FINANCIAL ASPECTS OF NANOTECHNOLOGY IN THE POLISH TEXTILE INDUSTRY

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Abstract

The situation of many Polish textile producers is difficult. Lifting import quotas on textile products following Polish accession to the EU and the Schengen zone resulted in vast increase in supply of apparel and textile products, mainly from Asian countries. According to the recommendation of the European Commission, one of the methods to remain competitive against low prices offered by China or India is to offer innovative products of considerably better quality. Unfortunately, it is estimated that only 25% of all textile enterprises innovate and most of the innovation occurs through imitation. While most Polish companies limit their expenses on R&D activities by adapting external ideas to local needs, some attempt to create competitive advantage by introducing more advanced technologies. Nanotechnology is providing for solutions that may help businesses gain technological advantage. This article presents the financial aspects of the introduction of antibacterial and bacteriostatic fabrics.

Keywords: nanotechnology, Polish textile sector, financing, innovation.

INTRODUCTION

Since the beginning of the XXI century, we have witnessed the shrinkage of the Polish textile industry. Once famous and prosperous Polish spinning and weaving mills either go bankrupt, become liquidated or are forced to face uneven competition against Asian companies. This competition is not easy since China and India are the two world’s largest economies as far as the textile industry is concerned. According to the information given by Gdynia Cotton Association, it is expected that the share of China and India in the world cotton consumption will amount to 57% in the 2010/2011 season [1]. Cheap yarns, cloths, fabrics and clothes are extensively exported to the EU from the emerging countries which successfully blocks the development of EU internal textile markets. For Poland it is not the only problem influencing the state of textile industry. There are many factors which had a large impact on the state of the Polish textile market.

One of them was a huge amount of textiles imported from Turkey after entering into force of the Free Trade Agreement between the Republic of Poland and the Republic of Turkey signed October 4, 1999 [2]. In year 2001 Polish exports to Turkey amounted to $138 million, whilst imports from Turkey were more than $250 million greater [3]. In the year 2005 those numbers were much higher, since export was on the level of $1,193.6 million and import amounted to $1,300.8 million. Most of these referred to the exchange of goods from the electro-mechanical industry, but still 27.5% ($361.6 million) of imported goods concerned the light industry along with textiles.

Another factor which contributed to the poor condition of Polish textile market was the growth of the underground economy and the illegal import of textile goods. According to the research of the World Bank [4], Poland ranks as 52 among 162 countries as far as the share of the underground economy in the whole economy is concerned. It is worth to point out that only 8 EU countries ranked behind Poland. In our country the underground economy and illegal import refers mainly to the light industry. Radosław Kalinowski – the sales manager of Andropol S.A. – estimates that at the moment (14.10.2010 [5]) least 50% of imported textile goods is not subjected to any supervision from the side of the government. This state acts against many companies that often fail in the struggle against unfair competitors. This phenomenon is particularly visible in the region of Łódź, which was once famous for its highly developed textile industry. From numerous knitting, weaving, spinning mills and companies producing synthetic fibres, which constituted the cradle of
Polish textile industry there is only a few that are still active on the market. Instead of those companies, we can find many salesmen and retailers selling cheap, imported textiles and fibres which sometimes happen to come from unknown sources. It is true that phenomena of illegal import and underground economy are not new, but recently their impact on Polish textile market became more significant. After the Polish accession to the Schengen Zone due to almost total elimination of boarder controls such practices became much easier, hence also more frequent. Polish accession to the EU also partially influenced the state of the textile market in our country. On the one hand the enlarged output market for many goods constituted tremendous export potential, but on the other it resulted in increased competition. Along with sometimes costly compliance with new regulations imposed by the EU (e.g. the REACH - Registration, Evaluation and Authorisation of Chemicals which influenced mainly the chemical industry but also companies such as dyeing mills) the situation led to the bankruptcy some enterprises.

