

Digital fashion – how and when?

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Virtual Reality and 3D systems are widely in use in many industries, both for design and marketing. Automobiles are designed by 3D systems, and the same images are further used in sales promotion and also in sales configurations. 3D design systems are also used by several fashion companies. But only a few go beyond that and present virtual products in web sites and in configurator applications like the famous Sales Wall by Adidas, which is regarded to be the company at the forefront in virtualization in fashion. 3D software solutions are widely available. Lectra offers tools for designers while Browzwear, Optitex and Clo3D go further by integrating the 3D designs to sales configuration solutions including moving avatars. The Korean golf wear manufacturer Elrod organizes virtual cat walks for presenting their garments, where nothing, i.e. models (avatars), garments, cat walk and scenery, is real. The visual quality of avatars and garments improves continuously. Furthermore, such systems make customized e commerce possible. The aim of the recently completed Horizon 2020 funded project 'fromROLLtoBAG' was to create an integrated consumer driven local production system with the help of virtual design and digital manufacturing. Consumers connected with mobile devices can customize the avatar, insert own measurements and virtually try on garments from suppliers collection. Once done the order is transferred to a local manufacturer which with digital printing, cutting and unit assembly produces the product and ships to the customer in one day. Besides offering digital market place to brand companies, the objective of the project was to bring garment production back to Europe.

Key words: digital sales and manufacturing, consumer driven local production, virtual design, digital sales configurations, digital fashion

1. Introduction

Most engineering industries have found 3D digital design and virtual reality applications extremely useful in product development, marketing

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and e commerce, primarily due to reduced lead times and savings in sampling and prototype materials. 3D sales configurator software makes it possible to market and display products before making them. Audi City in central London brings car dealerships back to city centers by displaying virtual instead of real cars [1]. However, such examples from the

fashion and textile world are not many. Yet, 3D software solutions are widely available. Lectra offers tools for designers while Browzwear, Optitex and Clo3D go further by integrating the 3D designs to sales configuration solutions including moving avatars for virtual reality catwalks. The technology and the visual quality of avatars and garments im-










Company	Lectra	Browzwear / Pragma	Optitex	Human Solutions	Clo3D	Tukatech	Pad Systems	TC2	TPC (HK)
Country	France	Singapore	Israel	Germany	Korea	USA	China	USA	Hong Kong
3D software	Modaris 3D Fit	Vstitcher	3D Runway	Vidya	Clo 3D	eFit Simulator	Haute Couture 3D	V-Dresser	Inter-active software
3D avatar and display									

Fig.1 Current suppliers of fashion industry 3D design and visualization software

prove continuously. The main software suppliers are presented in Fig. 1. Adidas is one of the few apparel firms that seriously implements virtualization on the overall design-marketing life cycle. During the ten year implementation process they have saved the cost of producing way over one million samples [2]. 3DEXCITE of Dessault Systems assisted Adidas and several other fashion companies in 3D visualization, and they estimate that not only time and money can be saved but companies can respond to changes faster and more effectively [3].

Against this background a Horizon 2020 financed Innovation Action project ‘fromROLLtoBAG’, i.e. Consumer Driven Local Production with the Help of Virtual Design and Digital Manufacturing for fashion and sports garments was launched at the beginning of 2015. The objective of the project was to create enabling virtual design and sales technology together with enabling digital manufacturing technology and to demonstrate that consumer driven on-line local production with no or low inventories can compete with globally operating chains, and at the end, bring production back to Europe. Consumers were identified to be the driving force behind these systems. By offering the consumers a novel and inspiring shopping experience, consumer driven local production lines can be suc-

cessfully established. Through the following steps the project aimed to bring the digital shopping experience beyond the state-of-the-art:

- The enabling virtual design and sales technology needs to be applicable for the consumers to use through digital and mobile connections, especially regarding the avatar, 3D sales configuration and interactive rendering.
- The modules of enabling digital manufacturing technology, i.e. digital printing, digitally driven cutting and assembly software are already commercially available, but usually applied to mass production lines. The ‘from-roll-to-bag’ continuous production line connected to consumer driven digital ordering system makes unit production, mass-customization and no or low stocks and lead times possible. Such lines can be installed inside the market, thus enabling the companies to bring production back to Europe.
- The radically new apparel product construction and pattern technology developed by University of Borås made the from-roll-to-bag production line physically possible. The new technology will change the conventional garment construction totally. Number of seams is reduced, material consumption will be decreased and assembly will be simplified.

- The results and benefits are communicated to the creative industry SMEs as well as to consumers by web site, articles, videos and social media, as well as Road-Show Workshops to be organized jointly with the fashion and textile industry organizations.
- Nine partners agreed to carry out the project according to the research course presented in Fig.2.

