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

Abstract

The textile and clothing industry is one of the most important industries in Europe and around the world. Over the last fifteen years, numerous relocations have taken place and production capacities were moved to other production sites. The European Union is the largest world market of textile and clothing products. The recession which affected this sector resulted in an adequate response aimed at maintaining already established positions. In this paper, the authors suggest maintaining or creating more complex machinery and equipment, sewing robots and functional units in medium-developed industrial areas. We emphasise the significance and application of intelligent systems as a basis for improving companies' position within the European textile industry. Examples of initiatives of modern textile techniques in Bosnia & Herzegovina and Croatia are presented.

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

Introduction: The textile & clothing industry of the European Union

Over recent years, a growing trend to transfer textile production from EU firms to developing countries, especially in Asia, has been noted. It is known that a great difference exists between the levels of technical education and technological knowledge of those countries and developed European countries. Thus, the EU and its industry must take the responsibility for the quality of products which have been manufactured in these countries on the basis of European technology. EU industry shows higher productivity and responsibility for innovation, quality, creativity, design & fashion, permanent reconstruction and modernisation. The sector can adapt to new technologies to a greater extent regarding information, communication technologies and methods of new production.

EU industry has played a leading role in the development of new productions in the field of making textile fibres and technical textiles. Medium-volume manufacturers employ about 20 workers. Their mean profit based on the capital invested varies from 10-60%, depending on stocks. These activities cover thousands of small jobs, especially in the cotton industry, which play a key role in employment and profit. They are often concentrated in particular regions; many companies have expanded their intensive production into Mediterranean countries, and especially into underdeveloped countries. Due to the geographic position of these countries, the EU manufacturers can change market

requirements, and can control the market contents by management and quality of expanded production.

The textile and clothing industry belongs to one of the world's most important global industries. The development of many countries in the world, and to an extent of the developing countries also, is dependent on these industries. They account 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 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 EU industry. The production and work forces are characteristic of the corresponding degree of regional concentration within the community. Most of the work force is female [1]. Investigations and technological development are also used by EU countries as political means in the integration process. Associate members participate in the total budget and pay the high annual 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 trade of textile products in the European Union is regulated by agreements between the EU and third countries on the basis of technical and environmental regulations and rules. The internal trade of textile and clothing articles in the EU is regulated by the Agreement on Textiles and Clothing within the World Trade Organisation, which implies respect for the agreement's rules [2]. Euratex, the European Apparel

and Textile Organisation in Brussels ¹⁾, follows these regulations. The European Union is the largest world market of textile and clothing products. The recession volume which affected this sector has resulted in a response [3 - 5] whose aim is to maintain the positions already acquired. The industrial policy of the European textile and clothing industry emphasises the need for promoting innovation in the clothing sectors by means of research, development and innovation, improvement of production quality and purchasing rationalisation.

The primary objects of the high-technology for competitiveness and continual development of the European textile industry are as follows: to maintain research activities and the development of new technologies, to define innovative strategies for better competitiveness and modernisation of the European textile sector, to ensure new transfer mechanisms for terminating the expansion, the compensation and application of thematic research networks and technology, and to increase the intensity of fundamental European textile researches by combining expert knowledge into a unique harmony by means of a connective project with a clear strategy. The characteristics of the European clothing industry are as follows: accelerated transfer of production function, first of all into Eastern European countries (which means abandoning labour-intensive production in Europe), market specialisation and investments in modern and innovative technologies, intensified market access and internationalisation, as well as strategic links [6-9]. The latter was given

special emphasis as the only means of survival for the textile branch, and as a good opportunity to strengthen the position of companies by combining different sources. It is necessary to restructure the overall program at the organisational, technological, financial, personnel and information levels. Special emphasis should be placed on the development of textronics [10], which are of special significance to the development and application of intelligent systems, intelligent clothing, textiles and footwear, as well as online systems for automatically monitoring the sewing processes [19] of high-quality garments.

Researchers and managers in Bosnia & Herzegovina and Croatia have also received their own confirmation of the challenge existing in the world textile market. A spectacular example may be the investigation carried out in Croatia into the application of intelligent carpets for usage in apartments or houses in order to protect the household against undesired visitors (e. g. burglars). After the household members leave the house, a security code is switched on, and the sensor-equipped carpet enters the security system of the house [11].

The aim of this paper is to present some selected examples of research into the application of modern techniques in the clothing industry in Bosnia & Herzegovina and Croatia, and to draw conclusions for improving the competitiveness of the European Textile industry.

