
IMPACT OF CHANGES IN THE POLISH LABOR MARKET ON THE IMPLEMENTATION OF TECHNOLOGICAL INNOVATION – CASE STUDY OF A COMPANY IN THE CONFECTIONERY INDUSTRY

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Introduction

The main constructs used in this paper are technological innovation and labor market. As Ph. Kotler (2004, p. 34) points out, innovation is the basis of competitive strategy today. In the literature we can find different approaches to the definition of innovation. Some of them treat innovation as a process while others focus on the final result of this process. J. Schumpeter (1960, p. 104) is widely believed to be a pioneer of the concept of innovation. He associated innovation with launching new products or implementing new production methods, entering new markets, finding new sources of raw materials and introducing new management methods. Some definitions treat innovation as something completely new (Nasierowski, 1997, pp. 45–46) while others include using the work of others (Stawasz, 1999, p. 47). The second approach is the most popular in the subject literature nowadays.

The technological environment and socio-economic environment are growing rapidly, which allows for the creation of new management systems (Jamali, 2005, pp. 104–105). Technologies are “rules and ideas which

control the methods of producing goods and providing services” (Kemeny, 2010, pp. 1543–1554). Technological innovations, therefore, are new rules and ideas about what to produce and how to produce it. They are very often connected with the concept of Industry 4.0. The term „the Fourth Industrial Revolution” comes from a strategic project of the German government which promotes computerization of production processes (Imkamp et al., 2016, pp. 325–335).

Literature studies indicate that the creation of demand for labor is the most frequently discussed problem, combining the innovations of our interest with the labor market (which covers all issues related to influencing labor supply and demand). Different authors (Capello, Lenzi, 2013, pp. 322–353) focus primarily on the changes in the job market resulting from Industry 4.0. We can call these changes secondary ones. There is a lack of detailed studies on the stimulating role of the changes in the job market as factors of implementing the technological changes in different industries. Therefore, the main purpose of the



article is to present the impact of quantitative changes in the Polish labor market, related to labor supply and labor cost, on the implementation of new technological solutions in the confectionery industry. In particular, an attempt has been made to answer the following research questions:

RQ1: Has the issue of the relationship between changes in labor market as factors of technological innovation been covered in the publications from the last ten years?

RQ2: How the changes in the Polish labor market impact the implementation of technological innovation in the confectionery industry?

The theoretical and empirical nature of the article is reflected in the scientific methods used. In order to achieve their aim the authors used literature studies and a case study of a confectionery company.

The structure of the paper is divided into the following sections. First, the authors present the background of the theoretical foundation which includes two issues, i.e. technological innovation as a driving force for changes in the labor market and characteristics of the confectionery industry in Poland in the context of the situation on the labor market. Then, a justification of the case study method is presented and the results of the research process are described. In the conclusion the authors also present directions for further research.

General literature background

Changes in technologies and their implications for the labor market

As indicated earlier, the analysis of scientific publication databases (Web of Science and Scopus) was used to answer RQ1. The following keywords were used: „process innovation” and „technological innovation” (treated as synonyms), „Industry 4.0” and „Fourth Industrial revolution” in connection with „labor market”. The authors were primarily interested in publications from the last ten years. The four combination of key words were used during the search in two databases. The statistics of the number of

the publications, which were found for each combination are presented in Table 1. The Scopus database includes the highest number of publications combining the issue of technological innovation with the labor market.

As it was indicated in the introduction, the attention of scientists is focused above all on the impact of the technological innovation associated with the Fourth Industrial Revolution on the labor market (Piwowar-Sulej, Podsiadły, 2019a). This revolution is characterized by a combination of equipment, software and communication, with particular emphasis on the last factor. Communication in this case relates to communication between intelligent machines using shared data and building networks. Thanks to the speed of this communication, improvements in key performance indicators are possible (Soldaty, 2017, pp. 6–16).

