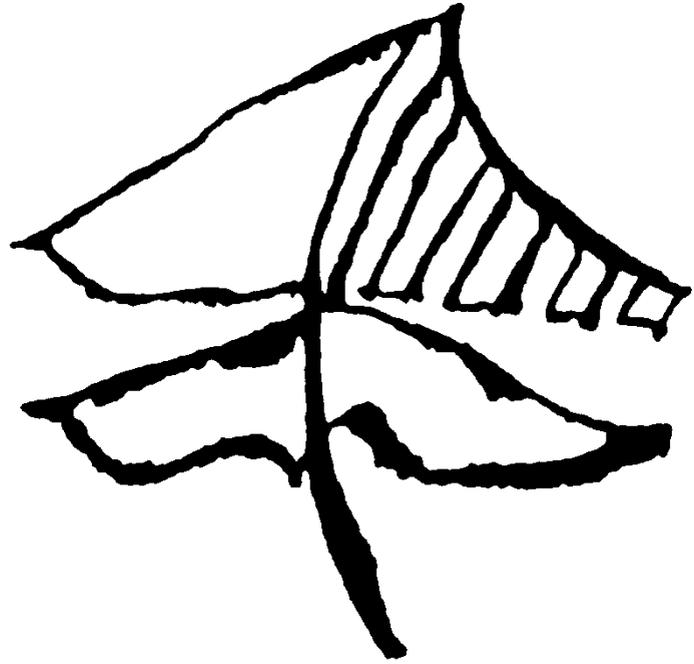


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Wojciech Lis



*Irena Bekier*¹

NEGOTIATING – STRATEGIES, COURSE AND RULES

Abstract: The article discusses the issue of negotiations. Its author presents definitions and basic conditions governing the course of negotiations, and characterizes the strategy applied in the agreement reaching process. Additionally, the article depicts key rules of negotiations based on the essence and the course of the very process of negotiations. The author underlines the importance of the development of a negotiation strategy, which should account for an alternative taken into consideration in the absence of agreement and pays attention to the most essential factors, which help to reach the negotiations' objective.

Key words: negotiations, strategies, rules of communication, needs, objective criteria, alternative solutions, concessions

INTRODUCTION

We can negotiate everything, every day. Although negotiations constitute conversations held by businessmen, diplomats, and merchandisers, they form a part of our everyday life from the moment we are born. Very few people are aware that they start their first negotiations right after being born when they communicate, by screaming, the following message: „I want to go back to the quiet and warm place”.

DEFINITION OF NEGOTIATIONS

According to R. Fisher, W. Ury and B. Patton (2012), negotiations constitute one of the methods of achieving the things we want from others, communicating and satisfying our needs as well as a bilateral means of communication aimed at reaching agreement. Negotiations are a difficult process of attaining a solution acceptable for both parties. Therefore, negotiations are considered to be a conversation allowing to reach an agreement or a desired solution to the existing conflicts and to improve human capabilities (Minton et al. 2005).

NEGOTIATION STRATEGIES

Negotiations take place provided that these two basic conditions are met:

1. partners have a common interest
2. partners are willing to cooperate

Unfortunately, some people treat negotiations as a fight at the expense of the other party. Such a strategy, called a hard, confrontational technique, is usually chosen by people approaching an interpersonal conflict like a challenge. They believe that the one who is determined and takes an extreme position is a winner. The basic characteristic of a hard negotiator is their aggressive attitude towards the partner, putting pressure on the partner, using threats, blackmailing and manipulating the other party in order to win at all costs. Behavior of a hard negotiator leads to a spiral of undesired behaviors because an attack triggers counterattack and a manipulation gives birth to another manipulation. This technique is often of no benefit for either party as a hard negotiator receives a hard response. Such a situation weakens the strength and good relations between the partners (Sobczak-Matysiak 1997).

Some people, when faced with a conflict, decide to reach an agreement at their own expense. They become subordinate and give up on their own interests. A soft negotiation strategy is chosen by those who wish to settle a dispute amicably and avoid stress. Such people would like to maintain

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good relations with the partner. However, a soft negotiator suffers a significant, personal loss: they feel used and sorry; they consider themselves losers, feel anger and are assured of a low self-esteem.

There is also the third strategy mentioned by R. Fisher and W. Ury. They call it a technique based on principles or the essence. They developed the technique during the implementation of the Harvard Negotiation Project. The authors state that there is a method of negotiating, which comprises both hard and soft approaches and does not entail the necessity to win or give up. The basis for the application of this strategy is an assertive approach, which assumes treating the partner with consideration and understanding and respecting their needs and rights. The positive effect of an assertive approach is a feedback because it encourages our partner in negotiations to abide by the same rules. The measurable result of this strategy is the possibility to achieve a good result amicably and effectively, maintain good relations with the partner and share a sense of being a winner (Fisher et al. 2012).

KEY NEGOTIATION RULES

Fisher and Ury believe that the negotiation technique they suggest is based on four key rules. These are:

1. **Separate people from the problem**
Negotiators are people with complex personalities, various emotional states and moods, different perceptions of the world and people and different levels of communication skills. During the negotiations, emotions and features of these people intertwine with the problem. It makes it difficult to identify it and leads the partners to focus on each other – Who is my partner and what are they like? It is necessary to separate people from the problem because concentrating on one's resentment and grievance hinders its resolution.
2. **Focus on interests, not positions**
The goal of negotiations is to satisfy the interests (needs) of both parties. The needs lie behind the positions taken by people. We need to discover and learn them because they motivate people to take action. It is important to be aware of one's needs and the needs of the other party as they are the reason a negotiator defends its position or is easily convinced by the partner. In everyday life, people often hold negotiations based not on the essence but on discussions about things they say they will or will not do. That kind of negotiation is called a positional bargaining and does not lead to an effective agreement.
3. **Develop solutions for mutual gain**
A good negotiator is a person who, before making a final decision, is able suggest numerous alternative solutions. People succumb to the illusion that there is only one solution to the problem. This results from the pressure, stress and treating negotiations in winner-loser categories. An impediment to accepting the winner-winner category is, among others, desire to win, competitive nature and the lack of recognition of negotiators' co-dependence.
4. **Apply objective criteria**
Notwithstanding the positive attitude of both parties and understanding each other's needs, there are also many opposing interests. In such cases, the authors suggest referring to objective criteria, not the pressure or our own ambitions. Reliance on independent criteria constitutes reliance on adopted and well-known provisions. In the absence of such provisions, the criteria may take a form of mutually respected experts, consultants, arbitration courts and even widely used practice.

Depending on a situation, different negotiation techniques are more or less efficient; hence, there are supporters of the so called "integrated behavior", which allows for maximizing mutual



gain by making concessions or developing new alternatives. M. Agryle, among others, suggests that:

- Negotiator should be decisive, clear about their demands and ready to make small concessions.
- Negotiator should not be too hard, should not attack or irritate the other party.
- Negotiator should not plan firm solutions, should be open to different possibilities and alternative solutions.
- Negotiator should adopt a rational attitude, verify different options and communicate with the other party in an open, unambiguous manner.
- Negotiator must give the impression of a confident, determined, and reliable person (Agryle 2001).

STRUCTURE AND COURSE OF THE NEGOTIATION PROCESS

All negotiations, organizational and these less formal, e.g., with a family or friends, are based on the same solution-development rules. Reaching an agreement constitutes a process, whose course comprises three stages. These are:

1. INITIAL PHASE, consisting in:
 - gathering and the analysis of available information and current situation
 - evaluation of chances, possibilities, weaknesses and threats related to the problem
 - making decisions on engaging in talks
 - more or less strict talks timetable and negotiations agenda
2. PHASE OF DECIDING ON A GENERAL AGREEMENT FORMULA, comprising:
 - defining interests and positions of both parties
 - presentation of suggestions of both parties
 - discussion over the suggestions aimed at the development of constructive solutions
 - development of a general agreement formula
3. PHASE OF WORKING OUT THE DETAILS, comprising:
 - consideration of the consequences behind the implementation of decisions
 - consideration of organizational and logistic problems associated with the implementation of decisions
 - development of documents necessary for the implementation of decisions
 - drawing up of an agreement (Watkins, 2005)

M. Watkins (2005) believes that the hardness of negotiations should be adjusted to the situation and the subject matter of negotiations. He also encourages compliance with a significant, in his opinion, principle, which anticipates elaboration of several different solutions for a particular case and an individual approach to each suggestion of the other party. Such a process prevents failure and bad relations of partners in the future.

DEVELOPMENT OF A NEGOTIATION STRATEGY

Effective negotiations require a prior strategy. Providing answers to the following six questions will be helpful in this regard:

1. What do the negotiations are really about?
2. Who will we negotiate with?
3. How to organize and when to hold the talks?
4. Should we hold the talks in the atmosphere based on partnership or hard or distant and professional?
5. What are our aspirations, how much are we bound by the objectives of the negotiations, are we going to be flexible?

6. What is the priority: defeating the opponent, strengthening our position or creating conditions allowing for further cooperation? (Watkins 2005).

The envisaged outcome of negotiations is defined by two measures. These are:

1. **LEVEL OF NEGOTIATION ASPIRATIONS** – this is a desired result we are aiming for. It is very rare for the negotiator to attain objectives in line with their level of aspirations. However, it does not constitute a failure.
2. **CONCESSION LIMIT** – this is the lowest acceptable result. The limit indicates alternative objectives, problem solutions, which are easier to accept by the other party. At the same time, this is the position, which is taken by the negotiator without the feeling of failure (Cohen 2005).

According to H. Cohen (2005) preparedness to the negotiations should include finding the best alternative to negotiated agreement in case we are unable to reach one. The author believes that the person without an alternative, the person who cares more, is in a weak position. A well-thought fallback called BATNA (Best Alternative to Negotiated Agreement), boosts a feeling of self-confidence, protects against accepting unfavorable conditions and accepting failure.

CONCLUSIONS

The everyday life, both professional and personal, faces people with the necessity to solve various problems, conflicts and disputes. Therefore, it is necessary to improve our negotiation skills in order to reach our own goals while maintaining good relations with those who are our partners in negotiations. Understanding of the process, its course, structure and rules of conduct, helps to succeed in this area. Some of the factors, which help to attain the negotiations' objective, are: knowledge of negotiation techniques, experience in negotiating, knowledge of the partner, development of other, acceptable solutions, knowledge of a negotiation situation, diligent completion of the preparation phase and development of a fallback, the so called BATNA.

REFERENCES

1. Agryle M., *Psychologia stosunków międzyludzkich*, PWN, Warszawa 2001.
2. Brożek B., Stelmach J., *Negocjacje*, Wyd. Copernicus Center Press, Kraków 2014.
3. Cohen H., *Negocjować możesz wszystko*, Wyd. One Press, Warszawa 2005.
4. Fisher R., Ury W., Patton B., *Dochodząc do tak. Negocjowanie bez poddawania się*, Polskie Wydawnictwo Ekonomiczne, Warszawa 2012.
5. Minton J.W., *Zasady negocjacji. Kompendium wiedzy dla trenerów i menedżerów*, Dom Wydawniczy Rebis, Poznań 2005.
6. Sobczak- Matysiak J., *Psychologia kontaktu z klientem*, Wyd. WSB, Poznań 1997.
7. Watkins M., *Sztuka negocjacji w biznesie. Innowacyjne podejścia prowadzące do przełomu*, Wyd. One Press, Warszawa 2005.
8. Watkins M., *Kierowanie przebiegiem negocjacji*, Wyd. One Press, Warszawa 2005.

*Anna Gawrońska*²

SEASONALITY OF SOLD PRODUCTION OF FURNITURE IN POLAND IN THE YEARS 2004-2015

Abstract: The aim of this paper is a statistical verification of seasonality phenomenon and calculation of seasonal factors of sold production of furniture in Poland. The work has been prepared on the basis of monthly data from Central Statistical Office for the years 2005-2014. The occurrence of seasonal fluctuations has been determined on the basis of statistical knowledge, using Kruskal-Wallis test. The increase of sold production of furniture occurs in March, September, October and November of each year as a result of seasonality. While, in July the value of sold production of furniture is lower by approximately 14% than the average sub-period, as the result of seasonality.

Key words: seasonality, sold production of furniture

INTRODUCTION

Many types of production are characterized by high seasonality. These are the fluctuations of a certain regularity and repeatability, occurring usually on an annual basis, and also in certain months and seasons [Guidolin, Guseo 2014, p. 34]. Seasonality of production is a response to clear fluctuations in market demand caused by external factors that occur repeatedly during certain periods. The external factor may cause an increase in market demand, for example coal as a source of fuel in heating periods. Seasonality may also result from periods of availability of raw materials, as is the case in processability-food industry. In such situation it is more predictable for a manager from the point of view of planning needs and resources. The more difficult situation occurs when periods of lower demand does not always occur regularly [Staniszewski, Legutko 2010, p. 39].

Each time causes of fluctuations may be different. They are due to natural factors (climatic variations: summer, winter, rainfalls), administrative or legal measures (starting and ending dates of school year, fiscal year) and cultural, social, traditional and calendar-related effects that are stable in annual timing (e.g., public fixed holidays such as Christmas, Valentine's Day) [Guidolin, Guseo 2014, p. 34]. Reasons for this may finally be due to several factors at the same time. Seasonality is primarily associated with periods of notably increase or significant decrease in demand [Staniszewski, Legutko 2010, p. 39].

The high seasonality for product demand has great impact on overall material consumption at manufacturing process. This is particularly essential in case of materials of long supplier response time (e.g. leather in the case of upholstery furniture). If the supplier lead time is greater than the expected finished goods lead time some on-site stock of material should be maintained. Therefore purchasing of such materials only on the basis of current sales order requirements is not sufficient and some sales forecast should be taken into consideration. If enterprise resource planning (ERP) systems are used for purchasing/production management this is controlled by so-called safety stock or minimum stock parameter. However in common ERP systems this parameter is static for each material and does not consider dynamic changes of demand. Hence, the awareness of seasonality and permanent adjustments of safety stock is essential to avoid material shortage [QAD Enterprise...2014, p.45, Smardzewski 2007, p.155]. Also, the knowledge of seasonal fluctuations and the reasons for their presence enables the proper management of the company and accurate forecasting of the economic phenomenon [Bulut 2014, Frances, Dijk 2005].

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PURPOSE AND METHODOLOGY OF RESEARCH

The existence of seasonal fluctuations in sold production of furniture is commonly known. The aim of this paper is statistical verification of this phenomenon and calculation of seasonal factors of sold production of furniture in Poland in the years 2005-2014. Research material consisted of data from the Statistical Bulletin of the years 2005-2015, published by the Central Statistical Office. The study analyzed seasonal fluctuations in the sold production of furniture in mln PLN each month from January 2005 to December 2014. Obtained time series composed of 120 units of time.

The occurrence of seasonal fluctuations can be determined based on graphical and statistical analysis and also beyond statistical knowledge of the phenomenon. The occurrence of seasonal fluctuations of sold production of furniture determined on the basis of statistical knowledge, using non-parametric test called Kruskal-Wallis test (rank-sum test). If a given phenomenon there are no seasonal fluctuations, then the distribution of these fluctuations should be the same in all periods. In examining the relevance of seasonal fluctuations adopted two hypotheses:

$$H_0 : R_1 = R_2 = R_3 = \dots R_d$$

$$H_1 : \neg H_0$$

Then, the chi-squared statistic for the $d-1$ degrees of freedom was calculated [Guo, Zhong, Zhang, 2013, p. 136; Wysocki i Lira 2005, p. 130-131]:

$$\chi^2 = \frac{12}{n(n+1)} \sum_{i=1}^d \frac{R_i^2}{f_i} - 3(n+1)$$

where:

d – the number of sub-periods periodicity cycle (12 months),

n – the number of seasonal effects ($n = \sum f_i$)

f_i – the number of seasonal effects in i 'th sub-periods,

R_i – the sum of rank in i 'th sub-periods

The calculated chi-square statistic was compared with the table value of chi-square (19.68) defined with the probability $\alpha = 0.05$ and degrees of freedom $d = 11$. In a situation, where the calculated chi-square statistic was greater than the table value of chi-square, the null hypothesis was rejected (H_0 – the sum of ranks for each sub-periods are the same) in favor of the alternative hypothesis (H_1 – the sum of ranks for each sub-periods are different). It means, that the seasonal fluctuations occurred in studied phenomena.

A description of sold production of furniture in each period was presented by a multiplicative time-series model [Wysocki i Lira 2005, p. 130-131]:

$$y_t = f(t) \cdot s_i(t) \cdot e(t)$$

where:

y_t – the value of the time-series y at period t ;

$f(t)$ – the function of development trend (trend) at period t ;

$s_i(t)$ – the seasonal factors at period, where $i = 1, 2 \dots d$ is the number of sub-periods of the cycle periodicity;

$e(t)$ – the irregular (or sometimes called the residual) component.

Decomposition of seasonal fluctuations, based on multiplicative time-series model, included the following steps [Wysocki i Lira 2005, s. 149-150]:

a) estimate the trend with a smoothing procedure such as centered 12-term moving averages

$$\left(\bar{y}_t = \frac{0,5 \cdot y_{t-6} + \sum_{i=-5}^5 y_{t+i} + 0,5 \cdot y_{t+6}}{12} \right),$$

b) eliminate the trend by dividing the value of the time-series by the centered 12-term moving averages ($z_t = y_t / \bar{y}_t$)

c) estimate the average of z_i values for a specific season ($\bar{z}_i = 1/m \sum_{j=0}^{m-1} z_{i+jd}$ for the i 'th sub-period fluctuations cycle where $i = 1, 2, \dots, d$; whereas m is the number of years of study of seasonality);

d) calculate the adjustment factor ($K = \frac{1}{d} \sum_{i=1}^d \bar{z}_i$)

e) calculate the seasonal factors ($s_i = \bar{z}_i / K$)

The seasonal factors calculated on the basis of multiplicative model determine if a percentage of the feature values observed in i 'th sub-period of cycle (due to seasonality) are larger or smaller than the average sub-period (100%).

RESULTS AND DISCUSSION

The value of sold production of furniture subject to large fluctuations in each months, in years 2005 to 2014. The growth of sold of furniture was in 2005-2007. Since 2008, was noticeable decrease in sold production due to the general economic crisis, which continued until the end of 2010. In particular, low values of sold production in each months - below the average value - were characteristic for the years 2009 and 2010. Since 2011, the value of sold production of furniture increased, and 2014 year ended with a sales value of more than 2 400 million PLN in each months (Fig 1).

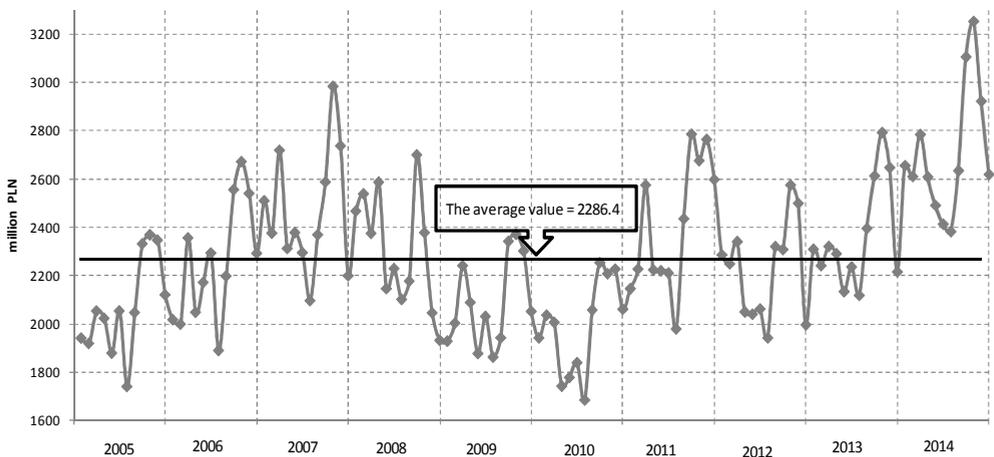


Fig 1. Sold production of furniture in 2005-2014 (million PLN)

Source: Authors' own elaboration based on: *Biuletyn Statystyczny 2005-2015*.

Polish furniture industry has a big production potential and it is one of the wood industries which contributes the most to the country's economy. In 2011, the furniture industry accounted for almost 1% of gross output and gross value added [Ratajczak-Mrozek, Herbec 2013, p.116]. In 2014 it reaches the eighth position among all global furniture manufacturers. Ahead from Poland,

starting from the highest position are: China, the USA, Italy, Germany, Japan, Brasil and Great Britain [Więckowska 2014, p. 96]. In addition, Polish manufacturers have managed to achieve the export value over 30 billion PLN in 2014 (first time in the history). Also, employment data indicate that the Polish furniture industry has recovered from the economic crisis. Not only the employment in the furniture and wood sector has increased, but also an increase in wages by about 5 percent was observed in the first quarter of 2015 compared to the same period of 2014 [Biuletyn informacyjny OIGPM, 2014-2015].

Based on Kruskal-Wallis test (rank-sum test) it was found that the calculated chi-square statistic has a value of 75.84, and so was greater than the table value of chi-square (19.68). The null hypothesis was rejected (H_0 – the sum of ranks for each sub-periods are the same) in favor of the alternative hypothesis (H_1 – the sum of ranks for each sub-periods are different). This means, that the seasonal fluctuations occurred in sold production of furniture. A characteristic feature of sold production of furniture in the analysis of seasonality was the increase in sales in four months during the year (March, September, October and November). The volume growth of sales was particularly strong in the autumn of each years, when for example in October there was a seasonal increase in sales of approximately 13% compared to the average sub-period [Fig. 2].

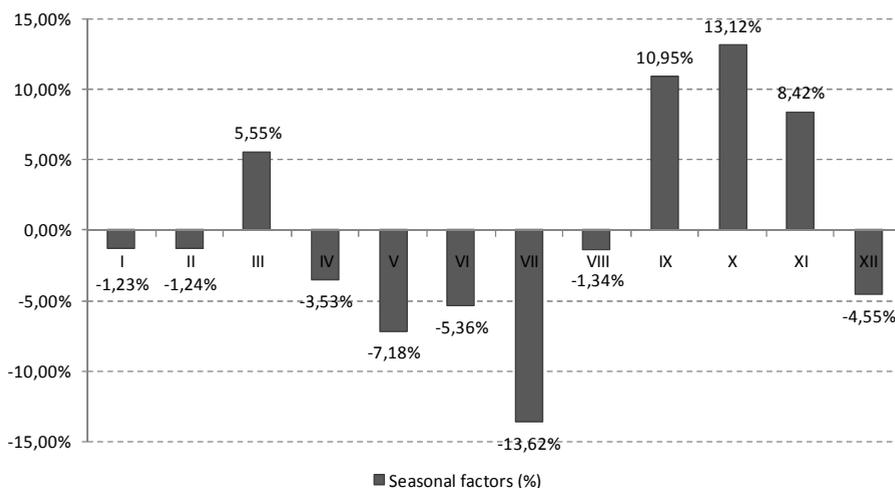


Fig. 2. Seasonal factors for sold production of furniture in 2005-2014 (%)

Source: Authors' own elaboration.