Bosnia & Herzegovina and Croatia's attempt of implementing modern techniques in the textile and clothing industry

Scanning by 3D body-scanners

An interesting scanning system developed by Human Solutions [12] with the use of 3D body-scanners was installed and used for measurements in the Faculty of Technical Engineering of the University of Bihać. The WB4 Cyberware program for the whole body scanner has been used in the CAESAR project to make high-resolution data of the human body. The whole body is digitally represented by a colour picture and by a series of data. All subjects are scanned in three bodily postures. The scanner possesses four scanning heads projected by a horizontal laser onto the subject.

The subject can sit or stand on the scanning platform. The scanner can record a subject area of up to 2 m height and 1.2 m width. The whole body is scanned for 17 seconds. After finishing the scanning, the digital image is 'closed'. 'Closing' is a process of combining the data from the four scanning heads. Several types of data were generated in the Cyberware scanner and in the Cypie software package. The Cyberware scanner can generate 'unclosed' data, or can enter the data from each scanning head; these contain a series of information and colours. The Cypir software package combines all the data into one closed file (one file consists of 9 megabytes of data in binary form, approximately 40 megabytes in ASCII form). The finished files are accessed on CD-ROM. Object dressed in standard cloths and their momentary position on the scanning platform are included in scanning. Standard garment parts for scanning include light green cotton shorts for bicycle riders (men and women), and a green sports bra. A latex cap covers the hair and ensures a better image of the form of the head. To better understand the data, a list of 99 variations was collected in collaboration with the police and the automotive, clothing and space industries [6-9, 11, 13]. To develop the method, efforts were made to obtain differences between these measurements. At the beginning, the CARLD Lab investigations-program used 99 body measurement variations to determine how many subjects are necessary in selection for the best range of models. Two of three scanning postures are the sitting and standing posture, as in traditional anthropometric measurement.

The standard scanned posture must follow certain rules:

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

The traditional anthropometric sitting and standing posture is highly productive. Several scanners support effective 3D scanning. For example, the traditional anthropometric standing posture implies that the arms are lowered, and the legs and ankles are held together. In this posi-

tion, it is impossible for the scanner to see many shadows under the arms and between the legs (shadows are hidden by the knees and ankles). By keeping the arms and legs apart (thus keeping them away from the body), the scanner is able to record and register more efficiently, and to recognise the arms and legs. The suggestions for sitting and standing postures in the CAESARE project are similar to the whole body, with some changes in the posture of the arms and legs.

The standard anthropometric sitting posture implies that the arms rest on the knees while the legs are closed together. When placed horizontally, the scanner laser does not reflect the light on the scanning head. Without this information, it is difficult to determine the measurements or the details of the arms. To solve the dilemma, the CARD research plan used a sitting position and provided visibility. The result is no longer horizontal, and can be seen by cameras. The arms are lifted towards the head, and bent at the elbow. No shadow is cast.

The 3D technology for body scanning has the following advantages: high resolution (1 to 3 mm), being cheap and simple to operate (by using standard components), rapid scanning (the measurement procedure lasts around 20 seconds), reliable data, ease of use, and the ability to follow process commands.

Intelligent garment manufacture

Another modern technology which will probably be introduced in our countries in the foreseeable future is intelligent garment manufacture. Changes in the CAD/CAM technology over recent years has increased the speed and development of new technological achievements. Fortunately, these achievements have encouraged and simplified garment manufacture, fabric utilisation and mass production. This kind of system replaces traditional production and inspires 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 the 3D scanner and the CAD/CAM production system is supplemented by the IPA software. NTU samples for cutting, for example, may be linked with Lectra (described further) [17], making 2D/3D mathematical models for the manufacture of clothing.

The scanned data is analysed according to the characteristic form, so that perfectly fitting garment samples can be made by a special adaptation system. Today, the 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, through production, and up to sales.

Modern software packages are being implemented to deal with the following areas: design, CAD, cutting area, visual presentation, data about CAD/CAM equipment, automatic cutting systems, automatic spreading, plotters, textile digital printer, and Internet communications platforms.

At present, the following CAD/CAM software packages for textiles and apparel are available on the world market: APSO –(development of CAD/CAM 3D visualisation 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 the sewing technology industry), FashionCAD –(CAD/CAM software for pattern design), Lectra systems – (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 the CAD/CAM system applied in the textile and clothing industry). This is only a small proportion of the examples of software packages which are currently applied. All of them enable the manufacture of clothing and footwear in an intelligent way, and should be taken into consideration when selecting which future system should be implemented.

