Application of Intelligent Systems as the Basis for Improving the Position and Competitiveness of the European Textile Industry

By: Isak Karabegovic & Darko Ujevic
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Abstract

The textile and clothing industry belongs to one of the most important global industries in Europe. Over the last 15 years or so numerous relocations have taken place (production capacities were moved to other production sites). The trade of textile products in the European Union is regulated by the agreement between EU and third countries on the basis of technical and environmental regulations and rules. The interior trade of textile and clothing articles in the EU is regulated by the Agreement on Textiles and Clothing within the frame of the World Trade Organization which implies respecting agreement rules. Euratex (the European Apparel and Textile Organization - Brussels, http://www.euratex.org) follows these regulations. The European Union is the largest world market of textile and clothing products. The recession volume which affected this sector resulted in an adequate response whose goal is to keep the acquired positions. As one of the directives in this paper the authors suggest keeping up or making more complex machinery and equipment, sewing automata and functional units in medium-developed industrial areas, and they emphasize the significance and application of intelligent systems as the basis for improving the position within the European textile industry.

Key words: EU textile industry, 3D body scanner, CAD/CAM (Computer Aided Design, Computer Aided Machining) technologies, e-commerce, practical intelligent system

1. INTRODUCTION

The EU industry provides more responsibility for a large number of medium-developed countries, especially from Asia. There is a great difference between these countries and Europe. The EU industry has got higher productivity and responsibility for innovation, quality, creativity, design or fashion, permanent reconstruction and modernization. The sector adapts to new technologies to a greater extent, respecting information, communications technologies and methods of new production. The EU industry plays a leading role in the development of the new production in the field of making textile fibres and technical textiles. Medium-volume manufacturers employ ca. 20 workers. Mean profit based on the invested capital varies from 10-60% depending on stocks. These activities differ by thousands of small jobs, especially in the cotton industry playing a key role in employment and profit, and they are often concentrated in particular regions. Many companies expand their intensive production into underdeveloped countries and the Mediterranean. Due to the geographic position of these countries, the EU manufacturers are able to change market requirements and to control the contents by management and quality of expanded production.

2. TEXTILE AND CLOTHING INDUSTRY OF THE EUROPEAN UNION

The textile and clothing industry belongs to one of the most important global industries in the world. It consists of important profit stocks and development of many countries in the world, and partly of developing countries. It accounts for 5.7% of the production value of the world's production in US$, 8.3% of the value of producer goods and more than 14% of world's employment. In the EU 120,000 textile and clothing companies employ more than 2 million workers, accounting for 7.6% of the total employees in the EU industry. Production and work force are characteristic of the corresponding degree of the regional concentration within the community. Most of the work force is female. Many companies expand their intensive production into underdeveloped countries and the Mediterranean. Due to the geographical position of these countries, the EU manufacturers are able to change market requirements and to control the contents by management and quality of expanded production. Investigations and technological development are also used by the EU countries as political means in the process of integration. Associate members participate in the total budget and pay the annual high membership dues, whereas their research institutes, universities, industry, small and medium sized companies simply take part in projects under the same conditions as EU member countries. The industrial policy of the European textile and clothing industry emphasizes the need for promoting innovation and clothing sectors by means of research, development and innovation, improvement of production quality and purchasing rationalization. The primary object of high technology cluster for competitiveness and continual development of the European textile industry is: to maintain research activities and development of new technologies, to define innovative strategies for better competitiveness and modernization of the European textile sector, to ensure new transfer mechanisms of terminating the expansion, compensation and application of thematic research network and technology, to increase the intensity of fundamental European textile researches by combining expert knowledge into a unique harmony by a connective project having a clear strategy.
The characteristics of the European clothing industry are as follows: accelerated transfer of production function first of all into East European countries which means abandoning labor-intensive production in Europe, market specialization and investments into modern and innovative technologies, intensified market access and internationalization as well as strategic links (1-4). The latter was especially presented as the only means of the survival of the textile branch and a good possibility of strengthening the position of companies by combining different sources. It is necessary to restructure the overall program at organizational, technological, financial, personnel and information level. It is given great significance to the development and application of intelligent systems, intelligent clothing, textiles, footwear and online system for automatic monitoring of the sewing process of high-quality garments. For example in Croatia investigations were carried out and the area for the application of intelligent carpet was found for the usage in apartments or houses in order to protect the household against undesired visitors (burglars). After the household members leave the house, the security code is switched on, and the sensor carpet enters the security system of the object (5).