The increase in sold production of furniture in autumn can be explained by the fact, that in this period people are staying at home more often and more attention is paid to house's equipment. At that time, developers also finish the construction of new houses, which is of course an impact on the furniture market. It is also the time to start the school year and furnishing of children rooms. In the autumn, the new collections of interior design are also introduced, but recently an increased interest in furniture can be observed also in early spring [11].

The sold production of furniture was lower in the remaining eight months than the average sub-period, as the effect of seasonality. The lowest value of sold production of furniture was in July each analyzed year - a decrease of approximately 14% compared to the average sub-period [Fig. 2]. This situation is related to the holiday period, when the most money's consumers is spent on vacation.

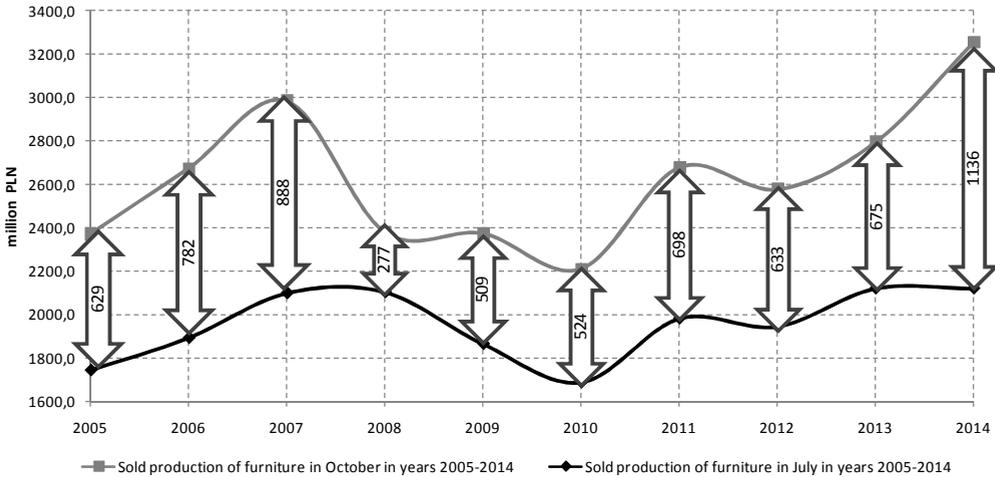


Fig. 3. The difference between sold production of furniture in July and October in years 2005-2014 (million PLN)

Source: Authors' own elaboration.

Figure 3 compares the value of sold production of furniture in the months of July and October in the years 2005-2004. These are the months in which the effect of the seasonality of sold production of furniture was the lowest (July) and the highest (October) than the average sub-period. Differences in the sold production of furniture between the best and the worst sales period associated with the seasonality characterized by high volatility ($v = 34.3\%$). The smallest difference between the highest and lowest value of sold production of furniture associated with the seasonality phenomenon occurred in 2008 (about 277 million PLN), which may be related to the general economic crisis. In turn, the biggest difference between the volume of sold production of furniture in July and October occurred in 2014, which in turn is related to high values of sold production during the period (very much above average).

RECAPITULATIONS

Based on Kruskal-Wallis test (rank-sum test) it was found that the seasonal fluctuations occurred in sold production of furniture in Poland in 2005-2014. A characteristic feature of seasonality was the increase in sales in four months during the year (March, September, October and November) and decrease in the remaining eight months compared to the average sub-period. The lowest value of sold production of furniture was in July each analyzed year (a decrease of approximately 14% compared to the average sub-period), but the highest value in October (an increase of approximately 13% compared to the average sub-period).

REFERENCES

1. Biuletyn informacyjny OIGPM, Grudzień 2014, Czerwiec 2015
<http://www.oigpm.org.pl/9/biuletyn> (access: 22.06.2015).
2. Biuletyn Statystyczny 2005-2015
<http://stat.gov.pl/obszary-tematyczne/inne-opracowania/informacje-o-sytuacji-spoleczno-gospodarczej/biuletyn-statystyczny.html> (access: 10.06.2015).
3. Bulut E. (2014), *Modeling seasonality using the fuzzy integrated logical forecasting (FILF) approach*, Expert Systems with Applications, No. 41, pp. 1806-1812.
4. Frances P. H., Dijk D. (2005), *The forecasting performance of various models for seasonality and nonlinearity for quarterly industrial production*, International Journal of Forecasting , No. 27, pp. 87-102.
5. Guidolin M., Guseo R. (2014), *Modelling seasonality in innovation diffusion*, Technological Forecasting and Social Change, Vol. 86, pp. 33-40.
6. Guo S., Zhong S., Zhang A. (2013), *Privacy-preserving Kruskal-Wallis test*, Computer Methods and Programs in Biomedicine, No.112, pp.135-145.
7. *QAD Enterprise Applications Standard and Enterprise Edition*, March 2014, p.45.
8. http://documentlibrary.qad.com/documents/2370665/2370819/MRPCR_TG_v2014SE_EE.pdf . (access: 10.06.2015).
9. Smardzewski J. (2007), *Komputerowo zintegrowane wytwarzanie mebli*, Wydawnictwo PWRiL, Poznań 2007, p.155.
10. Ratajczak-Mrozek M., Herbec M. (2013), *Actors-resources-activities analysis as a basis for Polish furniture network research*, Drewno, vol. 56, nr 190, pp. 115- 137.
11. Staniszewski M., Legutko S. (2010), *Analiza skutków redukcji zatrudnienia w przedsiębiorstwie produkcyjnym spowodowanej sezonowością produkcji*, Zarządzanie Przedsiębiorstwem, Nr 2, pp. 39-44.
12. Więckowska M. (2014), *Structural changes of furniture industry entities in Poland according to the REGON register in the years 2009-2014*, Intercathedra 30/3, pp. 96-102.
13. Wysocki F., Lira J. (2005): *Statystyka opisowa*. Wyd. AR. Poznań.
14. <http://franchising.pl/arttykul/6997/jesienne-meblowanie> (access: 22.06.2015).

Zbigniew Gołasz³

THE ECONOMIC AND FINANCIAL SITUATION OF THE WOOD INDUSTRY IN POLAND IN THE YEARS 2006-2013

Abstract: The primary aim of this study was to assess changes in the economic and financial status of the wood industry in Poland in the period of 2006-2013. This evaluation focused on basic economic and financial factors describing changes in the wood industry in terms of revenue, costs, financial results, sale prices, export activity, exchange rates, liquidity, debt, cost efficiency and resource productivity as well as profitability. The conducted analysis showed that after a deep crisis in the wood sector in 2008 the financial situation improved markedly in the next years. The advantageous course of changes was connected first of all with increased income and reduced general expenses, resulting in a considerable increase in yields from sales as well as returns on assets and equity. Generally, no significant changes were observed in the case of other areas and criteria applied in the evaluation of financial standing in the wood sector, i.e. liquidity, indebtedness and efficiency. However, a characteristic feature of the analyzed period was connected with a considerable increase in labor efficiency. In the years 2006-2013 labor efficiency in the timber industry increased in actual terms by as much as approx. 50%, which to a considerable degree determined the reduction of unit costs and the increase in profitability.

Key words: wood industry, economic and financial situation, Poland

INTRODUCTION

Socio-political changes initiated in the later 1990's and Poland's accession to the European Union in 2004 had a great impact on the direction of structural changes in the national economy. These transformations triggered processes of privatization, consolidation and concentration, further increasing in their dynamics with the accession to the EU and intensification of globalization processes. Moreover, the Polish economy was confronted with foreign markets, mainly the EU, leading to changes in price relationships, consumer preferences and enforcement of legal regulations. These processes affected all sectors, including the timber industry, an important sector of Polish economy.

The primary aim of the presented paper is to assess the economic and financial standing of the wood industry in Poland in the period of 2006-2013. The structure of the paper is composed of the introduction, followed by a presentation of methodological aspects and a characteristic of source materials. The next part comprises results of empirical studies, i.e. variation in the economic and financial standing in the years of analysis. The last part presents conclusions summing up the results of conducted analyses.

SOURCE MATERIALS AND RESEARCH METHODS

The analysis of financial standing of the timber industry is based on statistical data from the Central Statistical Office of Poland for the years 2006-2013 concerning enterprises from the sector of wood production and wood-based and cork product manufacture (except for furniture), straw and wicker weaving; section 16 of processing industry [Bilansowe.... 2015]. The used data concern entities keeping account books or revenue and costs registers for tax purposes, with the number of employees of min. 10 at the end of a given calendar year.

The assessment of the financial standing of wood industry used basic indicators describing the economic and financial situation in the wood sector. The starting point for the analysis was to present basic characteristics of the wood sector, including changes in the number of enterprises,

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changes in revenue, costs and financial results, the scale of bankruptcy among these enterprises, changes in the concentration of production, changes in prices for sold production as well as changes in the volume and structure of exports. In turn, the second step of analysis presents the levels and changes in conventional measures evaluating the financial situation of the wood sector in the years 2006-2013 in the form of basic indexes of liquidity, debt, management efficiency and profitability [Sierpińska and Jachna 2004, Sierpińska and Wędzki 2001, Waśniewski and Skoczyła 1998]. Moreover, in order to illustrate trends in changes within the investigated criteria evaluating the financial situation in the wood sector several analyzed criteria were presented in the form of tables and graphs.

BASIC ECONOMIC AND FINANCIAL CHARACTERISTICS OF THE WOOD SECTOR IN THE YEARS 2006-2013

The primary indicator of potential of any sector in economy is connected with the number of entities operating within this sector and their capacity to generate revenue and positive financial results. When analyzing data given in table 1 it may be observed that after 2008 the number of enterprises in the wood sector decreased systematically. While in 2008 the sector comprised 838 enterprises, in 2013 their number decreased to 770, i.e. by over 8%. Changes in the number of entities operating in the wood sector to a considerable degree were related with the considerably intensified phenomenon of bankruptcy among these enterprises. Presented data (tab.1) showed that after 2008 as many as 102 entities in the wood sector were declared to be bankrupt.

Table 1. Revenues, costs, financial results, bankruptcies and price index in Polish wood industry in 2006-2013

Years	Number of entities	Revenues from total activity	Cost of obtaining revenues from total activity	Gross financial result	Net financial result	Percent of entities with net profit	Number of bankruptcies	Price index of sold production
								mln PLZ
2006	785	17556,3	16558,2	999,1	854,1	79,2	9	100,3
2007	816	21040,8	19365,2	1680,0	1452,8	84,8	21	105,3
2008	838	20627,7	20232,0	393,5	288,8	70,6	11	97,9
2009	811	18465,5	18004,3	464,5	381,9	72,5	21	98,5
2010	787	20444,8	19867,2	577,7	434,2	77,1	23	100,0
2011	786	22411,6	21589,7	824,4	675,5	80,3	22	107,5
2012	784	23510,3	22663,5	848,4	748,5	75,6	11	102,4
2013	770	24909,6	23642,4	1273,9	1082,1	78,4	25	100,9
Σ	797	18007,1	17285,0	723,5	604,5	77,3	17,8	101,6
V (%)	2,6	39,1	39,2	64,4	68,0	5,4	33,5	3,1

Source: own calculations based on CSO

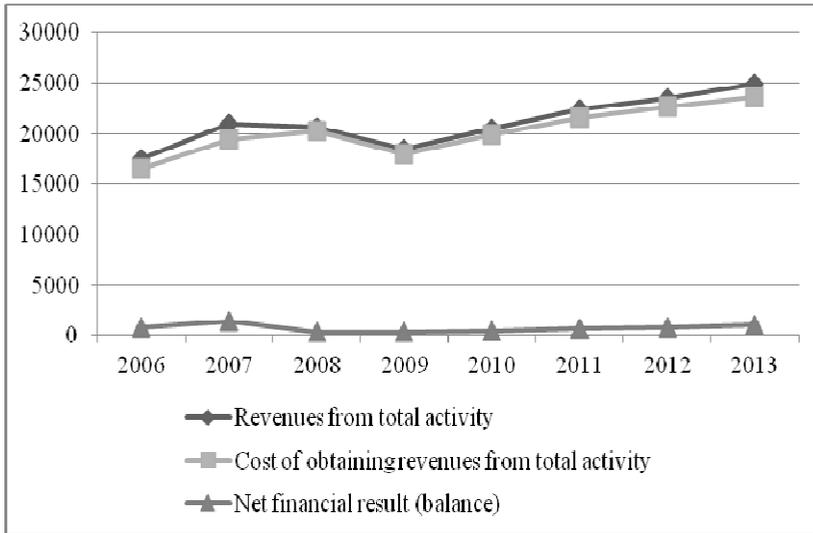


Figure 1. Revenues, costs and net financial results in Polish wood industry in 2006-2013 (thous. PLN zł)

Source: own calculations based on CSO

Despite the considerable reduction in the number of enterprises the wood sector revenue from this activity increased dynamically. In the years 2006-2013 nominal revenue from overall activity increased on average by approx. 5% annually, while in 2013 – in relation to 2006 – they were by almost 42% higher. As it results from data presented in Table 1, the increase in revenue in the wood sector was observed at a much slower rate of changes in prices of sold production, which generally means that the actual capacity to generate income increased in this sector. Thus disregarding the slump in revenue and dropping prices in the period of 2008-2009 it may be observed that the average annual nominal increase in revenue in the years 2006-2013 by approx. 5% corresponded to the average annual increase in prices of sold production of approx. 1.7%. Differences in the dynamics of changes in these parameters on the one hand show a definite increase in competitiveness of this sector as a result of increasing quantities of manufactured products on the market, while on the other hand they indicate a limited potential to control revenue using an increase in prices.

A very important factor determining the capacity to generate revenue and positive financial results in the wood sector is related with the effect of foreign trade and variability of exchange rates. In the wood sector export sales play a very important role, as indicated both by the number of exporting enterprises and the share of revenue from exports in total revenue. It results from data contained in Table 2 that in the wood sector in the analyzed period approx. 500 entities, i.e. over 60% all enterprises, were involved in exports of products, goods and materials and revenue from exports in the years 2006-2013 accounted for almost 37% total revenue. It should be stressed here that at a certain variability in time (mainly in the years 2008 and 2009) the value of revenue from exports increased in the investigated period from approx. 7 billion in 2006 to over 9 billion zloty in 2013, i.e. by over 30%, while this increase was promoted by the weakening of the national currency. However, we need to remember that the nominal dynamics of the increase in the revenue from exports was markedly greater than that of the increase in Euro exchange rates [Archiwum.... 2015]. Average annual revenue from exports of products, goods and materials increased by almost 4%,

while the exchange rate of the Euro (złoty/euro) by 1.1%. This means that next to the direction of changes in exchange rates, advantageous for exporting enterprises, first of all competitiveness of enterprises from the wood sector on foreign markets increased.

Table 2. Level and structure of export sale in Polish wood industry in 2006-2013

Year	revenues from export sale of products, goods and materials			revenues from export sale of products			average exchange rate
	number of entities	in mln PLZ	% share in revenues from total sale	number of entities	in mln PLZ	% share in revenues from total sale	PLZ/€
2006	542	6903,5	41,2	530	6565,9	39,2	3,89
2007	510	7683,2	37,7	497	7353,1	36,0	3,78
2008	490	6650,7	33,6	483	6360,7	32,2	3,51
2009	499	6498,1	36,3	487	6293,0	35,2	4,33
2010	493	7421,1	37,5	485	7041,8	35,6	3,99
2011	494	7912,1	36,4	486	7584,7	34,9	4,12
2012	495	7891,3	34,6	486	7521,4	33,0	4,18
2013	498	9070,2	37,3	492	8613,3	35,4	4,20
\bar{x}	503	7503,8	36,8	493	7166,7	35,2	4,00
V (%)	3,2	10,4	5,8	2,9	10,1	5,6	6,2

Source: own calculations based on CSO

THE LEVEL AND TRENDS OF CHANGES IN BASIC INDEXES OF FINANCIAL STANDING IN THE WOOD SECTOR

The assessment of the level and trends of changes in the financial standing of the wood sector was based on the application of basic liquidity indexes informing on the capacity to settle current liabilities and efficiency of working capital management, debt ratios informing on the level of indebtedness and debt security on assets, efficiency indexes presenting the capacity to control costs and the efficiency of use of financial resources as well as profitability indexes informing on the capacity to generate profits [Bednarski 1997, Sierpińska and Jachna 2004; Sierpińska and Wędzki 2001].

The level and directions of changes in the basic measure of liquidity, i.e. the current liquidity index, clearly indicate a high, stable capacity to regulate current liabilities with liquid assets, consistently with the recommendations of the theory of finances [Bieniasz and Gofaś 2014]. In the analyzed period the current liquidity index fell within the narrow range of 1.34 – 1.59, which means that on average in the sector current liabilities were secured in 134-159% by current assets. In turn, in the analyzed period the levels of the quick ratio, which in all the years was below 1 (0.85-0.98), were relatively less advantageous and at the same time they were markedly lower than those of the current ratio. Thus, from the point of view of the volume of normative liquidity in the wood sector measured by the quick ratio is low [Sierpińska and Jachna 2004]; however, due to its stability (V=7.16%) it may be stated to be a characteristic level for this sector. Still this also means that in

the modification of liquidity in wood sector enterprises an important role is played by inventory, which management efficiency defined by the inventory cycle did not present a definite trend. It results from data given in Table 3 that this cycle was increasing up to 2008, while from 2009 it showed a weak downward trend. However, generally over the entire investigated period the inventory cycle was long, amounting to almost 50 days, which indicates that on average in the wood sector inventory was recreated in the cycle exceeding 1.5 months.

An important determinant of liquidity in enterprises is connected with the policy of book credit, reflected in the time of receivables recovery [Bednarski 1997, Sierpińska and Jachna 2004]. In the years 2006-2013 the average time of liability settlement in the wood sector was 55.5 days, which indicates that receivables were recovered within a long cycle of approx. 2 months. Moreover, in this area of liquidity policy no definite changes have been observed. The length of the receivables cycle ranged in that period within a narrow and relatively stable ($V=10.75\%$) interval of 48 - 62 days, with no marked trend observed. From the point of view of liquidity assessment it is a disadvantageous situation, particularly if we consider the time of settlement of trade creditors, i.e. trade payables. As it results from data presented in Table 3, the mean length of the liabilities cycle in the wood sector in 2006-2013 was approx. 37 days. The length of the liabilities cycle was thus by approx. 34% shorter than that of the receivables cycle, which results clearly in an increased risk to liquidity. From the point of view of liquidity the cycle of liabilities settlement should be extended, as it provides a longer period of cash available for other purposes, mainly operations. In the case of the wood sector it is of particular importance due to the liberal policy of receivables management.

Table 3. Liquidity ratios in Polish wood industry in 2006-2013

	Current ratio	Quick ratio	Working capital cycle (days)	Inventory cycle (days)	Receivables cycle (days)	Trade payables cycle (days)	Cash conversion cycle (days)	
2006	1,53	0,98	42,2	43,4	55,2	37,2	61,3	
2007	1,59	0,94	42,9	47,4	48,0	31,0	64,5	
2008	1,36	0,78	32,8	53,3	48,7	36,9	65,1	
2009	1,34	0,85	35,7	51,5	62,1		39,4	74,2
2010	1,45	0,94	41,2	47,1	58,8		40,3	65,6
2011	1,44	0,88	41,8	52,8	60,7		41,4	72,1
2012	1,49	0,95	45,2	49,4	62,5		35,7	76,3
2013	1,38	0,85	32,1	44,4	48,2		31,7	61,0
\bar{x}	1,45	0,90	39,2	48,6	55,5		36,7	67,4
V (%)	5,59	7,16	11,81	7,17	10,75		9,68	8,16

Source: own calculations based on CSO

The cash conversion cycle is the resultant of the policies of inventory, receivables and trade payables. This measure is considered to be one of the best criteria in the assessment of liquidity, informative of the period which passes from the moment of withdrawal of cash for the settlement of liabilities to the moment of inflow of cash from collected receivables [Sierpińska and Jachna 2004]. In terms of assessment of liquidity the cash conversion cycle should be the shortest possible, since

the rapid return of cash allocated to activity makes it possible to re-use it for operations. In the case of the wood sector, mainly as a result of the long cycle of receivables and the short cycle of liabilities, the cash conversion cycle over the entire analyzed period was long. In the years 2006-2013 the length of this cycle ranged from 61 to 74 days, which means that on average in the wood sector invested financial resources returned to the enterprises in the form of cash in a cycle of 2-2.5 months. Moreover, the length of the cash conversion cycle varied little ($V=8.16\%$) and as a consequence did not show a definite direction of changes. This means that the efficiency of working capital management in the wood sector did not improve in the investigated period.

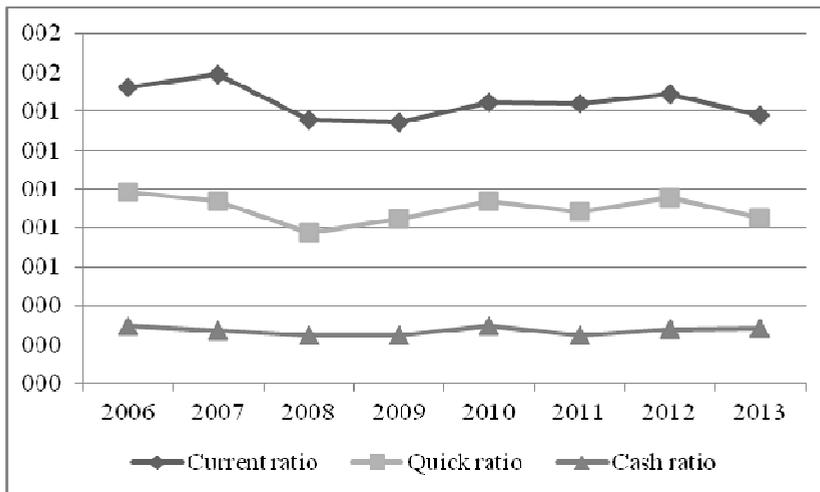


Figure 2. Current, quick and cash liquidity ratios in Polish wood industry in 2006-2013

Source: own calculations based on CSO

The next area in the assessment of the financial situation in the wood sector is connected with the level of indebtedness (tab. 4), which in contrast to liquidity makes it possible to evaluate enterprises in terms of total debt and long-term debt related with investment and modernization processes [Bednarski 1997, Sierpińska and Jachna 2004]. The primary criterion of assessment used in this case is the overall debt ratio, defining the share of total liabilities in financing of assets in enterprises. According to standards this index should fall within the range of 57-67%, since this range indicates a balance between borrowed capital and equity capital. When analyzing data contained in Table 4 it may be clearly stated that the problem of imbalance between borrowed and equity capitals does not exist in the wood sector. In all the investigated years the overall debt ratio was below 67% and did not go below 53% (2008). Generally similar conclusions may be drawn from the analysis of the equity debt ratio measured by the ratio of total liabilities to equity capital. From the point of view of financial security this ratio should be approx. 1:1, since it also defines balance between capitals; moreover, it is frequently adopted by banks as a criterion of creditworthiness when granting investment loans. In the wood sector the level of equity debt in the investigated years was close to optimal (0.78-1.12). In view of average values we may thus talk of capital equilibrium and positive creditworthiness of the timber industry.