The implementation of the idea of Industry 4.0 begins with the automation of production processes and depends on the simultaneous collection, transformation and exchange of huge quantities of data through the entire production process. To this end, it is necessary to utilize computer networks, the Internet and cloud computing. Intelligent networks of machines should combine Virtual Machining with real resources. The real resources also include employee potential, which can be analyzed in terms of quantity (number of employees) and quality (traits such as skills, experience, motivation etc.).

The rapid growth of technology shortens product life cycles. Because knowledge of technology quickly becomes obsolete, people are forced to relearn certain processes and procedures. The employees of the future will not perform as many simple repetitive tasks as they do today – machines will do them. The Internet will stimulate virtualization of work. There will be more and more contracts concluded with the use of cloud computing between employers and freelancers. The ability to monitor not only their work but also their other activities will expand as well (Piwowar-Sulej, 2018, pp. 121–129).

L. Ilie and I. Bondrea (2016, pp. 80–87) analyzed the impact of technological innovation on the availability of jobs and on the requirements as to the skills of the

Table 1. The statistics of publications discussing the research problem in the last ten years

Keywords and database	Year of publication									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Process innovation + labor market (WoS)	2	1	2	3	2	9	1	3	3	3
Process innovation + labor market (Scopus)	87	103	133	150	120	127	136	161	158	253
Technological innovation + labor market (WoS)	7	8	4	2	1	9	14	9	16	10
Technological innovation + labor market (Scopus)	297	357	451	429	402	460	450	514	599	695
Industry 4.0 + labor market (WoS)	0	0	0	0	0	0	1	20	23	30
Industry 4.0 + labor market (Scopus)	0	0	0	1	2	6	19	64	138	292
Fourth Industrial revolution + labor market (WoS)	0	0	0	0	0	0	1	8	10	12
Fourth Industrial revolution + labor market (Scopus)	0	0	0	0	0	0	13	72	155	244

Source: authors' compilation

employee of the future. The list of competencies of future employees includes interdisciplinarity, creative thinking and the ability to adapt, new media literacy, analytical skills and the ability to work in virtual teams (Davies et al., 2011, pp. 8–12). The analysis of the required competencies conducted in 2013 among Polish employers showed that the employers – regardless of the industry – had formulated many expectations towards office workers (e.g., organizational skills, interpersonal skills, technical skills, computer literacy and cognitive skills) (Górniak, 2014, p. 42).

A. M. Świątkowski (2018, pp. 1–9) identifies the Fourth Industrial Revolution with the growth of atypical forms of employment characterized by greater flexibility (including the ease of dismissing employee). According to Boston Consulting Group, by the 2025 there will be approximately 350,000 new professions (Lorenz et al., 2015). The demand for highly qualified people will increase while jobs for less qualified people will be reduced (Weber, 2016). These changes are already in progress. Research conducted by the OECD indicates that such changes are more visible on the USA labor market than on the European labor market (Spermann, 2016, pp. 335–346). In the report „Active People+ Future of Labor Market” it is stressed that in order to stay employed people should use a variety of competencies (including strategic, business and IT skills) when faced with a challenge. An employee who can use and combine these competencies is called an e-leader. By 2020 the European Union Economy will need as many as 1,000,000 such employees (Lisowska, 2017).

The last industrial revolution can be observed in the largest factories of the electromechanical, metallurgical and chemical industries. Implementation of innovation makes it possible to gain a competitive advantage for the confectionery industry as well. The companies from this industry are trying to overcome many challenges. The first challenge is the supply of essential raw materials such as cocoa beans. On the one hand, the demand for chocolate goods is growing as a result of increasing consumption in the developing countries, while on the other hand, cocoa bean production remains at the same level. This is due to limited arable land and the intensive farming methods which deplete the soil of essential nutrients. The deficit of cocoa beans in 2013 was 7,000 tons. The main chocolate producers predict that this deficit may reach the level of one million tons by 2020 and would be as high as two million tons by 2030. The situation will have an impact on the production costs, which will result in rising prices or falling profit margins (Fold, 2001, pp. 405–420). The second challenge for this industry is the problem with recruitment, which is related to the increase of the labor cost and high demand for the labor