3. SCANNING BY 3D BODY-SCANNERS

Cyberware WB4 of the whole body scanner will be used in the CAESAR project to make a high resolution of data about human body. The whole body is digitally represented by a color picture and by a series of data. All subjects will be scanned in three bodily postures. The scanner possesses four scanning heads projected by the horizontal laser on the subject. The subject can sit or stand on the scanning platform. The scanner can record a 2 m high and 1.2 m wide area (subject area). The whole body was scanned for 17 seconds. After finishing the scanning the digital idea is "closed", "Closing" is a process of combining the data by four scanning heads. A few types of data were generated in the Cyberware scanner and in the Cypie software package. The Cybeware scanner generates "unclosed" data or enters the data from each scanning head; they contain a series of information and colors. The Cypie software package combines all the data into one closed file (one file consists of 9 mb data in binary form of approximately 40 mb in ASCII form). Finished files are accessed on CD. Subjects dressed by standard and the momentary posture on the scanning platform are included in scanning. Standard garment parts for scanning include light green cotton shorts for bicycle riders, both for men and women, and a green sports woman's bra. A latex cap will cover the hair and ensure a better picture of head form. To understand the used data better, a list of 99 variations was collected in collaboration with police, automotive, clothing and space industries (2, 5-9). This system is installed and used for measurements at the Faculty of Technical Engineering, University of Bihac (6). To develop the method, efforts were made to obtain differences of these measurements. At the beginning CARLD Lab investigations used 99 variations of body measurements to determine how many subjects are necessary in the selection for the best range of models. Two of three postures for scanning are sitting and standing posture, in traditional anthropometric measurement. Standard scanned posture must obey some rules:

- to compare measurements precisely with traditional anthropometric variations,
- to be reproductive so that the subject is always scanned in the same manner,
- to position the body so that there is no shadow when scanning,
- to check whether anthropometric body measurement is used.

Traditional anthropometric sitting and standing posture is highly productive. A few scanners support effective 3D scanning. For example, traditional anthropometric standing posture implies that the arms are lowered, and the legs and ankles are gathered. In this position it is impossible for the scanner to see many shadows under the arms and between the legs (shadows are hidden within the knees and ankles). By keeping apart the arms and legs (keeping them away from the body) the scanner is able to record and register better and to recognize the arms and legs. Suggestions for sitting and standing posture in the CAESARE project are similar to the whole body with some changes of the posture of the arms and legs.
The standard anthropometric sitting posture implies that the arms and legs are joined in the knees. Placed horizontally the scanner laser does not reflect the light on the scanning head. Without this information it is difficult to determine and clear up measurements and determine details of the arms. To solve the dilemma, the CARD research plan made a sitting position and provided visibility. The result is not horizontal any more and can be seen by cameras. The arms are lifted towards the head, bent in the elbow. There is no shadow.

The 3D technology of body scanning has the following advantages: High resolution (1 to 3 mm), cheap and simple beginning (standard components), rapid scanning (procedure of measurement - 20 seconds), reliable data, simple for use, following process commands and simple use.

4. INTELLIGENT GARMENT MANUFACTURE

A change in CAD/CAD technology over the past years has increased the speed and development of new technological achievements. Fortunately, these achievements have encouraged and simplified garment manufacture, fabric utilization and easier mass production. Such a system replaces traditional production and inspires to innovations in garment designing. Technological development helped in the CAD/CAM function and provided a new way of applying the design system in production development. The technological space between 3D scanner and CAD/CAM production system is supplemented by the IPA software. NTU samples for cutting are linked with Lectra, making 2D/3D mathematical models for the manufacture of ladies' wear. Scanned data were analyzed according to the characteristic form so that by a special adaptation system garment samples can be made fitting perfectly. Today fashion industry is confronted with strategic challenges. Technology provides assistance to designers, manufacturers and retailers to overcome these challenges. Today's solutions are global from design over production to sales.

Modern software packages are implemented to solve the following:
- design,
- CAD,
- cutting area
- visual presentation,
- data about CAD/CAM equipment,
- automatic cutting systems,
- automatic spreading,
- plotters,
- textile digital printer and
- Internet communications platform.
On the world’s market there are the following CAD/CAM software packages for textiles and apparel available: APSO - development of CAD/CAM 3D visualization and editing of textile industrial and interior design, AUDACES - CAD/CAM for clothing, footwear, caps and bags, AUTOMETRIX - cutting system, sales software and CAD system for sewing technology industry, FashionCAD - CAD/CAM software for pattern design, Lectra systèmes - CAD/CAM for apparel, furniture, footwear and industrial textiles, NedGraphics - CAD/CAM supplies in the textile and clothing industry, OptiTex (new) - CAD/CAM for industrial sewing, Quest CAD/CAM provides independence of sales and services for CAD/CAM system applied in the textile and clothing industry. It is only a small number of examples of applied software packages. All these software packages enable the manufacture of clothing and footwear in an intelligent way as shown in Fig. 2 (1, 10-12).

![Figure 2: Intelligent method of the footwear production](image)

5. INTELLIGENT FOOTWEAR PRODUCTION

The fashion industry of today is faced with seven strategic challenges:

- price-cutting and productivity promotion
- to reduce time of marketing
- facing globalization activities
- development of security system of information exchange among employees
- exceptional quality
- to satisfy the needs of mass demand
- safe control and development of idea and trade mark.