The good financial situation in the wood sector is also shown by the level of long-term debt ratio, which in the years 2006-2013 ranged from 20.9 to 41%. In terms of this range the wood sector is a sector with a low debt ratio, since only these enterprises, in which the level of this index exceeds 100%, are considered to be seriously in debt. Moreover, as it results from data presented in

Table 4, the long-term debt ratio decreased in 2013 to 20.9%. Such a strong reduction of the long-term debt ratio to equity capital clearly shows an increasingly conservative character of development strategy in the sector, which while reducing liquidity risk, at the same time limits an increase in profitability of equity capital as a result of the decreasing effect of capital leverage.

Table 4. Debt ratios in Polish wood industry in 2006-2013

Years	Total liabilities/ total assets (%)	Total liabilities/ equity	Long-term liabilities/ equity (%)
2006	44,0	0,78	24,5
2007	45,6	0,84	27,9
2008	53,0	1,12	41,0
2009	51,5	1,06	37,6
2010	50,9	1,03	38,0
2011	52,0	1,08	38,0
2012	50,2	1,01	33,2
2013	44,4	0,79	20,9
\bar{x}	48,9	0,96	32,7
V (%)	7,0	13,3	21,1

Source: own calculations based on CSO

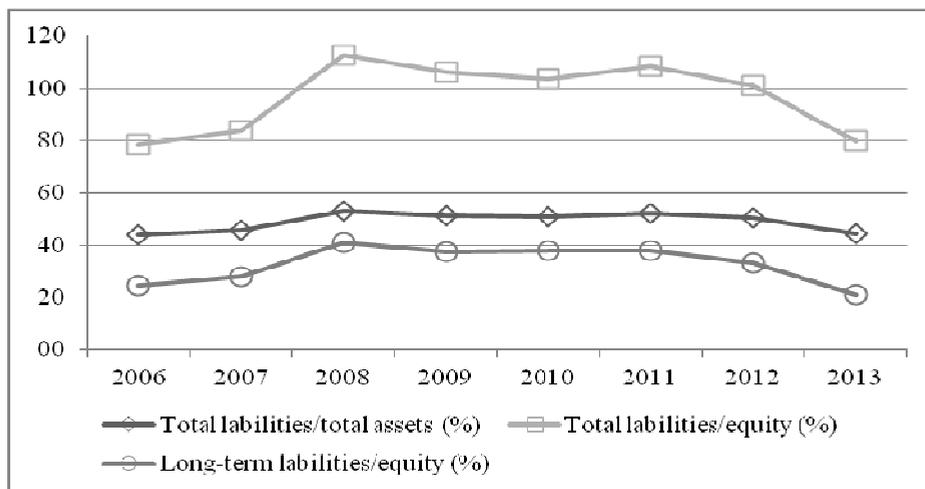


Figure 3. Debt ratios in Polish wood industry in 2006-2013

Source: own calculations based on CSO

When assessing effectiveness of wood sector enterprises (tab. 5) the used indexes were based on manufacturing costs, turnover ratios and workforce productivity index [Bednarski 1997,

Sierpińska and Jachna 2004]. The former, i.e. the cost index, over the entire analyzed period was high exceeding 90%, which clearly indicates low profitability of sales. Moreover, it may be observed that progress in the reduction of costs in relation to revenue from sales is very limited in the wood sector. Except for the years 2006-2007, when this index was relatively lower (92-94%), in most other years it exceeded 96%. From the point of view of this efficiency measure the result of the evaluation of the wood sector is negative as a consequence of both high costs and very poor potential to reduce costs in relation to generated revenue.

In contrast, changes in efficiency of the wood sector related with the utilization of assets and human resources are markedly more advantageous (tab. 5). In view of total assets turnover, fixed asset turnover and current asset turnover we may observe that while up to 2009 they were decreasing, starting from 2010 turnover in all asset categories was increasing considerably and systematically. The increase in asset turnover started in 2009 indicates an increase in efficiency of utilization of assets and thus an increasing potential to reduce unit production costs. Rather similar conclusions may be drawn from the analysis of changes in workforce productivity in the timber industry. In the years 2006-2013 nominal workforce productivity increased from 217.3 thousand złotys to 364.9 thousand złotys, i.e. by 68%. It needs to be stressed that the increase in workforce productivity resulted to a limited degree from changes in sales prices, which generally increased at a very low pace. Assuming the index of changes in sales prices as a workforce productivity deflator (tab. 1) it may be estimated that in reality workforce productivity increased in the wood sector by approx. 48%.

Table 5. Costs and activity ratios in Polish wood industry in 2006-2013

Years	Cost level indicator from total activity (%)	Total assets turnover	Fixed assets turnover	Current assets turnover	Labour productivity (thous. PLN zł/ employess)
2006	94,3	1,18	2,01	2,85	217,3
2007	92,0	1,23	2,05	3,07	244,4
2008	98,1	1,08	1,77	2,80	252,8
2009	97,5	0,97	1,58	2,54	253,9
2010	97,2	1,05	1,74	2,65	274,0
2011	96,3	1,09	1,89	2,58	320,7
2012	96,4	1,11	1,94	2,58	348,9
2013	95,9	1,21	2,01	3,06	364,9
\bar{x}	96,0	1,10	1,90	2,70	272,7
V (%)	2,1	7,0	8,3	6,5	15,7

Source: own calculations based on CSO

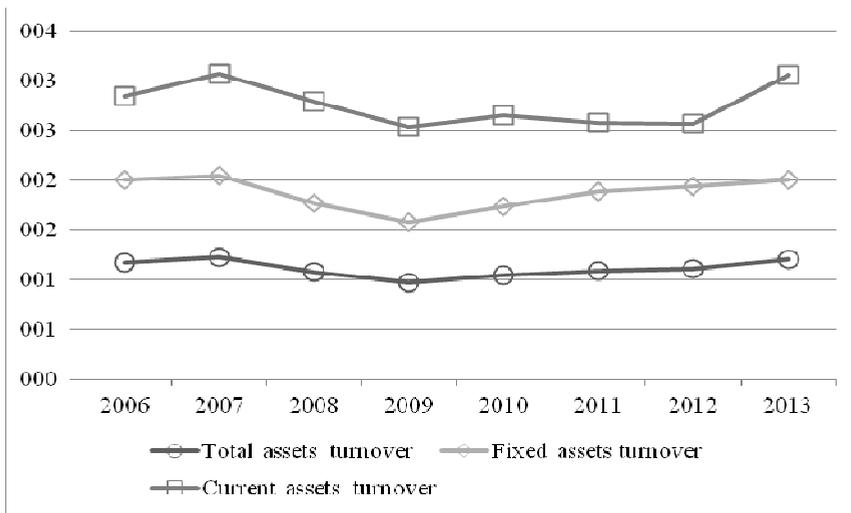


Figure 4. Turnover ratios in Polish wood industry in 2006-2013

Source: own calculations based on CSO

The last adopted criterion in the assessment of financial standing in the wood sector is profitability, informing on the capacity to generate profits in relation to generated revenue and allocated assets and equity capital [Bednarski 1997, Sierpińska and Jachna 2004]. It results from data presented in Table 6 that in the wood sector a considerable number of enterprises in the years 2006-2013 did not yield positive financial results. While in individual years the scale of this phenomenon varied, on average in the investigated period as many as 23% enterprises were not capable to generate profits. The negative implications of these statistics are additionally strengthened by marginal changes in the percentage of non-profitable enterprises ($V=5.4\%$) and their continuously high percentage in 2013 (23%).

The considerable number of non-profitable enterprises results in the generally low profitability of this sector and high variability of profitability indexes ($V=48-55\%$). Apart from the short period of 2006-2007, when non-profitable companies were relatively least numerous, in the other years profitability of sales and return on assets and return on equity were low. Particularly low indexes of profitability were recorded in the wood sector in 2008, i.e. the year in which the global financial crisis started and economies of most countries entered the slump period. In the investigated year the mean profitability of sales and assets did not exceed 2%, while return on equity at 3.4% was lower than the level of inflation (4.2%). After 2008 the wood sector systematically improved financial results, whereas at the end of the analyzed period (2013) the basic profitability indexes were slightly lower than in 2006. The advantageous direction of changes and high growth dynamics for profitability of sales, assets and equity still provide the basis for the return of the wood sector to high profitability. In terms of the most important criterion of profitability, i.e. return on equity, it will be possible first of all through an increase in profitability of sales and to a lesser degree through an increase in asset turnover or an increase in capital leverage [Gołaś 2014]. Forecasts in this respect are generally optimistic [Wyniki ... 2015].

Table 6. Profitability ratios in Polish wood industry in 2006-2013

Years	Percent of entities with net profit (%)	Gross turnover profitability ratio (%)	Net turnover profitability ratio (%)	Return on assets (%)	Return on equity (%)
2006	79,2	5,7	4,9	6,0	10,7
2007	84,8	8,0	6,9	8,8	16,1
2008	70,6	1,9	1,4	1,6	3,4
2009	72,5	2,5	2,1	2,1	4,3
2010	77,1	2,8	2,1	2,3	4,7
2011	80,3	3,7	3,0	3,4	7,1
2012	75,6	3,6	3,2	3,6	7,3
2013	78,4	5,1	4,3	5,4	9,7
\bar{x}	77,3	4,2	3,5	4,2	7,9
V (%)	5,4	45,1	48,4	54,9	49,5

Source: own calculations based on CSO

In the first half of 2014 the rate of increase in revenue was markedly greater than the rate of cost increase, as a consequence of which the cost index decreased to 93%, while profitability of sales in the wood sector increased to 6%. Changes in these parameters, at a stable level of asset turnover and capital leverage, justify forecasts of return on equity in the wood sector for the entire 2014 at approx. 12%, which means a return to high economic and financial efficiency.

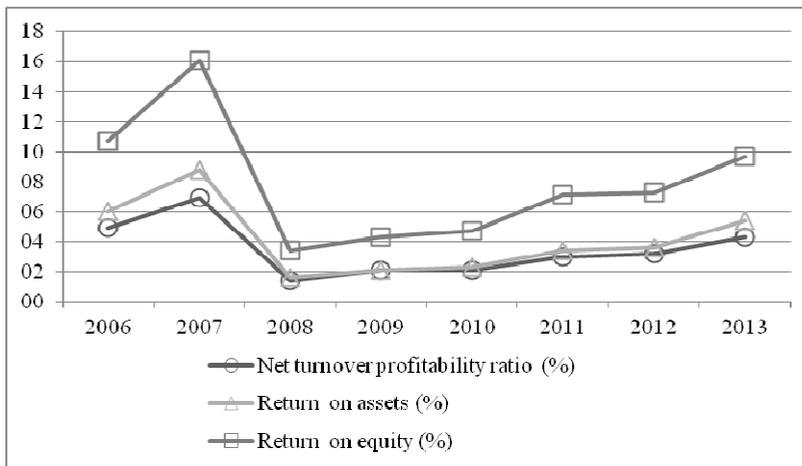


Figure 5. Profitability ratios in Polish wood industry in 2006-2013

Source: own calculations based on CSO

CONCLUDING REMARKS

It results from this analysis that after a deep slump in the wood sector in 2008 in the next years its financial situation improved markedly. The advantageous direction of changes resulted first of all from the increase in revenue and reduced operating costs, leading to the marked increase in sales profitability as well as return on assets and return on equity. In the other areas and criteria for the assessment of the financial situation in the wood sector, i.e. liquidity, indebtedness and efficiency, no marked changes were observed. In the investigated period the wood sector showed a safe level of liquidity, a low level of indebtedness and a stable asset productivity. A characteristic feature of the analyzed period was connected with a considerable increase in workforce productivity. In the years 2006-2013 workforce productivity in the wood sector increased in real terms by as much as approx. 50%, which to a large extent determined a reduction of unit costs and an increase of profitability.

REFERENCES

1. Archiwum kursów walutowych. Narodowy Bank Polski, Statystyka i sprawozdawczość. NBP, Warszawa, www.nbp.pl, (dostęp 02. 2015).
2. Bednarski L.: Analiza finansowa w przedsiębiorstwie. PWE, Warszawa 1997.
3. Bieniasz A., Gołaś Z.: Financial liquidity of wood industry enterprises in Poland 2006-2012. *Intercathedra*, 2014, 30/3: 7-14.
4. Bilansowe wyniki finansowe przedsiębiorstw niefinansowych. GUS, Warszawa, www.stat.gov.pl (dostęp 02. 2015).
5. Gołaś Z.: Profitability analysis of wood industry enterprises in Poland 2006-2012. *Intercathedra*, 2014, 30/2: 22-28.
6. Sierpińska M., Jachna T.: Ocena przedsiębiorstwa według standardów światowych. Wyd. PWN, Warszawa 2004.
7. Sierpińska M., Wędzki D.: Zarządzanie płynnością finansową w przedsiębiorstwie. PWN Warszawa 2001.
8. Waśniewski T., Skoczylas W.: Syntetyczna ocena wyników oraz sytuacji finansowej przedsiębiorstwa. *Rachunkowość* 1998, 4: 199-211.
9. Wyniki finansowe podmiotów gospodarczych I-VI 2014. GUS, Warszawa, www.stat.gov.pl (dostęp 02. 2015).

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DYNAMICS OF DEMOGRAPHIC DEVELOPMENT OF RURAL AREAS OF MAŁOPOLSKIE VOIVODSHIP

Abstract: The paper presents the analysis of the dynamics of population of rural areas in Małopolskie voivodship. The aim of the paper is to estimate demographical changes within the period of 2004 – 2011 and determine the forecast for subsequent years. The forecasting procedure is based on the method of exploration of trends. The paper also focuses on demographical processes by contrasting the countryside population and city population.

Key words: rural population, trend, forecast

INTRODUCTION

Małopolskie voivodship (according to the National Census, 31.03.2011) was inhabited by 3337,5 thousand people. This fact settled the voivodship on the fourth position in the ranking with respect to the size of the population after Mazowieckie, Śląskie and Wielkopolskie voivodship. At the same time one can notice that this population constitutes 8,7% of the total number of people in the country.

In the cities of Małopolska there were 1641 thousand people (7% of city population in Poland and the fifth position after Śląskie, Mazowieckie, Dolnośląskie and Wielkopolskie voivodships). Rural areas were inhabited by 1696,5 thousand people, which constituted 11,2% of the total population of rural areas in Poland. This placed the voivodship on second position after Mazowieckie voivodship in the ranking with respect to the size of rural population.

Since last National Census (2002) Małopolska population has increased by 105,1 thousand people, that is 3.3%. It was the second – after Pomorskie voivodship (4,4%) rate of increase of the number of people. Over this period the number of people in the whole country increased only by 0,7% on average. The increase of the number of people concerned both cities and rural areas in Małopolska. In case of cities the estimated increase was merely 0,9%, but on average the number of people inhabiting cities dropped by 0,9%. The increase of number of people in case of rural areas was much more significant – it reached the level of 5,7% (3,3% in the whole country). The number of people in rural areas increased systematically generally due to high migration from cities and positive natural growth.

According to M. Małopolskie voivodship has a very large number of small farms. On the other hand, the number of people living from farming has been constantly decreasing, which is parallel to processes taking place in the whole country. [Bogusz, Paluch 2011].

Table 1. Population of Małopolskie voivodship within the period of 2004-2011

	2004 (in thousand/ w tysiącach)	2011 (in thousand/ w tysiącach)	Dynamics 2004-2011 Dynamika 2004-2011
Voivodship in total/ Województwo ogółem	3244995	3346796	103,1
Cities/Miasto	1600037	1641853	102,6
Rural areas/wieś	1644958	1704943	103,6

Source: Own calculations

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MATERIAL AND METHOD

The analysis covered the period of 2004-2011. The data from the Local Statistical Office of Małopolskie voivodship. The research covered:

- ✓ The estimation of the intensity of changes of the phenomenon on the basis of the measure of increases $(Y_t - Y_{t-1})$ and indices $\left(\frac{Y_t}{Y_{t-1}}\right)$,
- ✓ The determination of the average rate of changes of the phenomenon computed as a geometrical average of the indices:

$$\bar{i} = \sqrt[n-1]{\frac{Y_n}{Y_1}}$$

where: Y_1, Y_2, \dots, Y_n - are the realizations of the variable observed in time ($t=1, 2, \dots, n$);

- ✓ Determination of the direction and the rate of changes – estimation of trends:

$$y_t = \alpha_0 + \alpha_1 t + \xi_t$$

where: y_t – variable describing the phenomenon in time t ;

t – time variable ($t=1, 2, \dots, n$);

α_0, α_1 – structural parameters of the model; t

ξ_t – random element;

- ✓ Trend extrapolation – determination of the expected values of the phenomena under investigation with specification of relative errors (ex post) of prediction.

DEMOGRAPHIC PROCESSES

The intensity of changes of population size

The average rate of changes within the period of 2004-2011 in Małopolskie voivodship was generally on the same level (Table 1). The most significant increase both in the number of people in total and the number of people in rural areas took place over the years 2011 and 2010. For the voivodship in total and for the rural areas it reached the level of 36702 and 22687 respectively, which was a little more than 1%.

Table 2. Number of people in Małopolskie voivodship – increases and indices

Year/Lata	Total number of people/Liczba ludności ogółem		Number of people in cities/Liczba ludności w miastach		Number of people in rural areas/Liczba ludności na wsi	
	Increases/Przyrosty	Indices/Indeksy	Increases/Przyrosty	Indices/Indeksy	Increases/Przyrosty	Indices/Indeksy
2004						
2005	6695	1,0021	-940	0,9994	7635	1,0046
2006	5247	1,0016	-1074	0,9993	6321	1,0038
2007	7356	1,0023	961	1,0006	6395	1,0039
2008	9368	1,0029	-617	0,9996	9985	1,0060
2009	11854	1,0036	8440	1,0053	3414	1,0020
2010	24579	1,0075	21031	1,0131	3548	1,0021
2011	36702	1,0111	14015	1,0086	22687	1,0135

Source: Own calculations

After the decrease in the number of people in cities noticed At the beginning of the period under investigation, the highest increase of the number of people in cities was observed over the years 2009 and 2010 and reached the level of 21031.

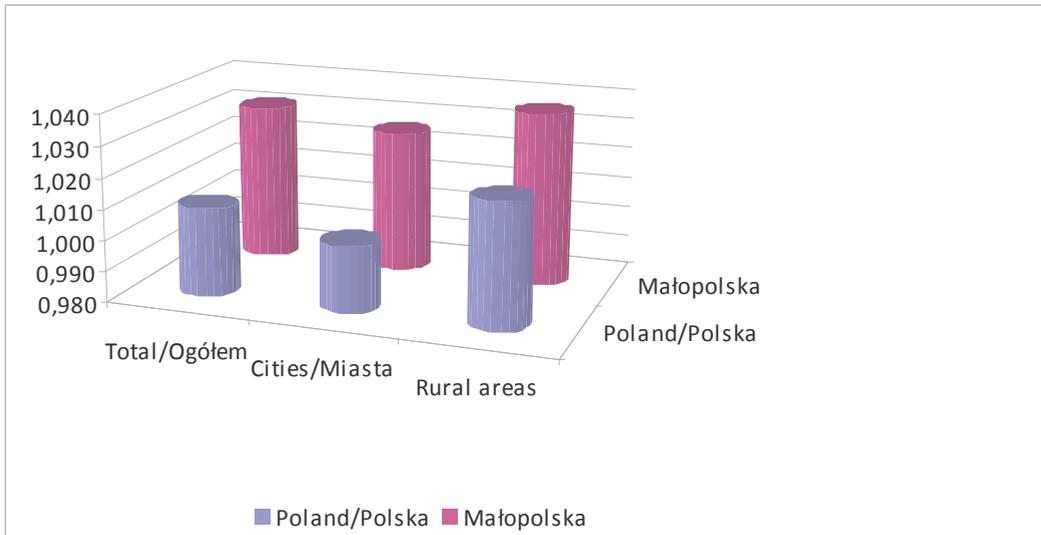


Figure 1. Rate of changes in the number of people of Małopolskie voivodship on the background of the whole country within the period of 2004-2011

Source: Own calculations

Trends of demographic development in rural areas of Małopolskie voivodship

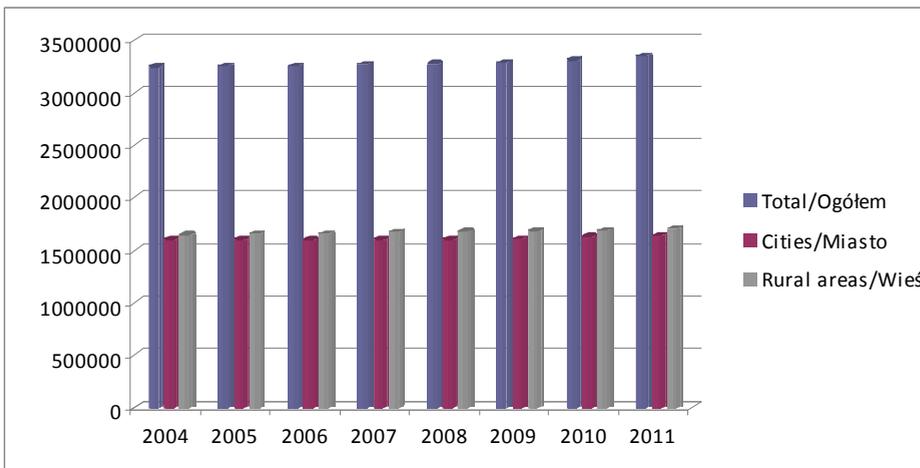


Figure 2. Number of people in Małopolskie voivodship within tire period of 2004 - 2011

Source: Own calculations

The development of population of Małopolskie voivodship in the aspect of comparison of rural areas and cities within the period of 2004 – 2011 is presented in fig. 2.