The development of the confectionery industry in Poland in the context of the labor market

In Poland, until 1989 all chocolate producers were members of the Confectionery Industry Union, which was the result of industrial nationalization and the economic system based on central planning. Although the Polish economic system was characterized by fewer regulations

in comparison with other socialist countries (Onufer, 2004, pp. 133–139), all strategic decisions were made at the highest level of the union’s management board. These decisions were connected with the product of particular factories, production output, raw material procurement and the size and structure of the workforce (for more see Kornai, 1985, pp. 43–49). This situation changed as a result of the revolutionary system transformation and privatization in December 1989. The parliament passed ten bills proposed by the finance minister, Professor Leszek Balcerowicz (Bałtowski, Kozarzewski, 2016, pp. 405–419). The transition from a centrally controlled economy to a free market economy introduced changes in the confectionery industry as well. The 1990s saw a dynamic growth of the confectionery market in Poland. This growth was based on three pillars (Piwowar-Sulej, Podsiady, 2019, pp. 166–167). The first pillar was the growth of existing Polish companies using their own capital. Colian Holding Inc., Wawel Inc, Mieszko Inc., Solidarność LLC, Skawa Inc., Śnieżka-Invest LLC, Odra LLC, Kopernik Inc. and Otmóchów Inc. are examples of companies that took this path. The second pillar was the establishment of new and family-owned businesses which would operate on the local market (Delic-Pol, Dr Gerard. Terravita LLC. and Union Chocolate LLC). The third pillar was direct foreign investments made by multinational confectionery corporations. This investment was made in both privatized Polish factories and greenfield production plants. The former type of investment is exemplified by the merger of PepsiCo and Wedel, the acquisition of Gopłana by Nestle and Kraft Foods’s investment in Olza. Such market players as Cadbury, Stollwerck, Mars and Ferrero decided to set up greenfield plants (Cadbury in Bielany Wrocławskie, Stollwerck in Jankowice, Mars in Sochaczew, and Ferrero in Bielsko Duże).

From 1991 to 1998 foreign investment in the Polish confectionery market came to USD 980.5 million, 40% of which was in greenfield sites (Wasiewicz, 2006). This situation was caused by the huge demand on the Polish confectionery market. Until 1989 the availability of confectionery goods was limited or even rationed. Between 1993 and 1995 the average consumption of chocolate and other confectionery goods in Poland was 0.36 kg per person per month, which was several times lower than that of countries such as Switzerland, Germany, Belgium, Great Britain and France. Foreign producers who recognized the opportunity to increase their sales eagerly invested in the new market. Their main goals were to improve their market share and to build brand awareness.

In the 1990s labor costs were not a crucial element of companies’ strategies because of the high unemployment rate and low wages in Poland. In 1996 the total annual labor cost per employee was USD 5,424 while the average cost among European Union member states was USD 33,572 (Stasiak, 2006, pp. 73–85). The average unemployment rate in the same period was 14% (Central Statistical Office, 2019). Companies did not have problems finding people willing to work. This is why the investment in machinery was focused mainly on simple technology relying on manual labor.



Another important factor of the development of the confectionery industry in Poland was accession to the European Union. Low labor costs and the removal of tariffs enabled producers to increase their profit margins. Foreign companies gained production sites for Western European countries. The main players started to move production from Western Europe to Poland. The level of foreign investment in the entire food industry in Poland increased from EUR 1.270 billion in 2005 to EUR 1.915 billion in 2015 (Central Statistical Office, 2016). One of the most important beneficiaries of these funds was the confectionery market, which reached an average annual growth of 4.4% during this period (MarketLine, 2014, p. 8). Thanks to this investment the export of Polish confectionery products increased by nearly 80%, from EUR 1.66 billion to EUR 2.98 billion, and Poland became one of the main sweets exporters in the world, with the market share of 4.8% (Department of Strategy and International Analyses, 2017).

