) and market size (revenues) per product segment are modelled here. The proportion of mass customized items in the market is also incorporated.

- Company view: costs and the margin per value chain step according to each of the partners are modelled here. Insights on product profitability can be gained using information on consumer end prices and individual market share.

- SERVIVE impact: In this sheet the effect of the project on different levers will be quantified. This is modelled for each value chain step and includes effects such as increased awareness or efficiency gains due to the portal model (CUSTOMAX).

- Output sheet (Community benefits): Here, the aforementioned effects are aggregated into a macro view and a forecast of KPIs is offered.

List of Websites:

The SERVIVE public website can be found at http://www.servive.eu.

For more information on the results of the project, please visit the results section of the SERVIVE website at http://www.servive.eu/Default.aspx?tabid=445&language=en-US.

For any further information you may contact the SERVIVE Coordinator:

Mrs. Konstantina Papachristopoulou

Athens Technology Center S.A.

email: k.papachristopoulou@atc.gr

Tel: +30 2106874300