Rough analysis of the development of the population of Małopolskie voivodship shows the constant increasing trend in case of number of people in rural areas. It has an impact on the forecasts according to which one can expect the increase of the number of people in rural areas up to 2020 and than up to 2035 - the decrease of the size of rural population down to the present state [Knapik. Kowalska 2014]. The trend line for the period under investigation can be described by the equation:

$$\hat{y}_t = 7,5902 \cdot t - 13567 ; \quad R^2=0,949.$$

One should notice that over the period of 2004 – 2011 being under investigation the number of people increased each year by 0,5% on average.

Table 3. The forecast of number of people in Małopolskie voivodship and its relative errors (ex post)

Year/Rok		Number of people (In thousands)/Liczba ludności (w tysiącach)		
		Total/Ogółem	Cities/Miasto	Rural areas/Wieś
2012	Forecast/Prognoza	3354	1639	1715
	Relative error (in percents)/ Względny błąd (procentowy)	-0,476	-0,329	-0,617
	Relative quadratic error/ Względny kwadratowy błąd	0,076	0,018	0,065
2013	Forecast/Prognoza	3361	1637	1723
	Relative error (in percents)/ Względny błąd (procentowy)	-0,293	0,130	-0,638
	Relative quadratic error/ Względny kwadratowy błąd	0,029	0,003	0,070

Source: Own calculations

Trying to answer the question of what kind of factors were the reason for such systematic increase of the number of people, the balance of natural growth and general balances of migrations in cities and rural areas were analyzed (fig. 3).

In 2011 the rate of growth in population size slightly decreased. The number of births observed in his year – 35,5 thousand – was by 1,5 thousand lower in comparison with the previous year (2010). Number of deaths (29,7 thousand) was more or less similar to the state in previous years. Still, the natural growth in the voivodship remained positive and equal to 5,7 thousand people, which placed the voivodship in the second rank in the whole country, just after wielkopolskie voivodship.

In comparison to the national average the number of people in Małopolskie voivodship has a relatively high level of natural growth. The value 1,8 per 1000 inhabitants was much higher than the corresponding national index, which in the years 2002 – 2005 was negative, becoming slightly positive since 2006 and in 2011 reached the value of 0,34%. In the area of the whole country higher level of natural growth was observed only in Pomorskie and Wielkopolskie voivodship.

Higher level of the national growth was the consequence of the higher level of births (10,8‰ – in the voivodship, 10,2‰ – in Poland) and lower level of deaths (9,0‰ – in Małopolskie voivodship, 9,8‰ – in Poland).

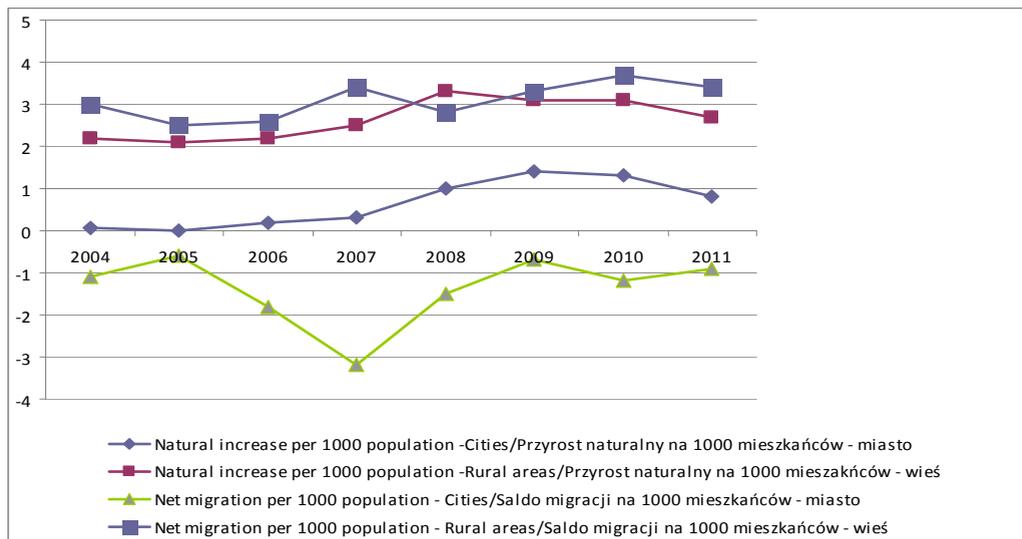


Figure 3. Natural growth coefficients and the balance of migration of population in cities and rural areas in Małopolskie voivodship within the period of 2004-2011

Source: Own calculations

High level of births follows from the fact that a great number of women entered the period of high fertility which in turn is the consequence of population boom of the eighties. The birth coefficient that expresses the number of births per number of women in the age of 15 – 49 remained low in 2011 reaching the level of 1,345 which was a little higher than the national average that had the value of 1,301. The coefficients are far from favourable that could assure simple generation replacement.

In spite of favourable demographic situation in Małopolskie voivodship, just like in the whole country systematic decrease of natural growth could be observed up to the year 2003. In the period of 1995 – 2003 the growth dropped by 64%. This trend was apprehended in 2004, the natural growth then was on the level of 3,8 thousand people. This was due to low rate of growth of number of births (by 0,3% more than in previous year) and significant drop of number of deaths (by 2,6%). This caused a little drop of natural growth index in comparison with its value in 2004. In next years the level of natural growth reached its previous value. In 2011 this trend changed – number of births decreased while the number of deaths did not change.

Significant differences occurred between rural areas and cities, although within last years they underwent reduction. The main reason for this was the permanent decrease of the number of births in rural areas and the increase of this coefficient in cities. The level of deaths for rural areas was slightly lower than in cities.

The process that significantly influence the level of population of a voivodship are migrations. Małopolskie voivodship is on the second position (1,3‰) for many years, just after Mazowieckie voivodship (2,7‰), that is the region of high positive migration index. Similar situation can be observed only in case of Pomorskie, Wielkopolskie and Dolnośląskie voivodship, but the value of this index is lower.

In 2011 there was observed the highest – since 2000 – migration level – 4,3 thousand people arrived, that is almost twice as much as in 2008, when 2,2 thousand people arrived. The migration

balance for Poland was negative for many years and in 2006 this trend reached its extreme and the size of population dropped by 36,1 thousand people, the highest level since 1990.

Spatial distribution of migration was very differentiated. In 11 districts the migration index was negative (the lowest in Tarnow -4,86%). Positive migration index was observed in 11 districts (the highest in Wielicki district +12,8%).

High migration index is observed in rural areas for the past few years. Intensity of immigration of population into rural areas was observed mostly in suburban zone of Krakow, the highest level of migration was recorded in communes of Wielicki and Krakowski district.

The area of population immigration into rural areas of the agglomeration of Krakow has widened significantly, mostly towards South East, but also North. Lower, nevertheless positive migration index was observed in case of suburban areas of Tarnow and Nowy Sącz. In comparison to previous years it went down significantly. Most rural communes in the neighborhood of cities also indicated the increase of population immigration, especially in the west part of the voivodship. In other parts of rural areas mostly in case of agricultural districts of Northern part of the voivodship (miechowski and dąbrowski district) and mountainous areas (gorlicki and limanowski district) and also in case of the west part of the voivodship (wadowicki district) one can notice the predomination of emigration processes [Kowalska 2009].

CONCLUSIONS

The investigation carried out in the paper allows for the following conclusions:

1. The number of population had been increasing over the whole period of investigation both in cities and in rural areas
2. Changes of the phenomenon under investigation were continuous, which allowed for determination of trends
3. Prediction of the variables under discussion indicates their permanent increase
4. The highest positive migration index was observed in Wielicki district, while the lowest – in Tarnow
5. In 2011 the increasing trend of natural growth in the voivodship under investigation went down significantly – the number of births decreased while the number of deaths remained on the same level.

REFERENCES

1. Bogusz M., Paluch Ł. 2011. Ocena wykorzystania funduszy w UE w rozwoju przedsiębiorczości na obszarach wiejskich województwa małopolskiego [W:] SERIA we Wrocławiu.
2. Kędelski M., Paradysz J. (2006) Demografia. Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań.
3. Knapik W., Kowalska M., (2014). Zróżnicowanie obszarów wiejskich w Polsce na tle procesów społeczno-ekonomicznych i demograficznych. (w:) Problemy drobnych gospodarstw rolnych. Europejskie Centrum badawcze Drobnych Gospodarstw Rolnych UR w Krakowie. Nr 1. 2014. Kraków. (s. 37-54).
4. Kowalska M., (2009). Zjawisko emigracji zarobkowej na terenie powiatu wadowickiego. Acta Scientiarum Plonorum Oeconomia 8(4)2009 (s. 97-105). Warszawa.
5. Okólski M. (2004) Demografia. Wydawnictwo Naukowe SCHOLAR. Warszawa.
6. Raport o sytuacji społeczno-gospodarczej województwa małopolskiego w 2013 r. (2014). Kraków.
7. <http://krakow.stat.gov.pl/>, <http://stat.gov.pl/>

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TECHNOLOGICAL INNOVATIONS IN THE PRODUCTION OF WOODEN PALLETS

Abstract: A wooden pallet assembly line was evaluated according to the Oslo methodology, which was developed by the OECD and Eurostat. The line enables the assembly of EUR-pallets as well as industrial pallets, coloured pallets and PBR pallets. The technological process of production of packages is in agreement with required specifications for standardised products in European and world recommendation systems: EUR, EPAL and CHEP. Product, process, organisational and marketing innovations were evaluated.

Key words: wood, innovations, pallets

INTRODUCTION

The technological process of production and assembly of wooden pallets was analysed. The set of modern machines and appliances in the line gives a possibility to improve and start manufacturing products with new sizes, better construction and wider range of colours. The technical and technological solutions in the line enable high quality and precision of production, which is necessary in modern processes of mechanisation and automation of logistics, transport and storage.

DESCRIPTION OF PRODUCTS

The innovative assembly line enables the production of all types of wooden pallets, which are manufactured and used in Poland and all over the world, i.e.

- 1) **industrial** pallets (English pallets), including heavy-duty products,
- 2) **EUR**-pallets, including EPAL pallets,
- 3) coloured pallets – for companies that specialise in package rental services, including the most common blue pallets for CHEP company, the world leader in pallet and container rental services (**CHEP** pallets),
- 4) PBR products – the global standard for logistics and storage in supermarkets (**PBR** pallets).

RESEARCH METHODOLOGY

The analysis of innovativeness was conducted according to the Oslo methodology, which is an international standard developed by the OECD and Eurostat for statistical research on innovations in industry and the market services sector. Product, process, organisational and marketing innovations were evaluated.

EVALUATION OF TECHNOLOGICAL INNOVATIVENESS OF PRODUCTION LINE

The line is equipped with an automatic block feeder and adjustable guides with a system of distribution of blocks by means of graspers. It gives a possibility to position elements on the worktop of both identical hydraulic machines, which are part of the assembly line and which are equipped with chain conveyors. The automatic block feeder very precisely positions pallet elements on the carriage of the nailing unit. Between the nailing units is a turntable with graspers and driven feeder chains. The turntable gives a possibility to turn the pallet 180 degrees during machining. In order to extend the range of possibilities each machine is supplied with an extension of 7-9 typical cutting matrixes.

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The line is equipped with three semi-automatic feeders for pallet construction slats, i.e. for:

- 1) stiffening planks,
- 2) upper planks (5 trays for different slat sizes),
- 3) lower planks (3 trays).

The feeder for stiffening and upper planks is located before the first hydraulic nailing unit, whereas the feeder for lower planks is located before the other hydraulic nailing unit. The trays give a possibility simultaneously to load slats of different sizes and to collect them according to the current demand.

The line is equipped with combined machines for:

- 1) corner phasing (machining). It cuts four corners of a pallet at a 45° angle.
- 2) cutting pallet edges. It is equipped with 6 end mills, which ensure different degrees of finishing and different appearance of pallet edges.
- 3) stamping pallets with check marks. It has 6 stamps for different identity marks required by clients as well as Polish and foreign regulations. The right, middle and left block can be stamped.

Thanks to this combined machine pallet edges and corner posts are processed much more precisely. The laborious pallet marking system is highly machined. Automatically marked symbols are legible and clean.

The line has an automatic nail counting system. There are two independent hydraulic systems for nailing metal connectors. Hydraulic nailing machines are considered to be more durable. They can ensure high-precision nailing for a longer period of time. Each nailing machine can work independently. As a result, nails are precisely driven into their positions at different levels of the pallet.

There are three turntables in the technological line. Two of them turn pallets 180 degrees, one – 90 degrees. It gives a possibility to machine all sides and edges of the means of group transport.

The production line is equipped with a device for stacking pallets. They are stacked one into another. It is a great advantage when transporting lighter pallets because the size of cargo loaded on a lorry depends on the stack volume rather than its weight.

ANALYSIS OF PRODUCT QUALITY

The machine enables initial automatic control of pallet quality. When more than two nails are driven wrongly, the machine stops working and informs the operator about the defect. Thanks to this, defects can be detected and eliminated at an early stage of production. This prevents further production of a faulty pallet. It is important because, as has been empirically proved, in an older production line which has been used for 7 years, in every work shift about 30 pallets are disqualified and rejected due to wrongly driven nails. It causes considerable, measurable loss every month and year. The implementation of the pallet nailing line under analysis considerably limits the number of faulty products. There will only occasionally be defective pallets.

TESTING TECHNOLOGICAL INNOVATIVENESS ACCORDING TO THE OSLO METHODOLOGY

As far as **process** innovativeness is concerned, assembly operations on the pallet nailing line are automated and mechanised. The line is centrally controlled with a touchscreen control panel. The machines installed in the line enable remote supervision and control of the production process in terms of assembling, feeding and finishing. Mechanisation definitely increases production efficiency and effectiveness. The company resources can be used much better.

The purchased set of machines gives a possibility to manufacture new and modernised products with new sizes and constructional solutions. The toleration of semi-finished and finished products is in agreement with specifications, which are necessary for products standardised in European and world systems: EUR, EPAL, CHEP and PBR.

In general, the installation, commissioning and implementation of unique machines grouped into an automated production line gives a possibility to manufacture pallets according to a modern technology, which is innovative on a national scale.

As far as **product** innovativeness is concerned, new products (pallets on sawdust supports and disposable industrial pallets assembled from planks with bark on the upper panel) and improved products (EUR-pallets and technical pallets) are characterised by high quality and precision of workmanship. The use of sawdust supports in pallets gives a possibility to handle waste rationally. Apart from that, the process of drying pallets is two times shorter than drying pallets with conventional solid wood supporters.

New and improved products are safer, more durable and resistant to damage. It is particularly important, especially for licensed EPAL products, which are systematically audited. The pallet manufacturer will lose the EPAL licence if the result of an audit is negative. In consequence, the manufacturer will lose the most important clients and key contractors, who are particularly concerned about unchangeable product quality confirmed by an independent institution. This is often decisive to starting or continuing cooperation.

In general, as far as product innovativeness is concerned, new and improved pallets are an innovation on a local and regional scale.

The analysis of **organisational** innovativeness reveals that the implementation of the new pallet assembly line leads to significant changes in the organisation of labour in the company. There is increased demand for staff in the enterprise. After the installation of the line the company can accept and complete more tasks. The order execution time has been reduced considerably. It is noticeable that the production cycle has been reduced. Roundwood is used more effectively.

The **marketing** innovation undoubtedly results from the fact that after purchasing the new pallet assembly line the entrepreneur can manufacture all types of wooden pallets which are produced and used in Poland and all over the world. This fact makes the entrepreneur a very versatile provider of packages for big clients. Products manufactured on the modern assembly line under analysis look much better. Pallet edges and corner posts are much more precisely machined. The mechanised, automated system of placing checkmarks on pallets makes them more legible and aesthetic than traditional checkmarks. Automated assembling, feeding and finishing processes ensure better use of the company's human and material resources. This results in lower costs of production, which may result in competitive prices offered by the company. This particularly applies to pallets with sawdust supporters and industrial pallets with constructions made from bark-covered planks rather than conventionally used square-edged timber, which is more expensive.

To sum up, the organisational and marketing innovations are considerable assets and they are innovative on the company's scale.

In general, the new pallet assembly line is an innovative product, which is definitely new on the Polish market.

SUMMARY AND CONCLUSIONS

The location of the modern line for assembling finished products was based on the ambitious aim of introducing technological innovativeness, i.e. creative improvements in methods of wooden pallet production. The most important results are as follows:

- manufacturing products (pallets) with new sizes and constructional solutions,
- increased precision in pallet workmanship,
- the application of a hydraulic nailing system, which is more durable and guarantees high precision of connections for a long period of time,
- both nailing units installed in the technological line can work independently – connectors are nailed at different levels and they are precisely placed,

- it is possible to initially control the pallet quality. When more than two metal connectors are nailed wrongly, the machine stops working and informs the operator that it is necessary to handle the problem and eliminate the defect. promptly,
- highly automated production process, which is centrally controlled with a touchscreen control panel.

The combination of high quality and competitive price may cause clients' widespread interest in the products.

BIBLIOGRAPHY

1. European forest sector outlook study 1960-2000-2020 (2005). Main Report. FAO, United Nations, Geneva
2. Eurostat yearbook (2014)
3. FAOSTAT (2015): www.faostat.fao.org
4. Food and Agricultural Organisation (2014): www.fao.org
5. Forest Stewardship Council (2014): www.fscoax.org
6. Frań J. (2008): Zarządzanie jakością w instytucjach gospodarczych. Wyd. Uniwersytet Szczeciński, Szczecin
7. Kotler Ph. (2005): Marketing. Dom Wydawniczy REBIS Sp. z o.o. Warszawa.
8. Kalinowski T.B. (2010): Innowacyjność przedsiębiorstw a systemy zarządzania jakością. Wyd. Wolters Kluwer Polska.
9. Lis W. (2010): Ekonomiczne problemy suszenia drewna i palet drewnianych. Przemysł Drzewny, nr 7-8/2010, vol. 61, s.12-26, ryc.12, tab. 16, poz. bibl. 31.
10. Lis W. (2014): Drewno i odpady drzewne – zastosowania technologiczne i biomasa. Raport. PRZEMYSŁ DRZEWNY. RESEARCH & DEVELOPMENT, nr 2/2014, s.38-45, tab. 1, rys. 5, poz. bibl. 16.
11. Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. OECD and Eurostat, 2005
12. ROZPORZĄDZENIA MINISTRA ŚRODOWISKA ORAZ MINISTRA GOSPODARKI z dnia 2 maja 2012 r. w sprawie określenia gęstości drewna (Dz.U. z 17 maja 2012 poz. 536)
13. Szczepańska K. (2009): Koszty jakości dla inżynierów. Wydawnictwo PLACET, Warszawa
14. Thompson J.R., Koronacki J., Nieckuła J. (2005): Techniki zarządzania jakością: od Shewharta do metody "Six Sigma". Wyd. EXIT, Warszawa.
15. UNECE Timber Committee / Fao European Forestry Commission (2014): www.unece.org
16. Wawak S. (2005): Zarządzanie jakością - teoria i praktyka. Wyd. Helion, Gliwice

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INCREASING COMPETITIVENESS OF SMALL AND MEDIUM ENTERPRISES THROUGH THE USAGE OF MARKETING COMMUNICATION IN CLUSTERS OF SERVICES IN SLOVAKIA

Abstract: Despite of the economy globalization and sophisticated global communications technologies, currently, more attention is paid to development of clusters and to marketing communication of clusters. The aim of this paper is the analysis of marketing communication tools in business clusters of services in Slovakia. This is known as the marketing communications mix. This is charting of the tools of marketing communication forming the basis of a marketing communications campaign in the cluster of services.

Keywords: cluster, services, marketing communication.

INTRODUCTION

The process of globalization leads us to universalization of world economy and, at the same time, it acts as the process of differentiation that causes its decomposition into smaller economic units. Territorial expression of differentiation of world economy is a process to which it is referred as regionalism (regionalization). Indivisible part of terms globalization and regionalization is also integration. The term integration is not used only at microeconomic level but also on microeconomic one, where integration is understood as a process of bringing functional units of an organization closer together, i.e. creation of clusters by binding two or more businesses under one management unit. Causes might be different, due to voluntary binding in order to improve economic results as far as the point of coerced binding related to the reason of economic problems. By the influence of cluster and the process of globalization in Europe, an economic platform for enterprises is created, that is supported not only by favourable demographic and cultural development but also by stable political situation enabling enterprises to expand, to establish themselves in new markets and to satisfy needs of customers by continual product innovation.

Customers' needs are constantly changing, which is caused by rising of living standards, higher life expectancy and demographic growth. It is a task of each company to replace classical business activities by sophisticated ones, which would solve market (customer) demand in more efficient way. It is necessary to develop new products, to introduce them to new markets and new target groups, and it is also necessary for the companies to lead their customers towards repetitive purchase and by proper communication to strengthen their loyalty towards brands [Loučanová, 2013; Loučanová, Zaušková, 2007; Straka, 2013; Triznová, 2013; Kaputa, 2001; Kalamárová, 2013].

The aim of this paper is the analysis of marketing communication tools in business clusters of services in Slovakia.

LITERATURE

Acceptable Enterprises in clusters have access to special and supportive factors of production. In fact, the process of modernization is internally driven by competition and well worked – out cluster demand. When talking about growth of these types of local forms, there is freedom and significant mobility among clusters and they are substantially significant all over the world in case that they avoid stagnation. Local clusters need to be favourable towards enterprises, risk capital, technology and other resources from all over the world in order to achieve long – term vitality.

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New way of thinking about both national and local economies can be represented by clusters. Clusters, in pursuance of enhancement of competitiveness, require new roles for companies of many levels and other shareholders [Porter, 2000].

Among the mentioned levels, there is marketing communication of clusters within the framework of 4Ps Marketing Mix, which serves as a tool for marketing management. It contains advertising, sales promotion, personal selling, public relations and direct marketing by Figure 1 [Kusá, 2005].