The technical development of production processes in the confectionery industry in Poland was infinitesimal because the labor costs remained low even after Poland's accession to the European Union. The processes were based more on solutions from the Third Industrial Revolution, which is associated with manual labor. In some cases, foreign producers reduced the use of robots while moving their production to Poland. For example, one chocolate producer from the Benelux region, who was using robots to package their goods, replaced them with Polish workers.

This situation has reversed within the last few years. In 2005 the unemployment rate in Poland was 17.6%. Over the last ten years the decrease in the unemployment rate is easy to observe (from 11.5% in 2010 to 5% in 2019, see Table 2).

The labor market in Poland was redefined and now it is considered an employee's market. Companies have to compete with each other in order to provide the necessary human resources. The increasing demand for employees has influenced the total labor cost which in the same period almost doubled, from USD 17,319.00 (Bagieńska, 2006, pp. 136–144) to USD 31,930.88 (Rosiński, 2017, p. 157). These changes have forced companies to innovate. In the next part of the article a case study of changes in the production of chocolate boxes as a response to the changes in the labor market will be presented.

Technological innovation as a response to the changes in the labor market. A case study

Description of the research method and the company under study

It is justified to apply case study as a research method when it is important to analyze the phenomenon in its actual conditions (Yin, 2009). The case study is used in particular for descriptive research topics. It then answers the question of what, where and how did something happen. With regard to exploration problems, it will answer

the question „why the studied phenomenon occurred”, i.e. in the analyzed situation: why the company implemented technological innovation. The materials for the case study were collected from 2016 to 2018 and were based on the direct observation method and structured interviews in seven plants in different locations with employees involved in technological projects, i.e., project managers, project engineers, process engineers and technologists. The number of respondents was 21 (two people from each plant). Data was collected and analyzed by one of the authors of this article, who is an employee of the company under study and has good knowledge in both company's internal processes and company's environment. The data collection was smoothly flowing, due to the fact, that it based on the personal network of one of the authors of this publication. The choice of the single longitudinal case study method is justified by the period of the studied phenomenon (in this case the research covers two years of company's operations). The case study is illustrative in nature (Stake, 2005).

The company under study represents a group of global chocolate producers. Its business model is based on the strategy of buying the most iconic regional or local producers with a strong position on the market and well-known brands. The company started operations in Poland in the 1990s and the first investment associated with the start of the production of goods in our country was to buy the plant where production of the most famous Polish wafer was based. The second step was to acquire a German confectionery producer that had invested in Poland in a new chocolate plant a few years earlier – a greenfield. The next step was to acquire one of the regional confectionery producers which focused on biscuit manufacturing. Thanks to this fact the analyzed company became the owner of additional two plants in Poland with a long tradition of the production of iconic biscuit brands. The last step of growing the business in Poland was to acquire a European chocolate producer which was the owner of three plants in Poland, all of them greenfield investments. As a result, the company under study owns seven plants in Poland, employing around 4,000 employees and producing chocolate, biscuits, gum and candies.

Before the authors present the case study, it is also worth describing the product whose changes in production technology will be described. According to Nielsen's research, published in November 2017, chocolate boxes represent 34 percent of sales in the category of chocolate products in Poland. Only the category of chocolate bars has a higher value, but the difference is only 2%. A significant group of consumers treats chocolate bars as an everyday product while pralines are seen as a more luxurious product, to be used occasionally. This segment is an important element of the development strategy of the largest companies, and it reached a 4.9% increase in value in the course of one year (Rogalska, 2017, pp. 5–6). This category is characterized by a decidedly higher profit margin potential compared to the category of chocolate bars. The price of chocolate boxes is decidedly higher than the price of chocolate bars, even when the weights