2. The Market

Garment imports to Europe have grown steadily over the past ten years resulting in massive job loss in the textile and garment industry. Fashion e commerce is expected to grow significantly both in Europe and the U.S. In fact clothing and sporting goods have already a 50 % share in e commerce in UK [4-6]. Due to a long lead time and poor forecasting accuracy the traditional fashion value chain (both brick & mortar and e commerce) performs poorly. Production orders are allocated six months prior to the selling season, while collection design starts even earlier. According to research by Tampere University of Technology and Hjort the key performance indicators in fashion retail chains in Europe were as follows [7, 8]:

- Sell-Through (proportion of goods sold at first price) 63 %
- Lost Sales (potential sales lost due to stock-out) 23 %

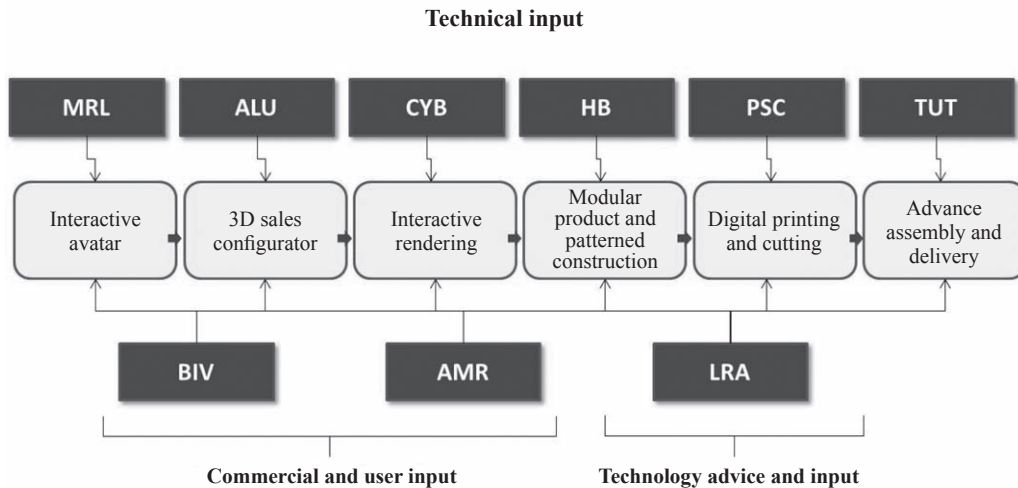


Fig.2 Three research partners (Tampere University of Technology, University of Borås, MIRALab), three ICT partners (Cyberlighting, Lectra, AluGroup) and three manufacturing partners (Printscorio, Salomon, Bivolino) joined forces to carry out the fromROLLtoBAG project

- Inventory turnover 2.9
- Real mark-up after all discounts 2.0 %
- Rate of return in mass e commerce between 40 % and 60 %

In mass merchandising the low purchase price is regarded as the corner stone of profitability in order to facilitate the high cost of the value chain, including low Sell-Through and slow inventory turns. But by eliminating these draw-backs, as mass-customized bespoke value chains do, higher purchase price can be tolerated. This in turn makes local manufacturing possible, and bringing production back to Europe becomes reality.

3. Concept and Approach

By implementing the 3D and augmented reality applications to an e commerce web site the consumers will have an inspiring shopping experience and extremely fast response to their shopping needs. This will be assured by the ‘from-ROLL-to-BAG’ production line, which enables production and delivery of customized orders rapidly. Inventories will consist of undyed fabrics and accessories, which can be flexibly used for the customized products, thus avoiding the problem of having large stocks of ready-made products normally needed by e commerce.

3.1. 3D Visualization and e Commerce

The consumer is connected to the sales application. By creating an interactive avatar, products from a brand company’s collection can be virtually tried on and modified. The sale configurator assists in selecting prints and fabric colors. Once the order is confirmed the product specification data is transferred further to a local on-line manufacturer for production.



3.2. Consumer Driven Local Manufacturing

The enabling digital manufacturing technology consists of a digital printer, a computerized cutter and sewing machinery for assembly. Fabrics are stored grey, and prints selected by consumer are printed by using sublimation heat transfer printing for polyester and direct pigment printing for cotton. Only the garment area is printed and the contour cutter follows the edge of the print when cutting. As products are printed and cut one by one the increased material consumption was avoided by use of radically new product construction and pattern technology. Once the product is ready it is shipped to the consumer.

4. Results vs. State-of-the-Art

The objectives and the results achieved by the project are in line with

various international projects which, by means of advanced technology, aim to bring the outsourced production of consumer goods back home, for example:

- **Open Garments** was a FP7 project with the overall objective to create a Manufacturing Service Provider (MSP) Business Model enabling individual garments. A new way of design, production and sales of consumer designed and configured garments is based on the provision of individualized services and products to customers and partners [10].
- **Horizon 2020, NMP 35 – 2014:** Business models with new supply chains for sustainable customer-driven small series production, which aims at returning delocalized manufacturing to Europe.
- **Apparel made for you** , an American initiative developing technology which allows apparel manufacturing to profitably return to North America [11].
- **Reshoring Initiative** , another American initiative, whose mission is to bring good, well-paying manufacturing jobs back to the United States [12].