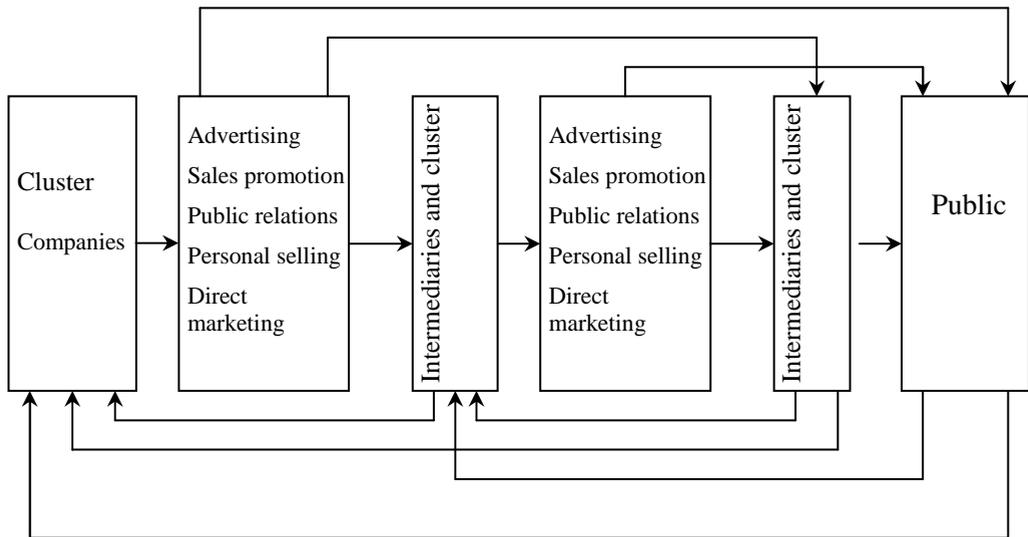


Figure 1. The Marketing communication system

Source: author's view by Kusá, 2005

Martin and Sunley [2003] state that defining of the term cluster does not free us from necessity to explain what is understood under the idea of cluster promotion, moreover, it might be an easier task than defining a cluster, as it would necessitate identification of threshold values also with their intensities and qualities of collaboration or relative shares of involved companies, other organizations and some manifestations of cluster outcomes.

Contrarily, cluster promotion can be defined as a set of measures, which may occur in any collection and style of implementation, which are directed towards the optimal interaction features of a clusters and it is all done by supporting development of specialized and competitive company structures of a region, without determination of concrete limits with regard to accomplishments [Raines, 2001].

European Commission [2001] wrote that clusters are all regional networks, which have to promote themselves in order to appeal to new members, to create assurance together with positive attitude towards the regional industry and, more crucially, to build a common identity.

METHODOLOGY

The methodology is formed on the basis of empirical analysis of clusters of services also with cluster assessment of marketing communication in Slovakia.

In these parts of the work, classical methods of scientific heuristics with special emphasis on description, analysis and synthesis of gained knowledge as well as existing and developing chosen indicators were used.

The methodology, whose main aim is charting of marketing communication tools, should contain three main steps.

Identification of Slovak clusters of services is the first one.

It is followed by the second step, whose role is to identify marketing communication tools for every cluster of services. This was achieved by interviewing knowledge owners, by filling out questionnaires by managers of clusters and by identification of people having the knowledge. It is assumed that knowledge owners own the knowledge associated with marketing communication. The idea of the interview was brought up in order to gather different views on marketing communication related to clusters of services.

After the collection of data its analysis connected to the usage of marketing communication tools in Slovak clusters of services is possible.

The final part of analysis consisted of evaluation of the ratio of the individual components of marketing mix that were used within the framework of marketing communication of clusters of services in Slovakia.

Afterwards, based on the information gathered in this way, model solutions for marketing communication of clusters of services in Slovakia will be proposed [author's view by Loučanová, 2013; Kriššák, 2012].

DATA ANALYSIS AND DISCUSION

In monitored period in Slovakia resulted in seven clusters of services: Cluster of tourism – west region of Slovakia, Liptov, Orava, Turiec, Balnea Cluster, 1. country cluster Smolenice, Košice Turizmus.

Second stage was identification of key tools marketing communication in each of them. We then analyzed the information on the use tools of marketing communication in these clusters (Table 1).

We then analysed the information on the use tools of marketing communication in these clusters.

The cluster promotion mainly builds upon existing potential of regionally concentrated firms providing services, other organizations and linkages in the sectors.

The services cluster uses most of the tools marketing communication Sale promotion and Public relations, and then direct marketing and Advertising. Sale promotion for most uses exhibitions, fairs, seminars and training courses, reports, social and sporting events, booklets. Public relations for most use advertising articles, final report, events and lobbying. In Direct Marketing are mainly used web and internet. Every cluster presents its own logo as advertising.

In general, cluster promotion puts a stronger focus on measures, such as facilitating contacts between various private and public actors and activating collective action, as social events, seminars and training courses, reports, lobbying, final report, web, logo etc. by Figure 2.

Table 1. Using the tool of marketing communication to services clusters in Slovak republic*

Clusters	Advertising						Sales promotion									
	print media	broadcast media Spodná časť	outdoor advertising Spodná časť	Internet advertising	logo	exhibitions, fairs Spodná časť	social and sporting events	booklets Spodná časť	seminars and training courses	reports	loyalty products Spodná časť	Začiatok fórmulára	competitive packing and presents Spodná časť	formulára	promotional products Spodná	
Cluster of tourism -west region of Slovakia	x	x	x	x	√	√	x	√	√	√	x	x	x			
Liptov	x	x	√	x	√	√	√	√	√	√	√	√	√			
Orava	x	x	x	x	√	√	√	√	√	√	x	x	x			
Turiec	x	√	x	√	√	√	√	x	√	√	√	√	x			
Balnea Cluster	x	x	x	x	√	√	√	√	√	√	x	x	x			
1. country cluster Smolenice	x	x	x	x	√	√	√	√	√	√	x	√	x			
Košice Tourism	√	√	√	x	√	√	√	√	√	√	x	√	√			
Clusters	Public relations									Direct marketing						
	advertising articles	lobbying	final report	charity	sponsoring	press conferences	Intranet	design manual	events	Personal selling	direct mail	web	telemarketing	on-line sales	social media	internet
Cluster of tourism -west region of Slovakia	√	√	√	x	x	√	x	x	√	x	x	√	x	x	x	√
Liptov	√	√	√	x	x	x	x	√	√	x	x	√	x	√	√	√
Orava	√	√	√	x	x	x	x	x	√	x	x	√	x	√	√	√
Turiec	√	√	√	x	x	√	√	√	√	√	x	√	x	x	x	√
Balnea Cluster	√	x	√	x	x	x	x	x	√	x	x	√	x	x	x	√
1. country cluster Smolenice	√	√	√	x	x	√	√	√	√	x	x	√	x	x	x	√
Košice Tourism	√	√	√	√	√	√	√	√	√	√	√	√	x	x	x	√

*Explanations: √ - use the tool of marketing communication; x - do not use the tool of marketing communication

Source: author's view by Križšák, 2012



Figure 2. The Marketing communication system to clusters of services in Slovakia

Source: author's view

CONCLUSION

Based on acquired knowledge through the interview, we may state that Slovak clusters of services are using, within their marketing communication, mostly sales promotions and public relations and, to a smaller extend, direct marketing. In advertising it is logo, as an identifier of concrete cluster of services, which occurs the most. In Slovakia, observed clusters of services are successful and, therefore, we suppose that it represents general model of marketing communication of Slovak clusters of services for their competitive ability.

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REFERENCES

1. European Commission Enterprise Directorate-General. (2001) *Methodology for regional and Transnational technology clusters : Learning with european best practices*. [on-line]. 2001. [cit. 10.07.2013]. Available on the Internet: S:\B2\Common\duartpa\Clusters\clustersmethodogiplan5_6.doc
2. Kalamárová, M. (2013). Využívanie miestnych daní na podporu a usmerňovanie využívania kultúrneho dedičstva v mestských pamiatkových rezerváciách na Slovensku In *Ekonomické spektrum* Roč. 8, č. 4 (2013), s. 11-20.
3. Kaputa, V. (2001). Manager as a decision maker. In *EDAMBA : 4. medzinárodná vedecká konferencia doktorandov EU v Bratislava* : Ekonóm, 2001. p. 111-116.

4. Kriššák, M. (2012). *Modelové riešenie marketingovej komunikácie v klastroch na Slovensku*. Technická univerzita vo Zvolene. Vedúca práce: Ing. Erika Loučanová, PhD. Zvolen: TU, 2012. 78 s.
5. Kusá, A. (2005). *Základy marketingu*. Zvolen : Technická univerzita vo Zvolene, 2005. 163 s.
6. Loučanová, E. 2013. Marketing communication to industrial clusters of slovak republic. In: *Studia Universitatis „Vasile Foldis“ Arad, 23/4, 2013*.
7. Loučanová, e., Zaušková, A. (2007). Methodology of Knowledge mapping in Industrial Clusters. In *INTERCATHEDRA No 23 : Annual Bulletin of Plant – Economic Department of the European Wood Technology University Studies*. Poznań, Poland. Vol. 23, p. 66-67.
8. Martin, R., Sunley, P. (2003). Deconstructing Cluster s: Chaotic Concept or Policy Panacea? In *Journal of Economic Geography* 3, pp. 5-35.
9. Porter, M. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. In *Economic development quarterly*. 2000. Vol 14. 15 – 34 p.
10. Saniuk A., Sakál P. Saniuk S., Witkowski K. (2014). Corporate Social Responsibility in the management of industrial enterprises In *Koncepty udržateľnosti organizácie*. 2014.
11. Straka M. (2013). *Logistika distribúcie, Ako efektívne dostať výrobok na trh*. Bratislava, EPOS 2013, 400 s.
12. Triznová, M. (2013). Current approaches to customer relationship management. *Intercathedra* 29/2, 89-95.



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INNOVATION IN THE WOOD SECTOR

Abstract: Information on the favourable forecast concerning economic growth for many organizations constitute a stimuli for a more radical investment policy.

The article aims at pointing factors which have an impact on the level of innovation in the companies from the wood sector as well as determining the opportunities and chances which are open for those being active on the market.

Key words: innovations, development, wood sector,

INTRODUCTION

According to the European Union economic prognosis for the Union, as well as the euro zone are optimistic this year. It is estimated that the EU member countries will develop at a pace of 1,8% GDP. It is 0,2% better than the estimated forecast.

Poland with its 3,3% GDP is among the most rapidly developing European states. Such fast growth, supported by the vast domestic demand, makes a strong stimuli for the increase in companies' investment levels (*www.biznes.pl*).

In this situation Polish companies face new challenges. Planning and implementing various investments is of vital importance in keeping their stable position. It has a key role, as the situation in the sector is being judged based on its investment level, at the same time, pointing at its role in the development of the whole economy. For a strong company position it is important that it uses its potential and the effects of its operations.

New opportunities are also opening for the wood sector. They mainly concern using innovative solution, as regards production efficiency, groundbreaking ideas related to creating and enhancing products, as well as reducing costs of manufacturing. , it is not always possible, due to external factors independent of the company, which make investment decisions more difficult.

WOOD SECTOR IN POLAND

Wood sector in Poland plays an important role for the whole economy. The measurement for its position is the sales volume as well as the level of investment in every single company. Its effect is the competition among the companies but also their care for the needs of the potential clients.

Juxtaposing and comparing different sectors of economy generating GDP for the state budget one can easily evaluate their condition. However, in case of wood sector such comparison and generalization is not precise because the level of company innovation depends not only on the financial or managerial but also technological possibilities, but mainly the level of raw material processing. It is therefore difficult to compare the efficiency of small companies or sawmills with large and buoyant companies at a very high level of technological development. Such collation does not reflect the real condition of the sector influencing its often inadequate assessment.

Characteristic for the wood sector is its high dispersion and diversification in terms of company size. Within the wood sector apart from small and medium size and micro companies, which share amounts to about 90% of all companies operating in the sector there are also large corporations. Faced with such strong diversification, both in terms of size and potential it is hard to talk about increasing innovation level throughout the whole sector.

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The higher the degree of processing, the more complicated technical, technological and organizational solutions may be implemented. Therefore, investment growth is more visible in wood-based panels or paper industry than in primary wood processing where the pace of both mechanical and technological development is much slower. As the result, the biggest financial resources are being spent on modernizing and increasing the level of technical development in large companies operating based on complex technological processes. Those are the companies benefiting most from all kinds of investments. Due to the new generation technologies, the biggest machinery parks or modern production halls those units not only improve production parameters of their products but also enhance their image and the fact that they are able to prepare an offer that meets their clients requirements places them among both European, as well as world leaders (*Foresight ...2011*).

The data presented in table 1 suggests that the share of wood sector sold production in the global production within the recent years is still significant. It shows the continuous demand for the products generated by that industry. Wood and wooden products are still marketable, while their interesting design and unique quality often make them unrivalled. Moreover, investment implemented by companies improves their efficiency and production capacity giving this sector a still stable position in Polish economy.

Table 1. Wood industry sold production in years: 2005, 2010, 2011, 2012, 2013.

Items	Share of wood industry sold production in global production [%]				
	2005	2010	2011	2012	2013
Production of wooden products...	2,9	2,6	2,5	2,5	2,8
Production of paper and paper products	2,4	2,5	2,5	2,5	2,7
Production of furniture	3,2	2,6	2,7	2,4	2,6
Total	8,5	7,2	7,7	7,4	8,1

Source: Own elaboration based on: *Mały Rocznik Statystyczny Polski GUS 2012* pages. 353-354; *Mały Rocznik Statystyczny Polski GUS 2013*: pages 352-353

Wood sector closely cooperates with numerous industries. Among them there are mainly forestry which supplies raw material for wood industry, constructions – the main recipient of the products of wood and furniture industry, as well as energy sector – recipient of wood and biomass. Its recipients are thus industries which are of key importance for the economy, which further emphasizes its significance and status.

Due to strong interrelations between those elements, cooperation is crucial. However, the wood sector is often put in a difficult position. It relates to raw material. Too low supply, which does not meet the needs of the sector, results in the increase in prices making reaching set targets related to the optimization of production costs, more difficult.

Despite numerous difficulties related mainly to raw material supply, wood sector operates very dynamically. Within the borders of our state there are a few large companies which play a key role, not just in our domestic economy. Those are mainly the producers of wood-based panels, plywood and furniture. They strengthen their position on the market, as well as develop their potential through implementing innovative solutions which aim not only at improving economic efficiency but also go in line with pro-environment trend set by the developed countries of Western Europe. Therefore, all kinds of rationalizations within the production, as well as organization of company processes are an absolute necessity. Such initiatives set a line of operations for the companies which wish to belong to the market leaders, that is the group of strategic companies.

Figure 1 shows those wood sector companies which between 2011 and 2013 implemented new or significantly improved products or processes.

The data shows that a significant group of furniture companies and the companies specializing in the production of paper and paperware incurred investment within their products, processes or both of these categories. The largest group of companies implementing investments, that is approximately 39%, belongs to the companies specializing in the production of paper and articles made of paper, the lowest share of companies implementing investments has been noted in companies dealing in the production of articles made of wood, cork, straw and wicker. They constitute about 12% of the companies implementing investment in this category. Therefore, based on the data presented in the figure above it may be concluded that the biggest share of innovation was implemented in the group of companies: „manufacturing paper and paper products”, and the lowest in the group: „manufacturing products from wood, cork, straw and wicker”, which only confirms the extremely different level of investment possibilities in this sector.

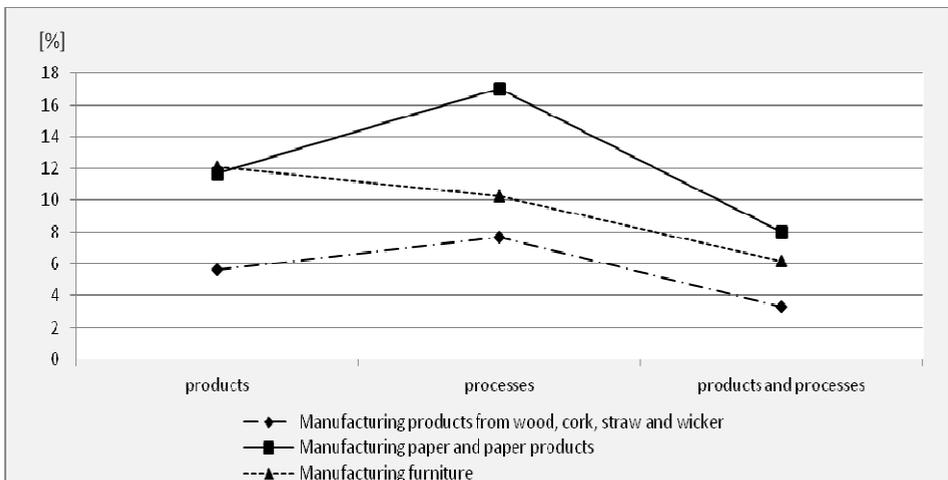


Figure 1. Wood sector companies which implemented new or significantly improved products or processes..

Source: Own elaboration based on „Działalność innowacyjna przedsiębiorstw 2011-2013” GUS.

FACTORS DETERMINING THE DEGREE OF INNOVATION AMONG POLISH WOOD SECTOR COMPANIES

The basic element determining the level of company investment is the capital. It may be the capital which the company owns or just the possibility of possessing it. Most frequently entrepreneurs use the external capital in a form of bank loan but there are also other forms of financing investments for example using European Union funds. Those are currently programmes supporting entrepreneurial initiatives such as: Operational Programme Intelligent Development 2014-2020 or Operational Programme Infrastructure and Environment 2014-2020. Institution which is responsible for creating favourable conditions for the development of Polish economy is Polish Agency for Enterprise Development. Its aim is to support innovations and company activities as well as the promotion of environment friendly forms of production and consumption. In the recent years Polish Agency for Enterprise Development is responsible for implementing action from three

operational programmes: Intelligent Development, Knowledge Education and Development as well as Development of Eastern Poland. Also the same institution organizes trainings for entrepreneurs enhancing employees qualifications. In this case there is a possibility of obtaining financing depending on the type of project (for example for specialized trainings small companies may get 45%, medium-size companies 35%, and large companies 25% of the costs). In terms of other projects support depends on the size of the company that is small units may obtain up to 80% of the investment, medium-size 70%, and large companies 60% (www.parp.gov.pl).

One of the most important programmes supporting innovation of Polish companies is “Horizon 2020”. It is the largest EU programme financing scientific research and innovation. It is an example of the cooperation between scientific units and industry. It is the economy based on knowledge that should play a key role in the improvement in factories and plants (www.mg.gov.pl).

An important factor influencing company investment decisions are legal regulations being implemented. The priority of the EU is currently environment protection and the reduction of pollution being created also by production plants. Therefore, a strong emphasis is being placed on limiting the emissions of CO₂ through increasing the efficiency of production processes or increasing the efficiency of production machinery. An important element which determines implementing innovative activities is often competition, which stimulates changes and search for new solutions. For companies undertaking investment decisions, especially the strategic ones, is always linked to a substantial risk. Therefore, it is always preceded by a thorough research and analyses. Unfortunately, often the fear of lowering economic ratios hinders their realization (Mydlarz, Wieruszewski 2012).

All activities are aimed at increasing competitiveness based on knowledge. Figure 2 shows the key factors significantly influencing the level of company investment.

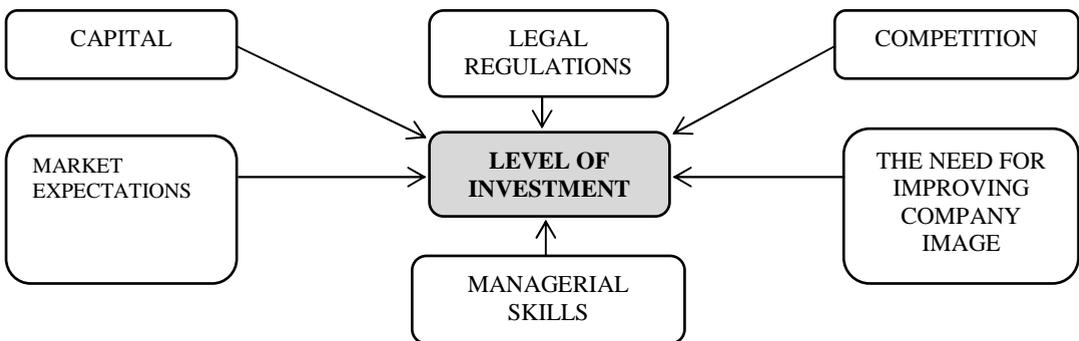


Figure 2. Factors determining the level of investment in a company

Source: Own elaboration

Companies implementing innovative solutions have lots of new possibilities and chances. Increasing the level their innovation companies may launch new products at a limited cost and better usage of raw material. New possibilities give those companies a chance to enter external markets due to adjusting the quality of their domestic products to the quality of European and world-wide producers. New markets guarantee sales increase, and lower costs of production determine their competitiveness. An important element is also the fact that innovative companies may belong to a group of highly recognized and respected, by both fellow producers as well as the recipients, global market companies.

CONCLUSIONS

The process of implementing technical and technological innovations constitutes an important aspect of company operations. It determines whether the company will develop or meet market expectations. All activities within technology, product or process related innovations, either directly or indirectly stimulate or boost the development of company innovation. They aim at modernizing the company and as the result create new possibilities for its market presence. Therefore, the majority of the projects are implemented to meet those expectations and allow Polish producers, also from the wood sector, to belong to the group of the most dynamic and innovative companies on the market.

REFERENCES

1. Mały Rocznik Statystyczny Polski. GUS 2012, 2014.
2. Działalność innowacyjna przedsiębiorstw 2011-2013. Wyd. GUS Warszawa 2014, ISSN 2083-2672.
3. Foresight w drzewnictwie – Polska 2020. Ekonomika drzewnictwa. Wyd. ITD Poznań 2011.
4. Mydlarz, Wieruszewski – Solid and engineered wood and its significance for innovative solutions in timber building projects. Intercathedra 2012
5. www.mg.gov.pl
6. www.parp.gov.pl
7. www.biznes.pl

*Joanna Prystrom*⁸

INNOVATIVENESS AND COMPETITIVENESS OF BELGIAN ECONOMY

Abstract: Innovativeness is perceived as one of the most important driving forces of economic condition. The issue concerns both individual economic entities as well as whole economies. Innovativeness, in fact, brings various positive results. Innovative activity provides possibility to introduce new, innovative products or services on the market, use of more effective and frugal production methods, etc. Consequently, it provides the chance for business development, introduction on new markets or increased participation in the present ones. It may often result in an increased production or possibility to create new work places. With regard to economic situation it may result in an increase of GDP or a decrease of unemployment rate, which profoundly influences economic situation. [Prystrom, 2013, p. 82]

The aim of the hereby study is to introduce the core of innovations and present chosen factors determining innovativeness in constructing competitive advantage, on the basis of Belgian economy, considered to be one of the most innovative and competitive in the world.

Key words: innovativeness, competitiveness, Belgian economy, institutional environment

INTRODUCTION

At the turn of XX and XXI century significant changes in functioning of world and national economies appeared. Basic production factors became technology and knowledge which in the modern, world economy are of crucial importance for long term economic development tendencies. They decide about innovativeness of a particular economy, that is its modernity, dynamics, socio-economic development and in result international competitiveness. [Ibidem]

Innovations are perceived as one of the most important driving forces of economic condition. The issue concerns both individual economic entities as well as whole economies. Innovativeness, in fact, brings various positive results. Innovative activity provides possibility to introduce new, innovative products or services on the market, use of more effective and frugal production methods, etc. Consequently, it provides the chance for business development, introduction on new markets or increased participation in the present ones. It may often result in an increased production or possibility to create new work places. With regard to economic situation it may result in an increase of GDP or a decrease of unemployment rate, which profoundly influences economic situation. [Prystrom, 2013, p. 82]

The aim of the hereby study is to introduce the core of innovations and present chosen factors determining innovativeness in constructing competitive advantage, on the basis of Belgian economy, considered to be one of the most innovative and competitive in the world.