To satisfy the seven strategic challenges, it is necessary to use new technologies. As aforesaid, so large numbers of software packages allow the company management to be located in one part of the world and the production site to be in another part of the world. One of such companies is LECTRA that developed LectraOnline Enterprise Exchange (LOEE). The Lectra on-line exchange is a safe exchange area via Internet which makes possible a good communication with business partners worldwide, at the right time, a safe environment and interactive process in the same document. This procedure ensures the company an increase in efficiency and a substantial reduction of prices as well as development time. Using the Lectra on-line exchange, it is possible to work interactively with business partners worldwide, to provide access via Internet to coloristic and ready product folders including graphics and fabric sketches, designs, specifications, patterns, trade mark etc. Without restriction of the size and type of the files, customers and salesmen can ensure pictures and drawings for the communication with partners, and they can be in another language or culture. The Lectra on-line exchange monitors which parameters work on the product and automatically informs via e-mail about any changes of the current product. By use of the the Lectra on-line exchange the costs for expensive data delivery can be reduced as well as for fax messages, mail and phone calls: electronic communications at the right time worldwide.
Centralization of the production information and better organization of the world's partner network:

- to centralize the whole files for one product or collection into organized folders for the collection, for the season etc.
- without restrictions of the organization, type and size of documents in the case of division and exchange
- less amount of double information about the product dispersed in workshops worldwide
- support by the WebDAV protocol allows a drag and flow of documents and folders directly between desktop and Lectra on-line exchange
- rapid organization of your world's partner network at a favorable price; together with support and training by the Lectra world's centre
- user-friendly security system; edited by professionals, intermediately accessible, only Web browser and Internet access are necessary
- available in 8 languages: English, French, German, Spanish, Portuguese, Japanese, simplified and traditional Chinese, Fig. 3.

The Lectra on-line exchange facilitates the exchange of patterns and brands at a great distance among production partners. Costs of failure and micro communications will be avoided by adapting patterns and brands in such a way that each partner can use them, regardless of file composing, size and experience. The Lectra teams provided a list of edited communications. The Lectra on-line exchange is open to the whole Lectra community including more than 10,000 Lectra customers and 60,000 users worldwide, and it is available to all their business partners, regardless of the site of their equipment.

![Figure 3: Concept of intelligent garment production](image)

To establish the best possible communication connection to the Laboratory containing a 3D body scanner for apparel and software support for footwear the Faculty of Technical Engineering, University of Bihac houses an Internet centre for remote learning (computer workshop with 20 or so most modern computers) and a Lectra-system for marker and cut production, Fig. 4 (14).
6. CONCLUSION

The development of 3D scanning technology is of great importance to the industry due to many reasons. This technology has a possibility of combining results of linear and non-linear bodily measurements; an imagined body is registered in the scanning process, and a description of bodily measures can be done in a few seconds. This technological process of describing bodily measurements is simpler and more accurate than manually registered measures. For possible storage of a great number of measurements it is possible to design clothing according to a unique form of the scanned human body. Scanning technology enables the measures to be in digital form and to be placed in the CAD system without human intervention, taking minimum time and possibility of faults. Textiles enter new fields of application increasingly, from aviation over medicine to construction; the application is multiple. Production communication is very important in the field of high technical textiles and garment manufacturing. The main goal is to find new possibilities for space technology in textiles and clothing. Technical textile intelligent clothing, smart materials and versatile electronics will play an important role in the future. Clothing includes a technology which will not only change fashion appearance, but also define the practicability of the new technology for better garment samples, including space technology which is at the beginning stage. An example of such a garment is a pair of Mamagoose pyjamas. A pair of Mamagoose pyjamas contains five sensors arranged in the area of breast and stomach, three of them monitor heartbeat, and two sensors monitor breathing. Double sensors guarantee accurate measurement. A special sensor is built into the garment and has no direct contact with the body and does not generate discomfort to the baby. A pair of Mamagoose pyjamas is made of two parts: the first one can be washed by machine and has no direct contact, whereas the second one with sensors is washed by hand. There are three sizes of pyjamas made from non-allergic fabrics and in a special design to protect sensors during use. The control alarm unit is connected with a pair of pyjamas and with the monitor for showing sensor data. It is programmed to monitor breathing and to alarm in the case of unexpected and dangerous situations. The data are stored before and after an alarm, in the situations which may be considered as dangerous. The following examples are: cold suit, intelligent shirt, intelligent jacket "Absolute Zero".
Based on theoretical and practical considerations of the situation of the European textile industry as well as on some major conclusive guidelines the following may be pointed out:

- By developing and applying modern intelligent systems one capital part in the production of equipment will remain relevant in medium-developed European countries.
- Technological projects with firm applicable solutions and application belong to future goals (15, 16).
- Programs of anthropometric measurements of the population have been started, having the improvement of old-fashioned systems of garment and footwear sizes in mind. In Croatia, such a program is being implemented under the title "Croatian Anthropometric System" (chief researcher is Ph.D. Darko Ujević).
- Only novel and modern techniques are the only possible way to achieve competitiveness and survival of the European textile, garment and footwear industry.

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