Another factor working against the Polish textile industry were the actions of the WTO that aimed at liberalizing trade. On the January 1, 2005 ended the process of removing quotas imposed by the WTO on textile trade between developed and emerging countries. The establishment of such restrictions was possible on the basis of the Multi-Fibre Agreement from January 1, 1974. According to the MFA, emerging economies negotiated maximum quantities of supplies to the markets of importers (developed countries). This agreement ended on December 31, 1994 and on January 1, 1995 has been replaced by an Agreement on Textile and Clothing which was one of the outcomes of the Uruguay Round. The general aim of this agreement was to apply (and gradually diminish) protection for textile and clothing goods after an expiry of the MFA. As a result of the ATC those goods were fully included into general GATT rules and elimination of restrictions imposed by the MFA. It should be noted that Poland was a member of both MFA and ATC (the latter included all the member countries that had ratified an agreement with the WTO). Since the expiry of the ATC, the trade of textiles and clothing goods became more liberal and is regulated only by the general principles and rules of WTO which do not impose any quantitative restrictions. Naturally there exist anti-dumping procedures, but their implementation is costly, time-consuming and in most cases requires a joint initiative of many companies, so in practice they are rarely used. Countries like China on the other hand use this situation and India which has a possibility to dominate previously protected markets. Those were only a few examples of factors which have influenced the situation of Polish textile industry. One can probably add many more items to this list, but examples quoted here were used only to illustrate the general situation and to answer the question why is the condition of Polish textile industry different from the one in other EU countries e.g. Germany or Greece.

1. THE RESPONSE OF EU – THE HIGH LEVEL GROUP

Some of the issues listed in the previous point have affected the entire EU (e.g. the end of ATC and the strong expansion of China and India to the west), so in 2004 the European Commission established the High Level Group [6]. This group consisted of representatives of European Commission as well as chosen entrepreneurs, traders, importers and members of local associations strongly related to textile and clothing market. The main goal of the HLG was to investigate the situation and to give recommendations to improve the competitiveness of the textile sector and to stimulate its future development. The High Level Group presented its findings in a report from June 30, 2004 [7] entitled “European textiles and clothing in a quota-free environment” with further amendments added on September 18, 2006 [8]. The High Level Group stated that “imports have grown following the end of the quota system, but their overall increases in both volume and value have been somewhat less than might have been feared” and that the EU should be able to maintain its technological lead at least up to the year 2020. It has been written that, according to the HLG, the textile sector requires restructuring and it is advisable for companies from this sector to cooperate and invest in development and innovations. Innovations were presented as a logical step aiming at increasing the competitiveness of the sector. Many entrepreneurs were aware of that fact long before the publication of the report.
2. INNOVATIVENESS OF THE T/C SECTOR IN NUMBERS

Analysing product innovations in the textile sector in the time span from years 2000 to 2010 one can observe that many innovative solutions from flame-retardant, heat-proof, antibacterial, bacteriostatic, water proof, oil or abrasive resistant fabrics to polypropylene and aramid yarns to smart and intelligent fabrics which can sense and react to environmental stimuli were introduced to the market. In spite of that, the textile industry is regarded as a low-tech and rather not innovative sector. The confirmation of such thesis one can find in many publications, e.g. in the report from NetFinTex project [9] and the sectoral report of Europe INNOVA [10]. The first document summarizes the NetFinTex project launched in November 2005, coordinated by EURATEX and financed by the European Commission’s 6th Framework Programme. Part of this report summarizes the research over companies from Belgium, Poland, Germany and Italy (1,500 companies were addressed with approximately 10% return rate) in terms of their R&D activities, means of innovation financing, etc. The other document is a sectoral report of Europe INNOVA which is an initiative of European Commission’s Directorate General Enterprise and Industry which for innovation professionals aiming at reporting and helping enterprises innovate faster and better. The afore-named report was published on 10.05.2008 as the part of “Sectoral innovation systems in Europe: monitoring, analysing trends and identifying challenges” edited by Michael Böheim from the Austrian Institute of Economic Research (WIFO). Information from the report were collected having analysed the course of the Innovation Watch – SYSTEMATIC project. In both reports one can find many references to the situation of Polish textile market. In the Europe INNOVA sectoral report textiles are presented as a low-tech with small share of innovating firms (25%). In this sector innovations occur mostly through diffusion 12%. The share of intermittent and strategic innovations is 10% and 4% respectively [10]. The currently prevailing trend in textile innovation is adapting new technologies to already existing products and simultaneous R&D investments. Unfortunately such investments in textile sector are on the level of 1% (the average of remaining 9 sectors equals 9.5%) whilst the competition index above the mean value for other sectors (0.71 in textiles, 0.66 for other sectors) [10]. According to Europe INNOVA report it also appears that the relationship between innovation and the amount of competition in the T/C sector is reversed compared to other Systematic sectors. The literature suggests inverted U-shaped or linear relation, but the T/C sector follows different pattern. According to the graph (Figure 1) with increasing competition (by low competition index) the intensity of R&D falls down, the inflexion point occurs at the competition index equal to 0.6 and after that point the R&D intensity raises swiftly – the relation can be therefore described as a U-shaped one.