INNOVATIVENESS AND ECONOMIC COMPETITIVENESS

Bearing in mind the significance of innovations in functioning of modern economies, it seems rather difficult to present one, coherent definition of the term. In general, one of the most relevant explanations concerning the issue of innovations seem to be conveyed in an approach of the innovations forerunner J.A. Schumpeter.

In accordance to Schumpeter's approach, innovations mean introduction of the new product, modification of the present one, implementation of new production method, obtainment of new sources and possibilities, use of untouched so far areas and markets or creation of new methods of business organization. [Schumpeter, 1932, p. 66]

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Moreover, innovations mean opening new markets where the particular processes, products or services were so far unknown, use of new methods of selling and purchasing, or finally acquirement and use of new raw materials or semi-finished products. [Schumpeter, 1960, p. 104]

Nowadays, innovations seem to be one of the most important driving forces of economic condition, as well as functioning within them - enterprises.

The effects brought by innovativeness lead to a reasonable conclusion that innovations determine competitive abilities, both of individual economic entities and whole economies.

In overall, competitiveness may be understood as constant combat between enterprises and economies so as to acquire greater number of possessed resources, which may facilitate attaining competitive edge on particular market segments, either on the national and international scale. Reaching such a leadership requires from the competing economic entities, learning and acquiring knowledge. [Hunt, 2000, p. 135]

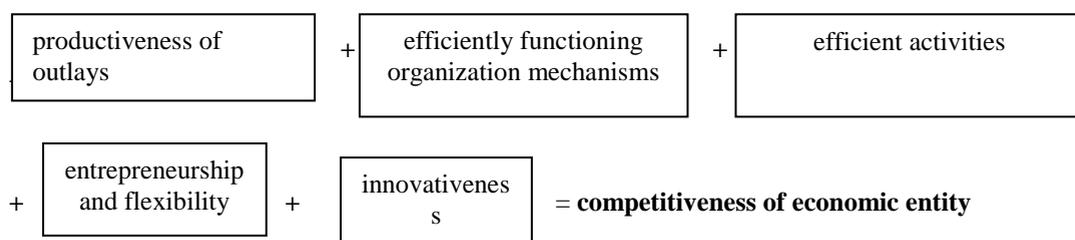


Figure 1. Competitiveness determinants of economic entity

Source: Own elaboration on the basis of: Bossak J. W., Bieńkowski W., *Międzynarodowa zdolność konkurencyjna kraju i przedsiębiorstw. Wyzwania dla Polski na progu XXI wieku, Szkoła Główna Handlowa [Warsaw School of Economics], Warsaw 2004, p. 38.*

In order to reach competitiveness, economic entities need to prove not only relatively high productiveness and efficiency but also flexibility, entrepreneurship and innovativeness. Competitive entity can render services and provide goods on the world market at lower costs than competitors and what is more, competitive entity can offer goods perceived as brand, unique and innovative. That is why, such an entity attains and reinforces competitive edge. [Bossak, Bieńkowski, 2004, p. 96](see figure 1)

Innovations occupy special place among factors conditioning competitiveness of enterprises. Innovations not only decide about the pace and directions of economic development but also to a great extent appoint forms and structure of international cooperation between enterprises. In this sense, they are factors determining international competitiveness of enterprises. [Prystrom, 2012, p. 104]

Taking into consideration the above discussed, economic entities willing to attain and retain competitive edge, shall care about high level of innovativeness. The results of which provide a chance for finding recipients' appreciation because of high level of global modernity and competitiveness which seem to be a result of proceeding changes on the market and in their surroundings. [Sosnowska, Łobejko, Kłopotek 2001, p. 146]

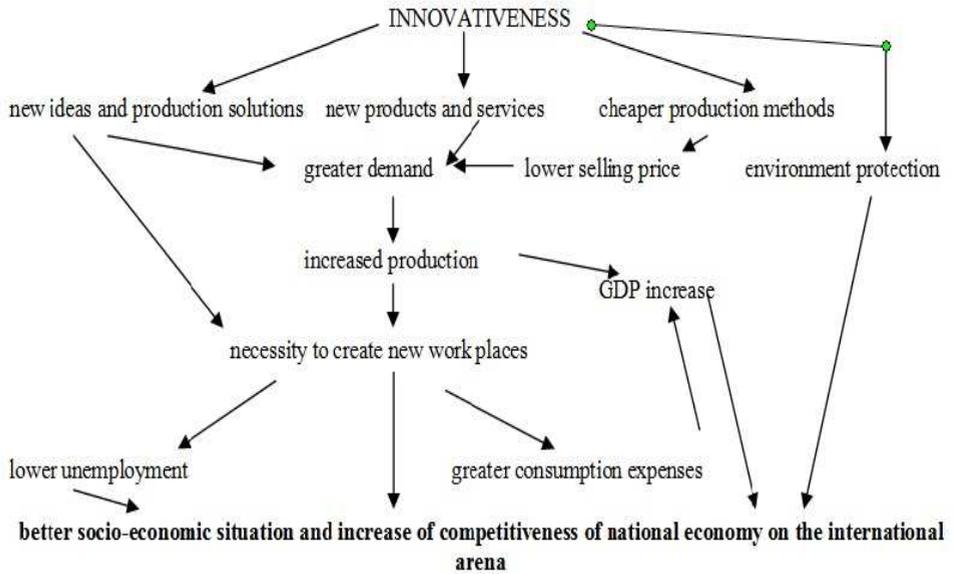


Figure 2. Innovativeness and competitiveness of national economy

source: own elaboration.

As it was aforementioned, innovativeness may be accompanied by the chance for development of innovative economic entities, increase and proceed new productions or introduction on new (potential customers) markets. It may be followed by creation of new work places. The more pro-innovative the enterprises prove to be, the lower unemployment rate is in a particular region. That improves status of population and therefore, people can increase consumption expenses, simultaneously accelerating economic mechanism.



Table 1. Elements of the institutional environment supporting innovativeness in Belgium – chosen examples

Institution and range of activities				
Policy-making, Support & Services	Consultative & Advisory Bodies	The elements of the institutional environment financing innovativeness	Professional Organizations & Associations supporting innovativeness	Research Infrastructures supporting innovativeness
-General administration for Education and Research, French Speaking Community -Belgian Federal Science Policy Office -Brussels Institute for Research and Innovation (INNOVIRIS) -Departement Economie, Wetenschap & Innovatie (Economy, Science and Innovation) -Wallonia Research & Technology Portal and few others	-Academia Europaea -Royal Academy for French Language and Literature -Royal Belgian Academy for Medicine -Royal Academy of Sciences, Arts and Fine Arts of Belgium -AFCN-FANC (Federal Agency for Nuclear Control) -Belgian High Representation for Space Policy -Bioethic Consultative Committee of Belgium -CERBC-RLBHG (Environmental Council of the Brussels-Capital Region) -CIDD-ICDO (Interdepartmental Commission for Sustainable Development -(CREf) (Council of Rectors of the French-Speaking Universities of Belgium) -(CIUF) (Interuniversity Council of the French Community) -(CWPS) (Walloon Council for Science Policy) and over 20 others	-Belgian American Educational Foundation (BAEF) -Belgian Federal Science Policy Office -Brussels Institute for Research and Innovation (INNOVIRIS) -Commission for Educational Exchange between the USA, Belgium and Luxembourg -EUROHORCs (European Union Research Organisations Heads of research Councils) -European Investment Bank (EIB) -European Molecular Biology Organization (EMBO) -European Science Foundation (ESF) -Fonds National de la Recherche Scientifique (FNRS) ⁹ -Fonds voor Wetenschappelijk Onderzoek-Vlaanderen ¹⁰ (FWO)	-Accord-wallonie ASBL -Advisory Council for Aeronautics Research in Europe (ACARE) -AGORIA -ARSMB. - KVBMG (Royal Association of Belgian Medical Scientific Societies) -(PROBIO) Association of Biology Teachers -Association internationale des professionnels et usagers des bioénergies (ITEBE) -Professional Association of Librarians and Documentalists -Belgian Association for Documentation (ABD-BVD) -Belgian BioElectroMagnetic Group -Belgian Bioindustries Association (BBA) -Collective Research Centres Union -Corps Scientifique des Universités Belges Francophones (CorSciF) -DSP Valley -EPE Association -euroCRIS (European Organisation for International Research Information) -EUROHORCs (European Union Research Organisations Heads of research Councils) and over 40 others	-BEGrid -Belgian Co-ordinated Collections of Micro-organisms (BCCM) -Belgian Nuclear Research Centre (SCK-CEN) -Consortium des Équipements de Calcul Intensif (CECI) -Cyclotron Research Centre at Louvain-la-Neuve (CRC) -Enabling Grids for E-science (EGEE) -European Molecular Biology Laboratory (EMBL) -European Organization for Nuclear Research (CERN) -European Portal on Research Infrastructures Database -European Southern Observatory (ESO) -European Synchrotron Radiation Facility (ESRF) -Europeana -GÉANT -Princess Elisabeth Antarctica -Réseau francophone des bibliothèques nationales numériques (RFBNN) -Vlaams Supercomputer Centrum (VSC) -World Digital Library

Source: own elaboration on the basis of: Policy-making, Support & Services, <http://www.research.be/ListURL/list.asp?KeyID=606&up=616, 20.10.2014> r. i Consultative & Advisory Bodies, <http://www.research.be/ListURL/list.asp?KeyID=618&up=616, 20.10.2014>; Funding Organisations, <http://www.research.be/ListURL/list.asp?KeyID=584&up=616, 20.10.2014>; Professional Organizations & Associations, <http://www.research.be/ListURL/list.asp?KeyID=630&up=616, 20.10.2014>; Research Infrastructure, <http://www.research.be/ListURL/list.asp?KeyID=638&up=616, 20.10.2014>

⁹ National Fund for Scientific Research.

¹⁰ Fund for Scientific Research – Flanders.

INNOVATIVENESS OF BELGIAN ECONOMY

Belgium belongs to one of the most developed countries in the world. It seems legitimate to claim that, in a sense, it is caused by innovativeness which, as it was earlier emphasized, results, *inter alia*, in introducing modern socio-economic solutions, obtaining of greater amount of recipients, development of innovative economic entities and necessity to create new work places. It seems obvious, that the more units show pro-innovative actions, the better socio-economic situation in the region is.

Innovativeness of national economy is determined by various factors. One of them is institutional surrounding, supporting and popularizing pro-innovative activity of domestic economic entities. In case of creating innovative domestic economy, the significant role is occupied by financing innovative enterprises, since the lack of the sources is one of the most frequent barriers in undertaking innovative activity among economic entities. Table 1 presents elements of institutional surrounding on the territory of Belgium, professional organizations and associations, supporting innovativeness in Belgium, as well as research infrastructures. (table 1)

Innovative abilities of domestic economy is also determined by the level of financial outlays for R&D activities. The R&D intensity in Belgium remained close to 2% during the period 2000-2009, passing from 1.97% of GDP in 2000 to 1.96% of GDP in 2009, as the result of two opposite trends. While the R&D intensity of the private sector decreased from 1.45% to 1.32%, the public R&D intensity increased from 0.52% to 0.62%. Belgium set an R&D intensity target to be achieved by 2020 between 2.6% and 3% of GDP. This target is ambitious with regard to recent trends but is within reach given the current structure of the Belgium economy. Compared to other countries, Belgium has the potential to increase the R&D intensity in existing sectors, both in the high-tech and medium high-tech sectors. [Innovation Union Competitiveness ..., 2011, p. 1] (table2)

Table 2, Gross Domestic expenditure on R&D in Belgium, Luxembourg and the Netherlands 2000-2012 (% GDP)

	2000	2001	2002	2003	2004	2005	2006
Belgium	1,97	2,07	1,94	1,87	1,86	1,83	1,86
Luxembourg	1,65	-	-	1,65	1,63	1,56	1,66
Netherlands	1,94	1,93	1,88	1,92	1,93	1,90	1,88
	2007	2008	2009	2010	2011	2012	2013
Belgium	1,89	1,97	2,03	2,10	2,21	2,24	-
Luxembourg	1,58	1,66	1,74	1,51	1,43	1,46	-
Netherlands	1,81	1,77	1,82	1,86	2,03	2,16	-

Source: own elaboration on the basis of: OECD.StatExtracts, <http://stats.oecd.org/>, 14.10.2014.

Table 3. R&D personnel in Belgium, Luxembourg and the Netherlands 2000-2012

	2000	2001	2002	2003	2004	2005	2006
Belgium	53 391,406	55 949,102	52 054,36	52 256,468	52 252,684	53 517,097	55 713,75
Luxembourg	3 662,9	-	-	4 010	4 317,6	4 391,7	4 376,5
Netherlands	91 313	92 904	91 548	90 147	95 702	93 599	97 835
	2007	2008	2009	2010	2011	2012	2013
Belgium	57 963,29	58 475,733	59 755,895	60 074,572	62 894,678	65 978,783	-
Luxembourg	4 604,5	4 651,6	4 711,1	4 988	5 318	5 634	-
Netherlands	93 788	93 432	87 874	100 544	116 326,334	116 666	-

Source: own elaboration on the basis of: OECD.StatExtracts, <http://stats.oecd.org/>, 14.10.2014



The level of innovativeness is to a great extent defined by means of R&D personnel employed, frequently being authors of innovative elaborations (see table 3). It can be noticed that in case of Belgian economy, the number of personnel employed on those positions exhibited and still exhibits an increasing trend, despite the decreasing period between 2002-2004. Ultimately, in comparison with the year 2000, in 2012 it increased approximately 81%.

Analysing table 3, it can be observed that the number of people employed on R&D positions, shows an increasing tendency, despite the fluctuations in 2002-2004.

Table 4. The number of patents registered in the PCT and EPO in Belgium, Luxembourg and the Netherlands in 2000-2011

Patent applications field under the PCT¹¹								
year	2000	2001	2002	2003	2004	2005	2006	
Belgium	806,1	779,1	801,4	839,3	974,2	1 019,9	1 098,3	
Luxembourg	56,0	32,6	34,6	28,7	50,4	37,8	51,7	
Netherlands	3 013,3	3 649,8	3 100,1	3 056,2	3 212,9	3 391,2	3 568,2	
year	2007	2008	2009	2010	2011	2012	2013	
Belgium	1 160,7	1 089,6	1 144,0	1 254,4	1 239,4	-	-	
Luxembourg	38,4	55,3	52,3	54,0	69,3	-	-	
Netherlands	3 577,5	3 571,7	3 247,1	2 943,8	3 487,6	-	-	
Patent applications field to EPO¹²								
year	2000	2001	2002	2003	2004	2005	2006	
Belgium	1323,5	1227,4	1347,9	1372,2	1545,6	1523,5	1563,7	
Luxembourg	85,7	74,0	64,8	89,7	116,7	100,0	109,9	
Netherlands	3502,6	3980,8	3623,3	3588,1	3694,4	3538,1	3827,9	
year	2007	2008	2009	2010	2011	2012	2013	
Belgium	1589,6	1513,0	1428,2	1497,7	1078,1	-	-	
Luxembourg	73,2	97,8	42,2	74,4	47,9	-	-	
Netherlands	3516,0	3620,8	3578,4	3063,1	2212,2	-	-	

Source: own elaboration on the basis of: OECD.StatExtracts, <http://stats.oecd.org/>, 14.10.2014

One of the effects of R&D personnel activities is the patentability, which can be understood as possessing exclusive rights to use defined solution in the industrial property security system. Such solutions include improvement suggestions, inventions and utility models. [Brzeziński, 2001, p. 33-37] (see table 4)

¹¹ The International Patent System (PCT).

¹² The European Patent Office (EPO).

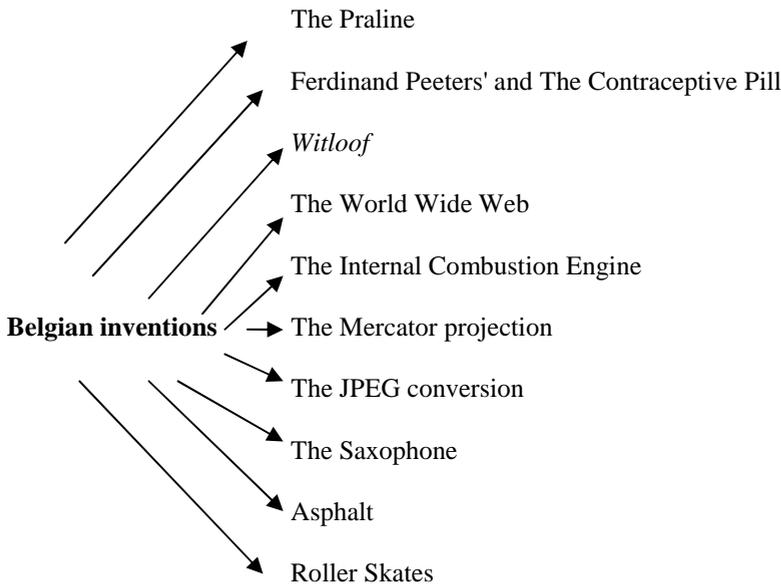


Figure 3. The most important Belgian inventions – examples

Source: own elaboration on the basis of: *The 10 Best Belgian Inventions*, <http://www.xpats.com/10-best-belgian-inventions>, 11.02.2015

Notable are also the Belgian discoveries and inventions, which became part of the socio-economic history and demonstrate the innovation ability of the Belgian economy. Examples of the prominent Belgian inventions shows figure 3.

1. Place and role of Belgium in the world economy [To a great extent elaborated on the basis: *Belgium – economic situation*, https://brussels.trade.gov.pl/pl/belgium/article/detail,642,Belgia_-_Sytuacja_Gospodarcza.html, 24.11.2014]

Kingdom of Belgium is the federal country, where three regions function (Flanders, Wallonia, Brussels – capital) as well as three language unions (French, Netherland and German). Unions possess highly developed rights in terms of culture and social issues; however; regions dispose of competences in various fields, i.e. economy, economic politics and promotion of export.

Belgium is a small country but it occupies a special place. Belgium is situated at the heart of Europe. This is a basic observation but the importance of its central geographical location between the most important countries in Western Europe needs to be highlighted. At the risk of seeming paradoxical, Belgium was in a way already playing a "European" role even before it became "Belgian". Just look at the past roles of Bruges and Antwerp in international trade, Leuven's role as a university town and the part Liège played during the industrial revolution. [*Belgium internationally...*]

This tradition of openness continues today. Belgium is still a hub for international contacts. More than 1,000 public and private international organisations (international institutions, diplomatic missions, lobby groups, think tanks, multinationals,...) have set up headquarters or have a



permanent secretariat in Belgium. Of particular note is the presence in Belgium, in addition to the institutions of the European Union, of Supreme Headquarters Allied Powers Europe (SHAPE), the headquarters of the North Atlantic Treaty Organisation (NATO), and the General Secretariat of the Benelux. [Ibidem]

Belgium belongs to the group of most developed economies in the world. Participation of services in the creation of national income reaches 70%. Belgian service sector is characterized by expanded system of transport and logistics infrastructure (land, rail, harbour – deep sea and amphibious) and position of Antwerp as an important world centre of industrial treatment, foreign trade and distribution of gems (diamonds), a.o. through diamond stock market. Diamonds are used for both production of jewellery as well as for industrial use.

The most important branches of Belgian industry are: chemistry, metallurgy, electromechanical (including production of vehicles) as well as food and textile industry. Vast majority of chemist production is located in Flanders. Huge chemists industry cluster was created around Antwerp which constitutes serious ease for import and export of goods in this city. It is worth adding that Belgium possesses 8% of shares in the European sales of chemists branch and 17% of shares in the European export of chemical goods.

The most important sectors of Belgian economy sectors in 2012 included: public administration, national defence, education, health and social care (22,8 %), wholesale trade and retail trade, transport, services related to accommodation and catering (19,9 %) as well as industry (15,9 %). [European Union ...]

Table 5. Innovativeness and competitiveness of Belgian economy competitiveness compared to other economies in the Benelux 2010-2014

	Innovativeness rank				
	2014	2013	2012	2011	2010
Belgium	7	7	#	5	6
Netherlands	6	5	#	7	8
Luxembourg	5	6	#	9	10
	Competitiveness rank				
	2014/2015*	2013/2014**	2012/2013***	2011/2012****	2010/2011*****
Belgium	18	17	17	15	19
Netherlands	8	8	5	7	8
Luxembourg	19	22	22	23	20

no data available

*GCI 2014/2015 including 144 economies

**GCI 2013/2014 including 148 economies

***GCI 2012/2013 including 144 economies

****GCI 2011/2012 including 142 economies

*****GCI 2010/2011 including 139 economies

Source: own elaboration on the basis of: Innovation Union Scoreboard 2014, p. 5,

http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf, 13.10.2014 r., Innovation Union Scoreboard

2013, p. 5, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf, 13.10.2014, Innovation Union

Scoreboard 2011, p. 7, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2011_en.pdf, 13.10.2014, Innovation

Union Scoreboard 2010, p. 4, http://ec.europa.eu/research/innovation-union/pdf/iu-scoreboard-2010_en.pdf, 13.10.2014,

Schwab K., *The Global Competitiveness Report 2014–2015*, World Economic Forum, Geneva 2014, pp. 13, 125-126, 288-

289; Schwab K., *The Global Competitiveness Report 2010–2011*, World Economic Forum, Geneva 2011, p. 15.

Belgium is a country of an economy widely open for international cooperation and foreign exchange. Therefore, Belgium depends on the dynamics of world trade and situation on the world markets, *inter alia*, market of energetic raw materials. Beneficial geographical location, expanded logistic and transport infrastructure (rail and road) and harbour (harbours in Antwerp and Zeebrugge), functioning on the territory of the country broadband of distribution centres of international concerns, allow Belgium to sustain the position of the world important points of international trade flow. The harbour in Antwerp is placed on the 2nd position in Europe (after Rotterdam) and 4th in the world in terms of trans-shipment value. Major export markets for Belgian economy are the following: Germany, France, Holland, and in case of import – Holland, Germany and France. [Ibidem]

Export generates approximately $\frac{3}{4}$ of Belgian GDP. Dominant positions in the Belgian export are: chemical products, electro technical machines and facilities, mechanical vehicles, plastic products, mineral products, metal works, food products and gems. Belgium export approximately 70% of produced chemical products; in 2009 those goods constituted the number of 27% of joint Belgian export. Major positions in Belgian import are: chemical products, electronic machines and facilities, mineral products, mechanical vehicles, metal works, plastics and gems.