Table 2. Unemployment rate in Poland in the recent ten years

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
The lowest unemployment rate in a given year (%)	11.5	11.8	12.3	13	11.3	9.6	8.2	6.5	5.7	5

Source: Central Statistical Office, 2019

of both products are very similar. The cost of making the fillings used in the production of chocolate pralines is markedly lower than the price of chocolate. For this reason, with a similar raw material cost, more revenue is possible because the consumer is willing to spend more money on a luxury product. To give this product luxury features, very complex packaging is used, characterized by a higher quality of materials and sophisticated design. For this reason, part of the higher profit from a similar raw material cost is consumed by the cost of packaging. The specific packaging method also requires a more complicated production process. High quality of this product is also associated with being made by hand.

Results of empirical research and discussion

The production process of chocolate boxes generally consists of two key stages. The first stage is the production process of chocolate pralines and the second stage is the packaging of pralines. Chocolate pralines are produced on an industrial scale using high-tech assembly lines consisting of a combination of chocolate mass depositors, filling depositors and cooling tunnels.

The traditional method of production is to pour chocolate mass into previously heated molds, forming chocolate bodies by inverting the filled mold and creating a thin layer of chocolate, which is then cooled. For such bodies, the filling and additives are portioned with the help of the depositor. After another cooling phase the chocolate pralines are closed by pouring the next portion of chocolate, which is cooled as well. The finished pralines are transferred from the mold to the conveyor. This method only allows the production of chocolate pralines based on one type of chocolate mass (milk, bitter or white), but it allows for several types of pralines by using molds of various shapes and dispensing several fillings at the same time. In case of chocolate boxes containing only one type of chocolate praline the product can be packed immediately after the mold is unloaded. In case of multi-flavor chocolate boxes, the pralines are placed on plastic trays and are stored in an intermediate warehouse between the production department and the packaging department until all flavors are produced.

The traditional method of producing pralines in the studied company required eight workers. The packaging process for chocolate boxes containing one type of praline and those with several flavors looked very similar, although they required different skills from the packaging workers. The first stage was to deliver plastic trays to a conveyor, through which they were forwarded to 20 packaging stands. In case of chocolate boxes containing one type of praline, the same type of chocolate praline was placed on each stand and the position within the package

was dependent only on the arrangements made between employees. In case of chocolate boxes with several flavors of pralines, at each of the stands only one praline flavor was packed and their positioning in the tray was strictly defined in the product quality protocol. Ten workers took part in filling each tray. At the end of the packaging, quality control of the trays was carried out and then the moldings were manually placed into the boxes. The rolls were separated from each other using a paperboard. Finally, the box was closed by machine and then wrapped in foil. Foiled boxes were manually packed into outer boxes, which were closed with a gluing machine and laid on a pallet by an employee. The whole process of packaging chocolate boxes required the service of 39 workers. For this reason, the previously described changes in the labor market forced the company to implement changes in the process of packaging of chocolate boxes.

The surveyed company firstly decided to seek solutions in the automation of the simplest operations. By using robots at three workstations, it became possible to reduce the number of staff from 39 to 31 workers. The robots replaced workers in lining the trays on the transporter, putting packing boxes into outer boxes and palletizing the cartons. The servicing of these machines was entrusted to employees working at other machines. Thanks to the use of communication solutions between machines, this service was limited to the in-line inspections. In terms of the average annual labor costs, the implementation of this solution resulted in an annual savings of around USD 255,000. Moreover, additional costs related to recruitment processes, personnel training, medical treatment etc. have also been reduced (amounting to additional USD 40,000 per year).

The next stage in the implementation of technological innovation in the analyzed company was the development of a solution for the packaging of single-flavored chocolate boxes. An additional robot was purchased, whose task is to pick and place the chocolate pralines. This solution led to the reduction of production staff to 10 people and achieved a savings of USD 670,000 per year.