![Fig. 1 The shape of the relationship between competition and R&D intensity](image)

Source: Sector Report – “Sectoral innovation systems in Europe: monitoring, analysing trends and identifying challenges”, Michael Böheim, Austrian Institute of Economic Research (WIFO), Vienna, 10.05.2008

Theoretically when the competition index in the T/C sector is above average the R&D intensity should be high. In Poland with above average competition index [2] this is not the case. In order to explain this, one should take into account one more relation – the dependence between R&D intensity and a technological gap of companies in the sector with reference to the world’s leaders. If the gap was equal to 0, the function would become a constant indicating no influence in R&D intensity and meaning that the country is on the level of technological frontier (Fig 2)
Poland is one of the countries where relatively high competition index does not indicate intensive R&D actions. When the technological gap is greater than 130% it starts to have a negative influence on R&D [10]. Such phenomenon takes place also in Czech Republic, Slovakia, Hungary and Portugal. Despite such afflictive information, recent changes in the T/C sector were appreciated. It was written that in the span of last two decades the industry “has undergone significant restructuring and modernisation efforts increasing productivity throughout the production chain, and reorienting production towards innovative, high-quality products”[10]. It has been emphasised that the T/C sector suffers from underestimation in terms of innovativeness, because companies in this sector tend to invest in non-technological innovation which is statistically invisible. There are also numerous examples of innovative companies, like EYBL or ELMARCO [10] which through their intensive research on nanotechnology and nanofibres managed to improve their products and gained competitive advantage. This proves that in spite of the state of the sector R&D actions are still vital for innovation’s success. Among many European companies from the T/C industry like e.g.: F.M.Hämmerle Textilwerke GmbH & Co KG, Merina a.s., Vútch-Chemitex s.r.o., Chemosvit Fibrochem a.s., H&M, ZARA/Inditex, Adidas, Puma or Christian Dior, there is one Polish company – Tricomed. It was presented as one of the leaders in terms of innovativeness and a company which heavily invest in R&D – 30% of employees are scientists. Tricomed used the knowledge gained by the research department to invent extremely good products like CODOFIX dressing nets. Unfortunately a set of wrong decisions combined with the change of management and company’s acquisition by TZMO caused the loss of company’s position on the market.