Intelligent clothing and footwear production

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

- price-cutting and productivity promotion,
- reducing marketing time,
- facing globalisation activities,
- developing a secure system for information exchange among employees,
- exceptional quality,
- satisfying the needs of mass demand, and

- safe control and development of an idea and a trade mark.

To satisfy the seven strategic challenges, it is necessary to use new technologies. As mentioned above, many software packages allow the company management to be located in one part of the world and the production site to be in another. The Faculty of Technical Engineering of the University of Bilić has adapted the LectraOnline Enterprise Exchange (LOEE) system. Developed by Lectra, a US company, and dedicated to intelligent clothing and footwear production, the Lectra on-line exchange is a secure Internet exchange area which permits good communication between business partners worldwide at the right time, a safe environment, and an interactive process of preparing the manufacture and safe documentations. This procedure guarantees the company an increase in efficiency and a substantial reduction of both prices and development time. Using the Lectra on-line exchange, it is possible to work interactively with business partners worldwide, to provide access via the Internet to colourists, dyeing and printing specialists, and ready-made product folders including graphics and fabric sketches, designs, specifications, patterns, trade marks etc. Without any restriction on the size and type of the files, customers and salesmen can prepare pictures and drawings for communication with partners, even in another language or culture. The Lectra on-line exchange monitors which parameters work on the product, and automatically informs users via e-mail about any changes to the current product. Costs for expensive data delivery can be reduced as well as for fax messages, mail and phone calls, by using electronic communications worldwide.

Centralisation of production information and better organisation of the worldwide partner network is achieved by:

- centralising the whole files for one product or collection into organised folders by the collection, by the season, etc.;
- liquidating the restrictions of organisation, type and size of documents in the case of division and exchange;
- less repeated information about the product dispersed in workshops worldwide;
- support by the WebDAV protocol, which allows drag-and-drop of documents and folders directly between the

user's desktop and the Lectra on-line exchange;

- rapid organisation of individual worldwide partner networks at a favourable price, together with support and training by the Lectra international centre;
- a user-friendly security system which is edited by professionals, intermediately accessible, only Web browser and Internet access are necessary;
- documents available in 8 languages: English, French, German, Spanish, Portuguese, Japanese, simplified and traditional Chinese.

The Lectra on-line exchange facilitates enables 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 fileformat, 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 location of their equipment. Our University has compiled a considerable amount of experience concerned with this system, both for production and for learning.

To establish the best possible communication connection to our Laboratory containing a 3D body scanner for apparel and software support for clothing and footwear, the Faculty of Technical Engineering of the University of Bihać houses an Internet centre for remote learning (computer workshop with information desks for students, with 20 modern computers) and a Lectra system for marker and cut production [14].

Summary

Textiles are increasingly entering new fields of application, from aviation over medicine to construction; they have multiple applications. Production communication is very important in the field of high-level technical textiles and garment manufacturing. The main goal is to find new possibilities for space technology in textiles and clothing. Intelligent technical textile clothing, smart materials and versatile electronics will play an important role in the future. Clothing includes technology which will not only change fashion appearance, but will also define

the practicability of the new technology for better garment samples, including space technology which is at its initial stage. The development of new textile fields also requires new technologies.

The development of 3D scanning technology is of great importance to the industry for many reasons. This technology can combine the 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 carried out in a few seconds. This technological process of describing bodily measurements is simpler and more accurate than manually registered measures. For storing 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, thus taking up a minimum of time and reducing the possibility of faults.

Conclusions

Based on theoretical and practical considerations of the situation of the European textile industry, as well as on some major conclusive guidelines, the following conclusions may be drawn:

- By developing and applying modern intelligent systems, a significant part of the production of equipment will remain relevant in medium-developed European countries.
- Technological projects with applicable solutions and application are among our industry's future goals [15, 16].
- Programs for anthropometric measurements which have been started should be developed, bearing the improvement of old-fashioned systems of garment and footwear sizes in mind [2].
- Novel and modern techniques are the only possible way to achieve competitiveness and ensure the survival of the European textile, garment and footwear industries.

Editorial note:

- 1) <http://www.euratex.org>
- 2) In Croatia, such a program is being implemented under the title of the 'Croatian Anthropometric System', directed by the researcher Darko Ujević Ph.D. [18].

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