According to the nature of Innovation Action projects of Horizon 2020, fromROLLtoBAG did not carry out extensive research, but rather by us-

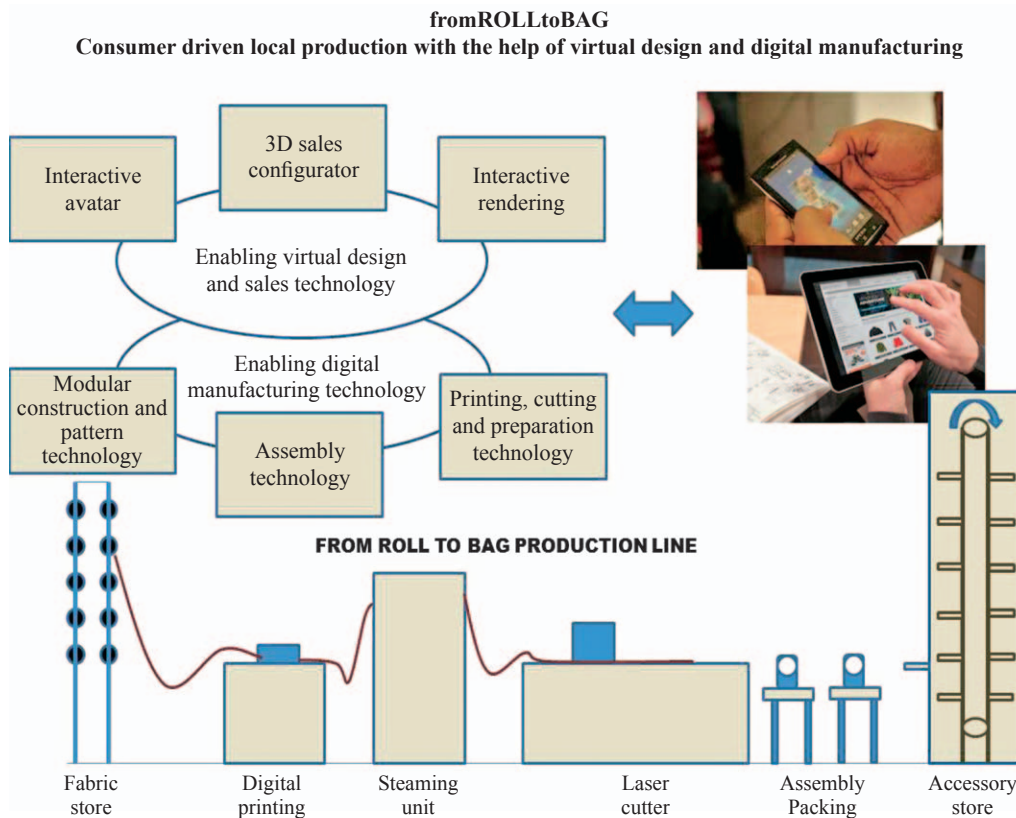


Fig.3 The enabling virtual design and sales technology and on-line digital manufacturing technology of the project



Fig.4 The radically new patterns based on kinetic garment construction theory were developed in order to maximize wearing comfort and to minimize fabric consumption [9]

ing existing technology and solutions, created a new business model. The system can be further exploited by different beneficiaries. Commercial Internet market place providers and local on-line manufacturers form the business platform and pave a way for brand companies to commence on-line bespoke garment business. Special technology from software providers will make the operations possible:

- **Consumers** drive the system by selecting, customizing and ordering products of their preference. They can select different brands at one on-line market place, try them on virtually and customize them.
- **Brand companies** can use the system as one channel to the market. They sell directly to consumers through the on-line service platform by providing collections and product data to the on-line store operator.
- **Software providers'** role is to sell or lease software to the operators (avatar, 3d design system, sales configurator, pattern design, production planning, PLM, etc.).
- **Commercial Internet market place provider** is a multi-brand on-line store without inventory. The cloud service is offered to the brand companies who are willing

Tab.1 Value Generation in different type of e commerce

	Traditional on-line fashion retailing	Customized on-line retailing	Interactive from-roll-to-bag retailing
Shopping experience	Traditional	Exciting	Inspiring
Customer loyalty	Low	Higher	High
Lead time	Long (6-8 months)	Short (7-14 days)	Short (2-3 days)
Inventories	High (turns = 2.9)	Fabric and accessories	Grey fabric, accessories
Retail performance	Sell-Through low (67 %) Lost Sales high (23 %) Real mark-up low (2.0) Returns high (50 %)	Sell-Through higher (85 %) Lost Sales low (10 %) Real mark-up high (4.2) Returns lower (10 %)	Sell-Through high (95 %) Lost Sales low (8 %) Real mark-up high (4.2) Returns low (0-1 %)
Risks	High inventory High unsold stock	High fabrics inventory Unsold fabrics	Grey fabrics only

to let consumers customize their purchase. Orders are passed on to local on-line manufactures for production.