Apart from some market leaders like LPP (being a leader in the T/C sector in Poland) Polish companies resemble the pan-European trend of textile industry being low R&D intensive. The situation of Polish textile industry is even worse than in many European countries which is visible in the second of aforementioned reports. According to the NetFinTex entrepreneur’s survey, only 50% of the Polish textile companies confirm that they invest in innovation (in other questioned countries the result reached 85%) and only 13% declare any R&D activities (overall value among respondents was over 50%) [9]. Additionally more than 50% companies are marketing innovations [10]. It follows from the content of the report that Polish companies more often than their counterparts from other countries protect their intellectual property using trademarks or brands [9]. On the other hand questioned Polish companies practically did not have patent application. Patents and the outlays on R&D are the two most important indicators of the innovativeness. It should be noted that, according to the research, Polish companies spend over 2.5% of their turnovers on scientific research and development of new products which is the best result among 18 countries listed in the comparison. [10] Similar values (around 2.3%) were noted by Greece, Belgium, Lithuania and Sweden. T/C enterprises from Hungary, Greece, Portugal and Cyprus spend about 1% of their turnovers on R&D and the EU average was a little over 1.6%. This result does not stem from the fact that Polish companies are R&D intensive, but it rather origins in their relatively small turnovers. Polish companies indeed invest high percentage of their turnovers in research but the real values are considerably smaller than in most foreign enterprises. Currently there are only a few companies of relatively stable position on the market and appropriate funds which are able to measure up to foreign competitors. Formerly a fine example of such enterprises were Polish spinning mills, but nowadays none of five biggest spinning mills ('Prędzalnia
Zawiercie S.A., WIMA S.A., ELKO Sp. z o.o., Polontex and Przędzalnia Andropol) continue their production activity. Similar, but slightly better situation occurs in other branches of the textile industry.

3. R&D FINANCING ACTIVITIES AMONG THE POLISH TEXTILE COMPANIES

In the age of shrinking textile market many corporations limit their investments and tend to focus on and develop one flagship product to gain competitive advantage. Not many companies are willing to take a risk and invest in research and development of many products simultaneously. Some bigger companies like Teofilów (knitting mill), Andropol (finishing mill) or some enterprises from clothing industry are active in terms of innovation and development, but still compared to the rest of the Europe Poland does not come out well. Our country is below average not only in terms of the number of innovative companies, number of innovative objects that use patents to protect their intellectual property, but also as far as the total sales of innovative products is concerned.

A situation is slightly different when it comes to statistics about the number of innovators collaborating with other agents (including universities). Most of Polish textile companies do not possess sufficient funds to create their own laboratory or R&D department, so they often outsource such activities to external agents. A perfect example of such an external research unit could be the Textile Research Institute of the Technical University of Lodz, which was very active in this field over the span of last 10 years. The Institute collaborated with many companies and managed to develop e.g. protective clothes for firemen, antibacterial materials for medical purpose, etc. Scientists from the Textile Research Institute not only work on developing different, innovative materials like functional nano- and micro textiles or barrier fabrics for the protection against harmful environmental influences, but they also actively cooperate with other units within e.g. Polish Federation of Apparel & Textiles or Gdynia Cotton Association [1]. Cooperation within such units is however not optimal since companies perceive other companies as potential competitors. Because of that they do not share all the information they possess thus full collaboration is impossible.

4. POLISH TEXTILE SECTOR ON THE EXAMPLE OF BACTERIOSTATIC FIBRES

If the situation of the Polish textile market looks as presented, how does the sector innovate? Innovation is mostly connected either with adapting already existing, foreign products to local needs or with cooperating with foreign companies and introducing their products to the Polish market. That way companies limit their failure probability and introduce innovative products at a relatively low cost. The overall situation of textiles as far as innovations are concerned is perfectly resembled by aforementioned antibacterial and bacteriostatic materials. Recently antibacterial properties of materials were high on agenda: companies start to implement it into many products from cosmetics to ceramics, furinute, mattresses to fibres and clothes. One of the first Polish textile companies which started to develop antibacterial products was Andrychowskie Zakłady Przemysłu Bawełnianego Andropol S.A. Since 1999 the company worked in collaboration with a Textile Research Institute of the Technical University of Lodz on a project partially financed by state budget aiming at developing special antibacterial materials for the medical industry (project was named “Przędze i tkaniny antybakterijne na poście i odzież dla służby zdrowia”). Successful cooperation of both units led to introduction of new bacteriostatic products to the market in 2003. Such fabrics were said to effectively diminish the risk of infections in hospitals, but despite the availability of a ready product there was no demand for it.