Belgium remains to be an open country for foreign investors. Attractiveness of Belgian market transcends from the central location in Europe, political and economic stability, expanded communications infrastructure, advanced level of industrial centres, tax and finance facilities, existence of European and international institutions, qualified, multi-lingual and effective labour force as well as high living standards and comfort of life.

Thinking of foreign investors, Belgium created system of financial and tax incentives, therefore few hundred of foreign and international concerns were attracted. The concerns created in Belgium coordination, distribution and service centres as well as factories. Belgium regularly modifies system of attracting foreign investors. Within 2005 – 2006 some solutions, acknowledged by the European Commission as non-compliant with the competition law, were substituted with new forms of incentives.

Among others the following were introduced:

- Solutions creating possibilities for concluding individual agreements between tax authorities and investors („ruling”) in a form of total financial projects;
- Possibility to match high-risk capital and capital loans, created so called: „intérêts notionnels” mechanism allowing the companies which do not use bank loans to reduce tax base of fictive costs of loans interest rate calculated, compared to own resources (it is estimated that companies may reduce tax liabilities approximately in 50%); corporation tax is relatively high in Belgium, its basic rate amounts 33,99% (companies with incomes lower than 90 and 25 thousand euros are offered more beneficial tax rates).

Belgian economy is one the most innovative in the world, simultaneously occupying place in the group of most innovative countries on the international arena. Unfortunately, there are no data available concerning state of innovativeness of European economies in 2012. Bearing in mind results from the years 2011 and 2010, in case of Belgium the decreasing trend can be observed. On the other hand, the Netherlands and Luxembourg indicated increasing trend with the explicit growth of innovative abilities of Luxembourg. Nevertheless, the worth emphasizing seems to be the fact that in the recent years Belgium is considered to be one of the most innovative economies in the world. Analysing table 5, it can be noticed that only Luxembourg between the years 2010-2014 demonstrated innovativeness growth of national economy. Belgium and the Netherlands were characterized by subtle fluctuation trend. Despite the fact, Belgium was located in the first 10, in terms of innovativeness of national economy and in the first 20 of most competitive countries in the world.



Table 6. Competitiveness of Belgium in comparison to the Netherlands and Luxembourg in respect of factors determining national economy innovative ability in 2014

	Belgium	Netherlands	Luxembourg
Education and development of professional skills	5	3	43
Technological ability	14	9	1
Innovativeness and facilitating factors	12	6	18
Including:			
Quality of education	6	8	25
Availability of research and training services	4	2	22
Range of trainings	9	12	3
Availability of the latest technologies	12	9	13
Firm-level technology absorption	20	21	8
FDI and technology transfer	32	37	9
Capacity for innovation	14	11	9
Quality of scientific research institutions	5	6	26
Company spending on R&D	11	17	16
University-industry collaboration in R&D	6	9	18
Availability of scientists and engineers	37	30	52
PCT patents, applications/million pop.	16	9	14

Source: Schwab K., *The Global Competitiveness Report 2014–2015*, World Economic Forum, Geneva 2014, pp. 125-126, 252-253 and 288-289.

In terms of competitiveness of national economy in respect of factors determining innovative ability, Netherlands, in 7 cases, occupies places in the first 10 among 140 countries worldwide. Slightly lower position is occupied by Belgium, however, it should be emphasized that in 2014 the economy of Luxembourg proved to be the world leader in terms of technological abilities, outclassing all the competitors. High position and what is more, the highest position among Benelux countries, occupies Luxembourg in respect of personnel trainings, 3rd position in the ranking.

CONCLUSIONS

Willing to meet the challenges of XXI century, economies and functioning within economic entities should be flexible and immediately react to ongoing phenomena and processes. Particularly helpful here, seem to be innovations which provide the possibility to implement changes and adjust to specific situation. Moreover, innovations may lead to generation of various profits.

Innovativeness results, *inter alia*, in reinforcing competitiveness condition of national economy. It derives from the fact that innovations mean all types of modernizations and upgrades which may attract greater number of recipients. Increased demand is closely linked to necessity to employ personnel, thus socio-economic status of population may improve. In consequence, it leads to higher consumption expenses and accelerates economic mechanism. That, in turn, may result in the improved socio-economic situation in a particular region and reinforced competitiveness.

Belgian economy is considered to be one of the most innovative economies in the world. It is because of efficiently functioning surrounding, supporting innovative activity of economic entities. Furthermore, an important issue in this particular event, seems to be the level of outlays reserved for research-development activity. Scientific employees also seem to be irreplaceable here, since they are equipped in knowledge and qualifications. Scientists become authors of many new inventions and elaborations which in a result effect in an increased innovative abilities and improvement of competitive position. Thus, Belgium is considered as one of the leaders in terms of competitiveness of national economies on the international arena.

REFERENCES

1. *Belgium internationally*, http://www.belgium.be/en/about_belgium/belgium_internationally/, 27.01.2015
2. Bossak J. W., Bieńkowski W., [2004] *Międzynarodowa zdolność konkurencyjna kraju i przedsiębiorstw. Wyzwania dla Polski na progu XXI wieku*, Szkoła Główna Handlowa w Warszawie [Warsaw School of Economics], Warsaw.
3. Brzeziński M., [2001] *Zarządzanie innowacjami technicznymi i organizacyjnymi*, Centrum Doradztwa i Informacji Difin Sp. z o.o. [Difin Counselling and Information Centre – limited liability company], Warsaw.
4. *Consultative & Advisory Bodies*, <http://www.research.be/ListURL/list.asp?KeyID=618&up=616>, 20.10.2014
5. *Funding Organisations*, <http://www.research.be/ListURL/list.asp?KeyID=584&up=616>, 20.10.2014
6. Hunt S. D., [2000] *A General Theory of Competition. Resources, Competence, Productivity, Economic Growth*, Sage Publications Inc., Thousand Oaks – London – New Dehli.
7. *Innovation Union Scoreboard 2014*, http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf, 13.10.2014
8. *Innovation Union Scoreboard 2013*, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf, 13.10.2014
9. *Innovation Union Competitiveness report 2011. Country profile – Belgium*, <http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/countries/belgium.pdf>, 15.10.2014
10. *Innovation Union Scoreboard 2010*, http://ec.europa.eu/research/innovation-union/pdf/iu-scoreboard-2010_en.pdf, 13.10.2014
11. *OECD.StatExtracts*, <http://stats.oecd.org/>, 14.10.2014.
12. Pangsy – Kania S., [2007] *Polityka innowacyjna państwa a narodowa strategia konkurencyjnego rozwoju*, Wydawnictwo Uniwersytetu Gdańskiego [Publishing House of University of Gdańsk], Gdańsk.
13. *Policy-making, Support & Services*, <http://www.research.be/ListURL/list.asp?KeyID=606&up=616>, 20.10.2014
14. Prystrom J., [2013] *Innowacje jako czynnik warunkujący konkurencyjność gospodarczą na przykładzie gospodarki Danii*, Optimum, Studia Ekonomiczne [Economics Studies], no. 3.
15. Prystrom J., [2012] *Innowacje w procesie rozwoju gospodarczego. Istota i uwarunkowania*, Difin, Warsaw.
16. *Professional Organizations & Associations*, <http://www.research.be/ListURL/list.asp?KeyID=630&up=616>, 20.10.2014
17. *Research Infrastructure*, <http://www.research.be/ListURL/list.asp?KeyID=638&up=616>, 20.10.2014
18. Schumpeter J. A., [1960] *Teoria wzrostu gospodarczego*, Polskie Wydawnictwo Naukowe, [Polish Scientific Publishers], Warsaw.
19. Schumpeter J. A., [1932] *The Theory of Economic Development*, Galaxy Book, New York.
20. Schwab K., [2014] *The Global Competitiveness Report 2014–2015*, World Economic Forum, Geneva.
21. Schwab K., [2011] *The Global Competitiveness Report 2010–2011*, World Economic Forum, Geneva.
22. Sosnowska A., Łobejko S., Kłopotek A., [2001] *Zarządzanie firmą innowacyjną*, Centrum Doradztwa i Informacji Difin [Difin Counselling and Information Centre], Warsaw.
23. *The 10 Best Belgian Inventions*, <http://www.xpats.com/10-best-belgian-inventions>, 11.02.2015
24. *Unia Europejska. Belgia*, http://europa.eu/about-eu/countries/member-countries/belgium/index_pl.htm, 27.01.2015



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BUILDING A BRAND AND BRAND MANAGEMENT STRATEGIES FOR MARKET SUCCESS

Abstract: The article discusses the importance of the brand of the company. It indicates the principles of creating a strong and recognizable brand and the creation mechanisms of the company logo. Also, the brand management strategies are characterized.

Keywords: brand, company, brand creation, brand management

INTRODUCTION

The importance of the brand is high, due to the need to differentiate the company's own products from the products of its competitors. Currently, the significance of brand awareness is widespread and this is the reason why many products are accompanied by a sign and this allows to distinguish products from competitive products and services. The brand is an important element of the product, because it protects the unique features of the products against copying and imitation, even when the competing products have similar functional properties.

A strong, recognizable brand is useful for gaining a group of loyal customers and thus achieving a sustainable position in the market. When building the brand, it is important to know the mechanisms for the creation of brand names and logos and the brand management strategies.

BRAND

The brand is a name, term, design, symbol or a combination of these made in order to identify a particular producer's goods and distinguish them among the competitors. Brand also functions as shorthand for indicating the market position of the products or the company that offers them (Sundbo, Darmer 2008).

The brand is economic, intellectual and legal property of the company. The brand is protected by law and good trade practice. It can be valued and it can also be the subject of sale and purchase transactions as intangible assets. That is what is referred to as the brand equity. It consists of the following elements:

- Time of the brand's existence in the market,
- Recognition,
- Market share,
- Image and domination,
- Market stability,
- Level of marketing support,
- Price of shares on the stock exchange,
- Degree of protection and the possibility of extension.

The brand fulfills an important function to protect the interests of customers, because the company consistently aims at keeping the highest level of quality of their products so as not to lose customer's trust (Szymoniuk 2006). The brand strength is expressed by:

- Customer loyalty to the brand - five categories of customers can be distinguished: habitual, satisfied, price sensitive, attached to the brand and loyal,
- Associations with the brand - feelings the brand evokes,

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- Perceived quality of the brand - customer opinion about the quality of the brand,
- Brand awareness – the extent to which a brand is recognized by potential customers and correctly associated with a particular product (Mruk 2012).

CREATING A BRAND NAME

The brand is made essentially from two major parts, i.e. the name and logo. The brand name includes the words, letters, numbers and combinations thereof. It defines the product category. It enables consumers “to identify and compare the offers of producers in the market segment” (Kall, Kłeczek, Sagan 2013). When building a brand a number of criteria are taken into account to ensure it properly fulfills its functions. Therefore, the rules for creating brand names have been formulated, as shown in Fig. 1. Adherence to these principles is not always synonymous with the market success of the created name, but it helps to avoid fundamental errors.

1. *Short and simple*
2. *Easy to pronounce*
3. *Recognizable and easy to remember*
4. *Evoking positive associations*
5. *Original and distinctive*
6. *Useful in various promotional activities*
7. *Pleasantly sounding*
8. *Legally allowed to be used*
9. *Possible to write and pronounce in most languages of the world (this applies to brands targeting the international market)*

Brand name

Fig.1. The rules for creating a brand name

Source: Own elaboration based on Mruk (2012).

Multitude of brands on the market makes it harder to create a brand that fulfills all the criteria, especially the principle of originality. It should be noted that quite a few brand names, although they do not fulfill all of the rules of their formation, however, have attained recognition and attachment with a long-term presence and effective instruments to communicate with the environment. Brands are formed in different ways. Some entrepreneurs decide to create their brand from:

- names – e.g. Mercedes, Joanna,
- surnames – e.g. Kruk, Ford,
- animals - Jaguar, Puma,
- geographical names - Nałęczowianka, Żywiec,
- plants - Iris,
- atmospheric phenomena - Bryza
- historic figures - Mieszko, John III Sobieski,
- creative names – Persil, Hortex.

When creating a brand name, it is worth thinking how it will be possible to use it in the future. When it is intended to contain various types of products, it is better to adopt the name associational or abstract. Descriptive names, in turn, can be quite troublesome in extending them to new products,

because they present the product offer too narrowly (Fig. 2). An example would be the Marvit brand, which is well suited for carrot juice, but not for apple juice. To build an effective brand, it is also important to connect the brand with a planned brand positioning strategy (Kotler 2012).

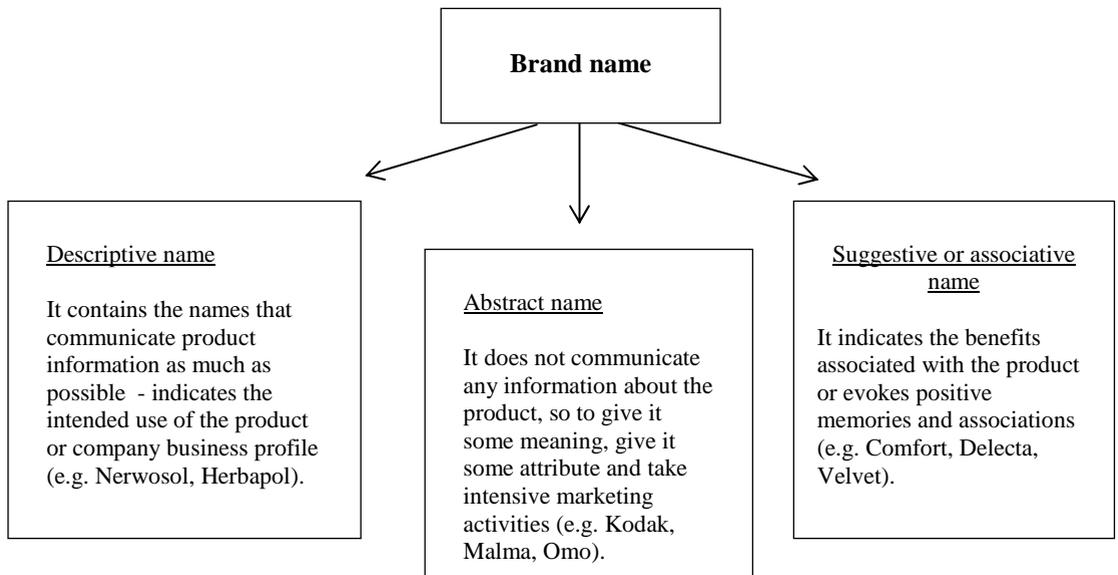


Fig. 2. Classification of brand names

Source: Own elaboration based on Pilarczyk, Mruk (2007).

BRAND LOGO

Sign of the brand (i.e. logo) as part of the brand cannot be expressed in words. Sign of the brand has a similar meaning to its name. It provides fast communication to the consumer, a functional or symbolic benefit that is associated with it. Therefore, it offers the possibility of influencing the consumer decision-making process, helping him or her choose a product by recognizing the offer and recall specific associations (Kall, Kłeczek, Sagan 2013).

Brand signs (logo) can be grouped, according to Pilarczyk, Mruk 2007, as follows:

- **Thematic signs** - include a graphic element that refers to the specific industry in which the company is present, e.g. an outline of cat's head in a figurative mark of Whiskas brand by Mars producing food for cats,
- **symbolic signs** - include graphic symbols related to particular associations, e.g. crown - a symbol of luxury and riches (taste), which is in the sign of Jacobs coffee Kronung,
- **signs inspired by heraldry** - use a variety of crests, emblems or elements thereof, showing the relationship of the brand with the traditions of a particular country, region, family or city, e.g. Lajkonik brand graphic sign referring to the tradition of Krakow, the region where the company originated.

- *signs inspired by figures or letters* - are graphically presented numbers, letters, words and brand names formulated in a specific way, e.g. the brand m & m's (by Mars)
- *abstract signs* - do not have any code and do not refer to the name of the company, the tradition of action, symbols, specific industry, etc. An example would be the sign of Nike brand. An abstract logo makes it difficult to link a sign with a name. This requires long-term, sometimes costly marketing campaigns. When the company is just starting its activities, it is recommended to use the company name in its logo,
- *signs inspired by the name of the company* - illustrate the brand name; an example may be the brand Puma.

The entire process of creating a brand (i.e., its name and logo) should be precisely subordinated to the company's marketing strategy and adapted to the design of the creators, so that it could correspond to the vision of the company. Such a brand will have a good effect on the image of offered products and will encourage their choice (Kotler 2012).

BRAND MANAGEMENT

The brand is a specific type of intangible assets. It requires professional management. In this way it does not lose its value and maintains a strong position.

Multi-brand strategy (also called individual brand strategy) - every product of the company has its own brand and company name remains in the background and is not shown. Customers buy products under the individual brands, in general not knowing the name of the owner or producer. One example may be such companies as Procter and Gamble and Unilever, which compete, among others, on the market of cleaning products. Each of them sells products under individual brands. It is worth doing so when there is a diverse range of products, i.e. there are products associated with several branches, such as personal care, sweets, food for animals. Consumers then have associations only with an individual brand. By offering various brands in many segments, the company can expand the range of its operations and increase its overall market share. While placing a new brand on the market, high costs of promotion have to be incurred, relating to the promotion of each brand separately (Dobiegała-Korona 2009).

Family brand strategy - all the products are sold under one brand. It is typical for companies with a long practice and good reputation. It is dominating among service providers. The specific nature of services makes it necessary to pay special attention to the development of the overall image of the company rather than individual products. In the case of a strong brand with a well established reputation, this strategy helps to bring new products to the market, highlighting mainly the attributes of the company. A possible threat occurs when an unsuccessful product is introduced on the market, because the company's image is affected by all products that are offered by the company under one brand (Dąbrowski 2010).

Family brand strategy can be considered in the following aspects:

- product line brand strategy - a common brand covers a range of products that make up the so-called product line, i.e. similar or complementary products, e.g. facial care cosmetics - gel, lotion, toner, face cream, eye cream, mask under the brand Nivea. Such a line can be created with the use of one product that already has a created brand by adding next similar or complementary products. The product line offered under the common brand strengthens the brand sales and builds a consistent image. It should be emphasized that there are limits to the line brand. Exceeding them, i.e. adding to the range of products of one brand, those



products that significantly deviate from their specific nature, can adversely affect the professional, competent and consistent image of the company.

- product range brand strategy - this strategy can be found on the market of cosmetics (e.g. Vichy), food products (e.g. Knorr), clothing (e.g. Benetton), kitchen equipment (e.g. Moulinex). A common brand is made by all the products in the range, that is, multiple products are characterized by one brand. Marketing Communications focus on one name, building brand awareness common to the entire range. This contributes to cost reduction of introducing a new product under the brand already known. Extension of the product range brand by new products may cause the brand to become unclear or inconsistent, i.e. the brand may stop functioning in the mind of the recipient as an integral whole. One solution to this problem is to include the name of the product line, e.g. the brand Knorr to include the name of the line products Sauces or Fixes, or, as the manufacturers of hair care do, use different colors for shampoos or conditioners for different hair types. This method clarifies the product and structures (organizes) the range of the brand, as the market shelves do. This allows the separation of products in a clear way, so that the indicated line (shelf) can satisfy the same needs of the consumer (Sojkin 2003).

Dual brand strategy (i.e. combined) - uses the advantages of the family brand strategy and the individual brand strategy, so it allows the use of two brands, i.e. the company's brand and the brand of the product. It is possible to offer certain products under the family brand and the other under the individual brand, e.g. the company Bahlsen offers Hit biscuits under its own company name (Bahlsen) and also under the brand name of the product (Hit), but also it offers the brand Krakuski which functions only as the individual brand product (not associated with the company Bahlsen). Another example of the combined brand can be Opel (Omega, Corsa), Nestle (Kit Kat, Lyon, Princessa). Company name (supporting, for example Nestle) guarantees approval for a wide range of products, classified under individual brands (e.g. Kit Kat), the product range brands and product line brands. The individual brand, in turn, shows its uniqueness (Kall, Kłeczek, Sagan 2013).

Monolithic brand strategy (umbrella brands, brand extensions) - covers a variety of products existing on different markets. Each of these products has its own characteristic communication program and a distinct promise to the buyer. One example may be the brand Philips. This brand offers TVs, irons, lamps, telephones, batteries, shavers, depilatories, hair dryers and kitchen equipment such as toasters or coffee machines. An umbrella brand brings together the customer's trust and the company's reputation produced in many products. This makes it possible to use the capital which lies within the name of a recognizable brand. The distinctive and recognizable brand attracts potential customers, employees, suppliers, investors and shareholders (Pilarczyk, Mruk 2007).

Social awareness of the brand may lead to almost immediate acceptance of the company's offer by inducing trust, credibility and reliability of potential customers. With Monolithic(umbrella) brand strategy every department in the company is responsible for its own communication program, therefore it is not limited by rigid guidelines imposed by the brand. Competing with specialized brands requires such companies to prove their uniqueness, so a well-thought strategy is needed for each department of the company. This is due to the multitude of product categories covered by one brand. An easier task is to gain a good reputation in one segment than in several at the same time (Szulce, Janiszewska 2012).

Private brand (private label) – it appeared with the development of trade networks. The growing strength of trade intermediaries in negotiations with producers means that the number of products offered under private labels of retail networks is increasing. The attractiveness of the

brands of retailers is generally associated with a lower price as compared to the brands of manufacturers. Usually, they are implemented with products addressed at mass markets, e.g. milk, juice, mineral water (Dębski 2009).

In practice, different ways of using a private label can be seen. Here are examples:

- Brand of a commercial intermediary is the same as its name, e.g. Carrefour and Tesco,
- Brand of a commercial intermediary is different from its name, for example Aro brand in Makro network,
- Several brands of its own within one network, for example Melly own brands (producer Hortex), FruVita (producer Bakoma) - belonging to Biedronka network.

The choice of a specific strategy should take into account the limitations resulting from the offered goods, expectations and habits of consumers in relation to the brand and also the existence of other brands and the position of competitive companies (Pringle, Hamish 2008).

CONCLUSIONS

Summarizing this article, the following conclusions can be drawn:

1. Brand provides fast communication of the benefits of buying the product to the consumer. The brand name and its logo, being thought out and chosen according to the strategy of the company, have a positive impact on the company's image and help to achieve a market success.
2. In the case of the multi-brand strategy, if there was a critical problem with one of the brands in the brand portfolio, profitability of the company would be safer. Then the sales of a single product can reduce, but the products of other brands will not lose their buyers.
3. The benefit of the family brand strategy is minimization of marketing costs, because by promoting a product the whole product range becomes promoted, but it should be noted that in the case of introduction of an unsuccessful product on the market, this will affect the image of the whole brand.
4. The dual brand strategy combines company's brand ensuring adequate quality assortment with the individual brand product showing originality of the product.
5. The umbrella brand strategy is recommended for companies with good reputation and establishment, which allows them to save money on marketing activities during expanding the geographic or product market. Excessive diversification of the forms of promotion or advertising style of certain products sold under a particular umbrella brand make it difficult for consumers to perceive the brand consistency.
6. The brand of commercial intermediaries appeared with the development of commercial networks. It is aimed at mass markets. It is typically characterized by a lower price compared with the price of the manufacturer.
7. Brand management plays a very important role in the development of the company. It is important that the company chooses a brand management strategy appropriate for its goals.