It is worth mentioning that in order to fully assess the cost-effectiveness of the above-presented solutions, it would be necessary to present the expenses related to the purchase of the machinery. However, because the price in the contract between the company and the equipment supplier is privileged information, this is unfortunately not possible. Investment costs are likewise considered trade secrets. Nevertheless, based on information from the surveyed company, the return of expenditures incurred should be made within four years.

As indicated above, publications often list innovation as one of many factors influencing the demand for labor. Oxford Economics states that about 1.7 million

manufacturing jobs have already been lost to robots since 2000, including 400,000 in Europe, 260,000 in the US and 550,000 in China, up to 20 million manufacturing jobs around the world could be replaced by robots by 2030. Each new industrial robot wipes out 1.6 manufacturing jobs (BBC, 2019). There is lack of statistics on how many jobs have been replaced by robots in Poland. One can only find a forecast prepared by McKinsey Global Institute which states that 7.5 million jobs in Poland can be fully automated (Ratajczak, 2017). This means that half of the Polish workforce can be replaced by machines (in the manufacturing sector, for example). Oxford Economics also points out that regions where more people have lower skills, which tend to have weaker economies and higher unemployment rates anyway, are much more vulnerable to the loss of jobs due to robots (BBC, 2019).

However, in the company under study no workers lost their jobs and the unemployment rate in Poland is low. The technological innovation was implemented because of the problem with the supply of workers. Moreover, so far, not all problems related to changes in the labor market have been solved in the analyzed company. Production of the multi-flavor chocolate box continues to take place in the factory and still requires the same number of staff. A potential solution is possible, involving a redesign of the production line and implementation of cold stamp technology. On the basis of the experience gained in the production plant, the project team responsible for moving further production processes from the old EU countries to Poland have changed their strategies. Even at the stage of project budgeting, assumptions were made to implement the latest technological solutions in order to make production costs independent of changes in the labor market by reducing the demand for workers.

Conclusions

The authors identified a lack of research on changes which occur on the job market and are considered to be factors which stimulate technological changes in different industries. This allows us to answer RQ1. The analyzed relationship has not been covered in the publications from the last ten years. Based on the results of the case study method, which was presented in the article, we can also answer RQ2. The changes in the labor market in Poland positively stimulate the implementation of modern technological solutions in the confectionery industry. It can be assumed that in this branch of the food industry, an intensive progress is currently being made in the automation of production processes.

At this point, certain limitations resulting from the applied research method should be emphasized. The case study covered only one confectionery industry business. It is therefore difficult to generalize the result obtained across the entire industry. However, it can be assumed since the company owns seven plants in Poland that the same factor related to the labor market had an impact on all plants. The situation concerns all companies which operate in the confectionery industry in Poland.

It is worth highlighting that the latest technological solutions are neither maintenance-free nor service-free and require different types of knowledge, experience and skills from employees. Therefore, another important area of research is the ability of the Polish labor market to provide qualified employees in response to these changing requirements. This area should be a part of future researchers.

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Wpływ zmian na polskim rynku pracy na wdrażanie innowacji technologicznych w przemyśle cukierniczym

Streszczenie

Zidentyfikowano lukę badawczą dotyczącą przeobrażeń na rynku pracy, które są stymulatorami zmian technologicznych wprowadzanych w różnych branżach. Stało się to podstawą dla prezentacji wpływu zmian zachodzących na polskim rynku pracy na wdrażanie nowych rozwiązań technologicznych w przemyśle cukierniczym. Teoretyczno-empiryczny charakter artykułu znajduje odzwierciedlenie w zastosowanych metodach naukowych. Do realizacji założonego celu wykorzystano studia literaturowe oraz studium przypadku przedsiębiorstwa z branży cukierniczej.

Słowa kluczowe

rynek pracy, zatrudnienie, innowacje technologiczne, przemysł cukierniczy, Polska