The majority of patent applications was created in collaboration with external research units (in this case all were called for in cooperation with the Technical University of Lodz or the Textile Research Institute). Information from the Patent Office of the Republic of Poland confirm that the most popular form of securing protected knowledge is using trademarks or brands. The above list also confirms that the number of patent applications is relatively low, but sufficient to protect a few most popular methods of obtaining antibacterial and bacteriostatic properties in textile products. Currently there exist a few different methods of incorporating
antibacterial properties to fibres and yarns - two methods proposed by Andropol S.A., the use of NAVIA™ products, Purista® technology used by the Fereti company and many others like Tencel® with aloe-vera layer in Gluck products to name a few. The first two methods were developed by Andropol S.A. together with scientists from the technical University of Lodz. The first one introduces bacteriostatic properties by incorporation of 2-hydroxy-4,2,4’trichlorobiphenyl (Anvasan AM 110 new). The fabric must be appropriately prepared, subjected to bioactive agent, dyebathed and subjected to anticontractile finishing. Andropol S.A. used such a technique to produce medical fabrics. The second method used by this company utilizes silver nanoparticles. The first step is to prepare a mixture containing Ag nanoparticles (the method used to create such a mixture was patented by the Technical University of Lodz), water as well as binding and condensing agents. Such mixture is later applied to various textile products with the use of printing, spraying or coating techniques. Another example of a substance which gains recognition in terms of its bacteriostatic properties is silica with nanoparticles of silver V1. The idea for such a product was imported from abroad and developed in Poland by POCH S.A. which is a part of Kulczyk Holding. Product exhibits bacteriostatic properties – inhibits the growth of bacteria and eliminates nasty odors. 16.01.2008 POCH's silica gained acceptance of the Ministry of Health and was allowed to the market as a bactericidal product. The market name of this substance is NAVIA™. In cooperation with Webertex S.A., POCH S.A. developed the technology of its application to textile goods. After Webertex S.A. filed a petition for bankruptcy, the product was adopted by Thanfarb S.A. and its application method was improved by this company in order to keep optimal bacteriostatic parameters for a longer time. Aforementioned Fereti company is a well known manufacturer of baby bedding. The company enhances its products with Purista® fabrics. The technology comes from the United States and is said to be a durable antimicrobial treatment that helps to control the bacteria growth. Each of presented companies tries to gain their competitive advantage using different approaches to the same type of innovation. At present Andropol S.A. is one of the biggest Polish textile companies. It is recognized as the leader in the production of military fabrics for the Polish army as well as produces many different types of fabrics. Their bacteriostatic fabrics for medical purposes are said to demonstrate bactericidal properties after 50 washing cycles. Tkanfarb claims that their technology is even more stable and can keep 85% of their original antibacterial properties after 70 washing cycles. Fereti on the other hand specializes in baby beddings and tries to increase their market share by narrowing the target group of potential customers. Also many other products are available on the market of antibacterial textiles but which of them will gain recognition among the customers will be verified by the market.

CONCLUSIONS

The end of the MFA and ATC in connection with other factors like an agreement with the Republic of Turkey about the free trade and the Polish accession to the Schengen zone had a harmful effect on the Polish textile sector. The sector is globally considered as a low-tech and low R&D intensive [10], but it Poland the situation is even worse. Polish, once prosperous, spinning, weaving, dyeing and finishing mills no longer operate and the market is filled with cheap Asian products. What is more countries like China or India constantly improve the quality of their products while managing to keep extremely low prices. Despite this fact there are companies in the textile sector with a strong position on the market which are constantly searching for possibilities to become more competitive. In order to do that they invest in research and development which not only secures their position on the market, but also helps them to be abreast of new technologies. The example of antibacterial and bacteriostatic fabrics shows that innovation in the textile sector is not only possible but also necessary to increase the competitiveness of the sector and to gain advantage over cheap Asian imports. This situation can be generalized to other branches of textile sector, since the situation in terms of innovativeness is common for the whole sector. The presented example also points out that the majority of innovations base on foreign ideas. It stems from the fact that Polish companies do not possess sufficient funds to invest in their own R&D departments or to develop many products at the same time. Polish textile companies prefer to securely invest in one flagship product and minimize the risk of losing the position on the market.
LITERATURE


[6.] European Commission – High Level Group, 2011