- **Local on-line manufacturers** are service companies who receive orders from Commercial Internet market place providers and, after making the product, ship it directly to the consumer. The manufacturer’s inventory consists of grey fabric and basic accessories which can be used for making different types of garments flexibly.

The competitiveness of the system is far better than with other e commerce retailing channels. The shopping experience is inspiring to consumers and up-loaded personal details for avatar creation boost customer loyalty. Lead time from committing to product order from manufacturer to consumers is extremely short. Inventory consists of grey fabric and accessories only, which flexibly can be used for making different kinds of products. Due to the ‘from-hand-to-mouth’ nature of the business excellent retail performance can be achieved when measured by Sell-Through %, Lost Sales %, Inventory turns, Mark-up and Return rate. Risks of obsolescent stock is very low compared to traditional and customized

on-line retailing. The results quantified by a Business Plan are summarized in Tab.1.

5. Conclusion

The ultimate objective of the project was to demonstrate that consumer driven local production with the help of virtual design and digital manufacturing can be set up and run competitively. The future commercial platforms will be established by local on-line manufacturers and commercial Internet market place providers.

Collections by various brand companies will be offered to consumers. The future Business Model is highlighted in Fig.5.

Both the enabling virtual design and sales technology and the enabling on-line digital manufacturing technology created during the project were tested by the commercial partners. The pilots confirmed that, due to more efficient supply chain, products offered through fromROLLtoBAG type Internet market place tolerate higher manufacturing costs compared to traditional retailing (on-line or Brick-and-Mortar), as highlighted in Tab.2. By assuming that the retail tag price is the same, the purchase price (landed supply cost) can be calculated backwards for both channels. Income per product to the on-line from-ROLLtoBAG retailer is higher as only 5 % is sold at discount (mainly campaigns for left over fabrics) compared to 40 % in traditional retailing. The same productivity can be achieved with lower retail margin as the fromROLLtoBAG market place provider does not carry similar costs as traditional retailing. The brand company earns the same margin through both channels. And finally, the purchase price from the local on-line manufacturer can be much higher compared to the landed cost of imports.

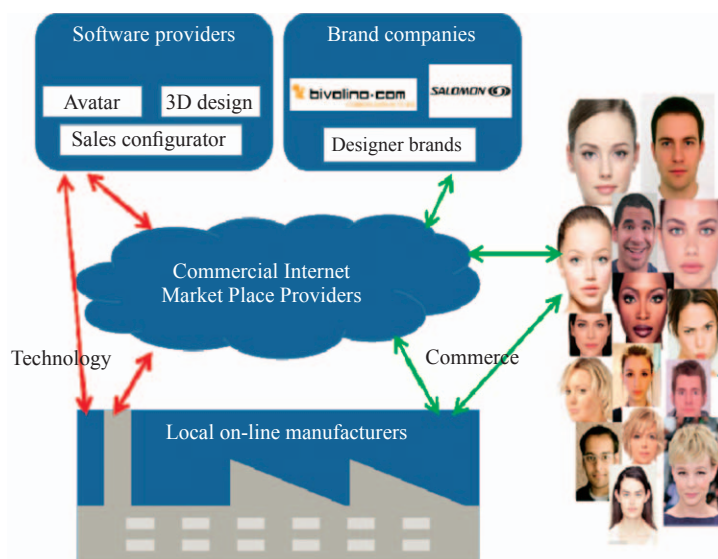


Fig.5 Business Model for exploitation of project results

Tab.2 Revenue generation through traditional and fromROLLtoBAG channels

	Retail tag price	Sold at discount	Average discount	Income per piece	Retail margin	Transfer price	Brand margin	Landed supply cost
Traditional								
%		40 %	50 %		50 %		45 %	
Euro	60.00			48.00	24.00	24.00	10.85	13.20
ROLLtoBAG								
%		5 %	50 %		30 %		45 %	
Euro	60.00			58.50	17.55	40.95	18.43	22.52

Besides fromROLLtoBAG project there are already several firms which use digital systems in design and marketing successfully. Adidas was already mentioned. UNMADE is a UK based knitwear firm which allows consumers to customize their collections and organizes on-line digital manufacturing in central London [13]. Bivolino’s special software for mass customization of shirts is used by several other firms like Marks & Spencer [14]. Gradually, in line with technology development, we can expect to see more and more applications, which will also make local production a possibility.

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