REFERENCES

1. Creating Experiences In The Experience Economy (2008): Red. J. Sundbo, P. Darmer. Edward Elgar Publishing, Massachusetts.
2. Dąbrowski T. (2010): Reputacja przedsiębiorstwa. Tworzenie kapitału zaufania. Wolters Kluwer Polska, Kraków.
3. Dębski M. (2009): Kreowanie silnej marki. PWE Warszawa.
4. Kall J., Kłeczek R., Sagan A. (2013): Zarządzanie marką. Wyd. Wolters Kluwer SA, Warszawa.
5. Komunikacja marketingowa instrumenty i metody. (2006). Red. B. Szymoniuk. PWE Warszawa.



6. Kotler Ph. (2012): Marketing. Dom Wydawniczy REBIS Sp. z o.o. Poznań.
7. Migracje klientów a wartość przedsiębiorstwa. (2009). Red. B. Dobiegała-Korona. PWN Warszawa
8. Mruk H. (2012): Marketing. Satysfakcja klienta i rozwój przedsiębiorstwa. PWN Warszawa.
9. Pilarczyk B., Mruk H. (2007): Kompendium wiedzy marketingu. PWN Warszawa.
10. Pringle H., Gordon W., (2008): Zarządzanie marką - jak wypromować rozpoznawalną markę. Dom Wydawniczy Rebis, Poznań.
11. Szulce H., Janiszewska K. (2012): Zarządzanie marką. Wydawnictwo Uniwersytetu Ekonomicznego, Poznań.
12. Zarządzanie produktem. (2003). Red. B. Sojkin. PWE Warszawa.

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ETHICAL ASPECTS OF FORESTER'S PROFESSION

Abstract: There is no human activity, which could be free of any valuing (axiological) implications – both on the level of cause and effect. Every activity, individual or collective, private or concerning public sector, entails specific consequences: therefore every situation is an ethical situation. Also, participants of every situation enter that situation being more or less aware, and bring with them certain set of values. Therefore, the question concerning the ethical code of forester's profession (employee of a forestry company) seems to be legitimate.

Key words: ethics, professional ethics, professional codes, practised ethics, moral norms, public sector, traditional system of supervision, values, forests, forests ecosystems, forester's profession.

INTRODUCTION

Does any sector of economy need ethics? Moreover, does it need ethics which have been specially abstracted and addressed to it? Aren't simple rules of law or – at the most – application of general ethics, binding for everyone, regardless of their professional areas, sufficient? So – what about the ethics of forester's profession?

MANAGEMENT AND PROFESSIONAL ETHICS CODES

Let us begin with a general reflection. The role of moral norms in the functioning of contemporary public sector (state-owned, private and local government) ought to be a premise, which precisely determines the role of an individual and their influence (as an official) on its functioning. State forests have not been privatised (although there have been such projects). Their role and functioning in life and social ecosystem are undervalued, and the ethical aspects of managing them are attracting less and less attention.

Yet, the basic functions of ethics in the management process are as follows [Kudrycka, 1995]:

1. *it is the foundation of management* – ethically motivated officials make decisions, based on the criteria of factual knowledge, and thus their actions and the actions of their subordinates are more effective;
2. *it legitimises the actions of superiors* – this is a condition for trust for the institution;
3. *it prevents pathologies* – corruption, nepotism, mobbing, etc.
4. *it creates positive values* – in public life and economic activities;
5. *it facilitates making decisions* - particularly in difficult situations.

In the above approach, ethics should not constitute the core but the foundation of a well functioning economic entity. It creates positive examples, it prevents various pathologies, which activities within this sector are still prone to.

The domain of *professional ethics* is determining the effect of socially authorised employees' behaviour on the type and character of accepted social relations and ties and on the functioning of particular professional groups, in this case, of forestry employees. It should be noted here, that most professions in Poland, have their ethics codes, treated as sets of rules, which representatives of various professions ought to follow in their professional career. Unfortunately, beside hunters' ethics code, foresters do not have their own intrinsic ethics code (beside hunters' code).

Professional ethics codes do not constitute a new and separate form of ethics, but are merely a detailed description, or an attempt at applying generally accepted professional behaviour in the

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character and moral dilemmas of specific professional groups. Moreover, the reflection on professional ethics (here, of the forestry sector, including wood processing) aims at explaining that ethical situations connected with this area of economy, are not specific. Codes set general framework, which may help in dealing with various ethical questions, however, they cannot be expected to provide specific and explicit answers. The knowledge of the codes and ethical problems is meant to provide the ability to interpret and apply general theories in a specific situation [Kołakowski, 2006].

In this aspect, there is need of education encompassing ethics, including professional ethics. The ethical intellectualism of Socrates [Krońska, 1989] expressing the conviction that knowing good is equivalent of living well, is obviously naïve (there is also need for wanting good, which however, does not come together with the knowledge). Nevertheless, the knowledge of good and evil is a necessary condition for our actions to be ethically responsible. If the actions of the entities of social life invariably entail certain ethical conduct, this conduct shapes the social fibre, it is highly desirable that the ontological and axiological source of this conduct be known – otherwise “the anonymous forces of culture”, which philosophers talk about, will take over.

THE CODE OF ETHICS OF FORESTRY WORKERS

Notwithstanding, let us get back to the aforementioned sector of forestry and wood processing. The question, does it need ethics, our intuitive answer will be, probably yes, since we can see breaches of general ethical standards on a daily basis. Therefore, before we go on to discuss professional ethics itself and its codes, let us pose the question: what are the reasons for breaching those standards by workers?

One possible answer may be that it could be workers being faced by a temptation or humiliation and a too easy acceptance of credibility of excuses.

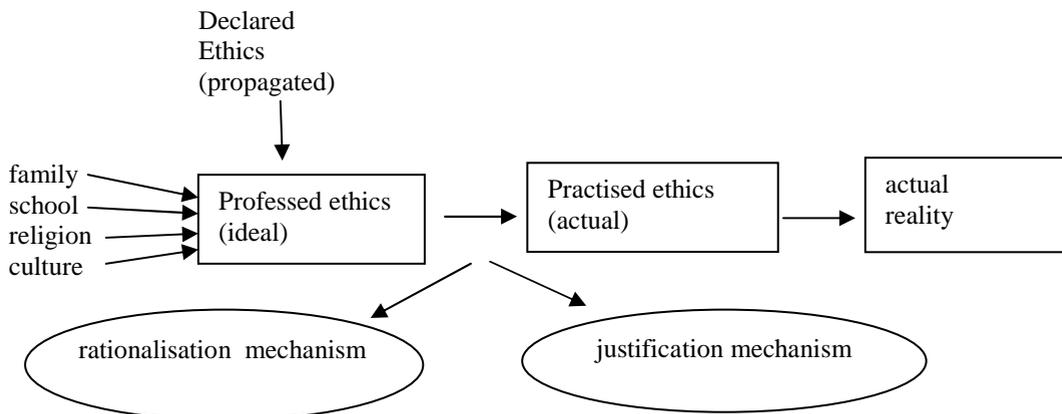


Figure 1. Two types of ethics: the professed one, and the practised one

Source: J. Filek, *Ethical aspects of the activities of local government*, Published by AE, Kraków 2004, p. 28

Rationalisation mechanism is based on invoking social and recognised values, while interpreting them in such a way, as to explain our own behaviour, in a way which could diminish the moral reprehensibility of that behaviour [Aronson, 2014]. Typical formulas used in rationalisation are: “*this is the only way*”, “*I can't make ends meet on my salary*”, “*I'm not doing this for myself but for my family*”, “*it was an unusual situation, we were having financial problems,*

my wife lost her job”, “*in this country, with such much corruption and low salaries, this is the result*”.

The mechanism of justification is based on simple in form and content, reference to similar behaviour from other people in similar situations and the conviction that we should act as the other do. This mechanism is well described by such statements as: “*everybody does it*”, “*others do that too, I won't be any different*”, “*I only do what my superiors do*”, “*let's follow the examples of the politicians*”, “*those in high places set a bad example*”, “*at work we have an arrangement and we have to stick to it*”, “*in our profession this is common practice*”, “*this happens everywhere*”, “*this is life*”.

Furthermore, there are often justifications through invoking the mistakes, incompetence, losses and wastage caused by “*those in management*”, and in the new economic reality, a bribe is referred to as a commission on the job done. This mechanism is well illustrated by the statement: “*there's nothing we can do*”, “*it isn't really a big deal*”, “*that's how it's always been done*”.

Mismanagement and thriftlessness are justified by the fact, that this is *free money and nobody gets harmed*. Both mechanisms, although different, serve the same purpose, that is to protect our self-esteem and dignity from the moral conflict caused by the inconsistency between what we think and say and what we do. Therefore, the main purpose of those mechanisms is setting our conscience at ease, only rationalisation reduces the moral conflict in an individual, and justification concerns the society, as it is a social process of authenticating justifications.

The question of honesty is not new. Since economic entities, public services and their staff (workers) were founded, there have always been attempts at using them for “various obscure purposes” (including political). However, nowadays, for obvious reasons, there is more focus on the ethical context of managing the economy. Various ethical infringements at work, even trivial ones, may be caused by ignorance, lack of culture or the conflicts of roles. An employee, also a manager, often balance between the requirements of law, morality, professionalism and organisation. Loyalty for the company, local community, acting in circumstances of interests conflict, openness and transparency of actions, are great challenges for many of them.

Traditional system of supervision is connected with the right to supervise and evaluate the efficiency of the activities of staff. Those activities, in order to be efficient, require supervision from the supervisory bodies, which are part of the bureaucratic machine of the state. Equally effective, if not the most effective means of supervision, is deliberate and voluntary observance of ethical standards by staff and management, which may prevent many organisational pathologies.

However, it should be noted, that there are certain professional situations, which entail job specific (i.e. forestry, wood processing workers) moral and social dilemmas, connected with the performance of professional tasks [Sulek, Świniarski, 2001]. In the field of forestry a good exemplification of those dilemmas may be the relation between individual interest and social interest, and very often – contradiction between private interests and group interests, individual interests and social interests, concerning professional group and public interest. The result of those frictions and relations is an attempt at defining interest in relation to a particular profession and professional group, as well as – as a result – a legal legitimization of the refusal to perform professional tasks which are incompatible with the accepted social objectives [Zwoliński, 1993]. Definitions concerning specific professional groups can be found in collections of standards known as codes of ethics [Sulek, Świniarski, 2001]. Unfortunately, as we mentioned before, in the case of forestry (except for hunting) – there are not clearly defined and described codes of ethics and the existing ones only pertain to the field of economy and marketing. Still, this does not mean that in forestry, there do not exist and are not respected any ethical professional standards.

Nevertheless, the code of ethics of forestry workers should define the rules of conduct for all workers of this sector of economy. Above all, they should treat their job as a public service provided

for the state and local community, and thus, through their conduct, build the ethos of their profession, creating its image and reputation. When performing their duties they should follow a set of universal ethical rules, which include: law and order, impartiality and objectivity, honesty and reliability, cooperation and loyalty, responsibility, openness and transparency, kindness in interpersonal contacts, admirable conduct at work and in other instances.

Many ethical values which are typical of forester's profession, can be found in the Act on forests from 1991. They are in article 7.1. of the Act and concern, among others:

- 1) preservation of forests and their impact on climate, air, water, soil, living conditions and health of man, as well as nature's balance;
- 2) protection of forests, particularly forests and forests ecosystems which constitute natural fragments of our domestic wildlife or forests which are of special value, due to:
 - a) preserving natural diversity,
 - b) preserving forests' genetic resources,
 - c) landscape qualities,
 - d) needs of science;
- 3) protection of soils and areas which are particularly at risk of pollution or damage, as well as those of special public importance;
- 4) protection of surface and depth waters, sink retention, in particular in areas of drainage divide and water supply for underground water bodies;
- 5) production, in accordance with rational economy rules, of wood and raw materials and by-products of forest exploitation" [Dz. U. z 1991 r., Nr 101, poz. 444].

Also, a forester is obligated to create a balance in forest ecosystems, improving natural resilience of tree stands, including preventive measures and protective measures, eradicating organisms harmful to forest infrastructure, as well as protection of forest soil and water. These activities serve the purpose of preserving forest plants, nurturing and protection of forest, rebuilding stands of trees and rational forest economics (obtaining wood, materials, protection of undergrowth, production of saplings).

There are four types of universal values relevant in economic activities, which should be reflected in the activities of forestry and wood companies [Strong, 2000]:

- *democratic* – these include activities guaranteed by the constitution and the law in fulfilling the public mission and strengthening public trust (protection of environment and forest resources, rational use of raw materials, renewing resources, etc.). Workers of this sector of economy must realise that by protecting forest, they protect the society from itself, seen as a plundering and consumerist lifestyle;
- *professional* – these include such elements as: competence, professional perfection, improvement, effectiveness, impartiality, as well as quality, innovation, working for the public good, partnership, teamwork, etc.;
- *ethical* – these encompass such values as: integrity, impartiality, responsibility, prudence, fairness, objectivity, selflessness, law abiding, etc.;
- *human* – similar to ethical values, they include existential values, relevant in interpersonal relationships, such as: respect, tolerance, good conduct, respect for human dignity, etc. They may relate to the process of management and deal with participation, involvement, communication and consultation.

Code of ethics is a catalogue of behaviour, which determines the code of conduct and behaviour of workers. It is a collection of rules and ethical values, which determine the way of conduct connected with public interest. It is a logically ordered collection of rules, whose purpose is not creating new standards, explaining deviations from general ethics, replacing our own ethical

feelings, but specifying, detailing the standards of general ethics to meet the requirements of specific professions.

However, let us emphasise that professional codes of ethics, although necessary, are still only “minimum programme”. When on the grounds of moral sciences we mention “awareness” or “knowledge” we do not mean the encyclopaedic collection of schools of ethics, rules of conduct, codes and moral strategies, but the awareness of ethics' ambiguity. It is not about moral relativism here, but about the assumption – let us stress that again – that every ethical situation is unique and as such requires application of axiological theory in *praxis*. We are dealing with an ethical situation when we need to make a choice: not so much as a choice between good and evil (after all, there is no great dilemma here, as the basics of ethics and basic rules clearly regulate conduct in such cases) but above all, a choice between one good and another good, between interest of individual and interest of a collective or between two competing public interests. Therefore, it is about ethical (or: sensitivity) awareness, which will allow interpretation and optimisation, which will follow. A code of ethics is merely a starting point for moral reflection and the framework, which cannot be trespassed in order to prevent apparent abuses of power [Ricoeur, 2005].

In this sense, an inspiration for contemporary ethical reflection still remains Aristotle, who put the ethics of creative search above the morality of standards and obligations. Aristotle believed that one of the basic ethical rules is the rule of appropriate measure, the essence of a happy medium. According to him “....a spendthrift gives out too much and takes too little, a miser takes too much and gives out too little” [Aristoteles, 1966]. The most effective attitude in interpersonal relationships is maintaining moderation: however, in order to achieve that, reading codes is not sufficient – you need ethical sensitivity, enabling reflection.

However, reflection may not be suspended in vacuum. In order to protect ethics against the temptation of anarchy and nihilism, it is necessary to have foundation based on specific moral framework. Such framework, as we know, is provided by code of ethics, which in relation to the subject of this paper, concerns the following points:

- 1) determining target group;
- 2) duties of staff and management to each other and to the society;
- 4) conduct in situation of conflict of interest;
- 5) abuse of power resulting from the professional position;
- 6) utilisation of the company's resources for private purposes;
- 7) restrictions connected with undertaking certain activities;
- 8) definitions of conduct and ways, situations and conducts which contravene the code;
- 9) application of sanctions in the case of infringement of the rules of the code.

CONCLUSION

Defining the key values for forestry workers is the first step towards ensuring ethical conduct of this professional group. Also, it is necessary to create a comprehensive system of solutions, which guarantee (and more accurately” facilitate”, since no system can guarantee ethical conduct of a free individual) ethical work of this sector of economy. Such system should also be fostered by the execution of law, which regulates potential standards of proper conduct (penal regulations should be fostered by the right to access to information, so that citizens have a direct instrument of supervision). Another feature of the system of solutions facilitating ethical conduct should be an integrated structure of management of the mechanisms of eliciting responsibility and facilitating ethical conduct, working towards the professional socialisation of officials as well as ensuring proper working conditions [Ethics In the..., 1996].

Although the constitution and laws set out the standard model of human conduct, including that of workers, still there is a lot of room left for ethical models, and observing the law is insufficient

for proper functioning of economy and state. Therefore, we need education, whose purpose is to expand ethical awareness. We deliberately say “ethical awareness”, because it is not about providing ready answers to the moral dilemmas of forestry and wood processing sectors but about the ability to think independently, i.e. the ability to analyse and interpret, to diversify and distinguish, to notice nuances of sometimes fundamental importance, to formulate general conclusions, and finally – to ask questions, attempt to provide answers and to be prepared to make decisions.

REFERENCES

1. Aronson E, Człowiek istota społeczna, PWN, Warszawa 2014.
2. Filek J., Etyczne aspekty działalności samorządu terytorialnego, Wyd. AE, Kraków 2004.
3. Hausner J. (ed.), Administracja publiczna, PWN, Warszawa 2011.
4. Knosala E., Zarys nauki administracji, Wolters Kluwer Warszawa 2010.
5. Kowalski T., Kodeks etyczny a kształtowanie zasad etycznych w administracji, 2004.
6. Kołakowski L, Etyka bez kodeksu, w: Czy diabeł może być zbawiony, Znak, Kraków 2006.
7. Krońska I., Sokrates, WP, Warszawa 1989.
8. Kulesza M., Niziołek M., Etyka służby publicznej, Wolters Kluwer, Warszawa 2010.
9. Kudrycka B., Dylematy etyczne pracowników administracji, Temida 2, Białystok 1995.
10. Ricoeur P., O sobie samym jako innym, PWN, Warszawa 2005.
11. Strong A, Raport Fundation 2000.
12. Sułek M., Świniarski J., Etyka jako filozofia dobrego działania zawodowego, Bellona, Warszawa 2001.
13. Zwoliński J., Po co etyka zawodowa, PWN, Warszawa 1993.

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DYNAMIC ANALYSIS OF SELECTED AGRICULTURAL MACHINERY PRICE CHANGES IN THE YEARS 2011-2015

Abstract:The use of modern agricultural machinery on farms is an indicator of progress in agriculture; the use of the latest technology determines competitiveness of agriculture in Poland. High price of agricultural machinery and its continuous increase makes the renewal of machinery-park affordable only for commercially strong farms. The research paper presents the changes in prices of selected Polish agricultural machinery over the last five years.

INTRODUCTION

Quantitative and qualitative facilitation on agricultural holdings in agricultural machinery and equipment is a progress indicator in agriculture (Piwowar 2013). One of the factors determining the competitiveness of Polish agriculture is the use of new technologies with high economic efficiency. This involves the necessity of constant renewal and modernization of the machinery (Rybacki, et al, 2011a). The definition of machinery-park is hidden behind its name, all kinds of machines and devices being incorporated on a farm; it is estimated that a modern mechanized farm uses about 150 different types of machines and equipment (Durczak 2011). Agriculture machines belong to a group of technical objects, which in terms of exploitation are clearly distinguishable from other ones; they need to meet numerous requirements in terms of their durability, performance and reliability, which is mainly caused by the specificity of agricultural production. Reasonably sized machine park may not impose the holding more than its capability for replacements (Rybacki 2013, Osuch, et al, 2015). The decision on the purchase of a suitable agricultural machine is among the most contributory factor for running the farm. This is most often caused by the need to match the technical and operational parameters with the existing machinery, acreage, and the direction in which the farm production is lead (Rybacki et al 2011b; Rybacki&Durczak 2013). Before taking decisions on the purchase of agricultural machinery, all available information should be exploited, which were gained at subsequent stages, that is among others evaluation of the need for purchasing, selection of machine with specific technical and operational parameters, selection of a particular type of machine that satisfies all the requirements founded by the owner (Skudlarski 2006; Rybacki and Durczak 2013). The purchase of agricultural machinery should be made by taking into account the above mentioned conditions, as they determine the need for rational planning of investments, including the appropriate intensity of the use. This is especially important in the conditions of Polish agriculture, characterized by low investment capacity and lack of opportunities for intensive use of machinery on the farm (Muzalewski 2007; Lorencowicz 2007). Equipping agricultural holdings in Poland with modern agricultural machinery and devices is still not satisfactory (Szewczyk 2010). Despite the increased interest of farmers in the tendency for acquisition of technical measures after the Polish accession to the European Union community, due to the possibility of applying for co-financing in investments related with modernization of farms, in Poland, considerable aged machinery and equipment with the high degree of wear is still the problem (Piwowar 2012). The

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issue of facilitating the domestic agricultural holdings by implementing technical measures is associated – on one hand with the needs, and on the other –with capabilities for the implementation (Muzalewski 2000). One of the most important economic categories is the price; it is an important measure of profitability in production, it determines the economy performance. Agriculture machinery- for the majority of Polish farmers- are still too expensive, as the statistics indicate, machines are being replaced with an average of once in 20 years (Zajac et al, 2010). High prices of technical means causes that investments in new and modern agricultural equipment can be explicitly afforded by developed and commercially strong agricultural holdings (Pasyniuk 2005). The prices on agricultural machinery and devices are impacted directly by the possibility to apply for EU funds under the common agricultural policy (Zajac et al, 2010). In recent years we can observe a significant increase in the prices of technical measures for agriculture. The paper presents the price analysis of agricultural machinery on the basis of selected Polish machinery production in the years 2011-2015.

MATERIALS AND METHODS

The conducted analysis being the subject matter of the Introduction chapter of this research paper proves the importance of appropriately machinery-park for agricultural production, being selected in terms of their quantity and quality and indicates the meaning of machinery price for modernization processes on farms. Relevant decisions on investments in machinery create opportunities for using cost-efficient production technology and acquiring highly-qualitative agricultural products.

The objective of the study is to analyze the process of price changes for machinery and equipment being produced by leading polish manufactures. For the source of data were used product catalogs and price lists.

Subject of the analysis in terms of dynamics of price changes were manures, stubble units, balers, seeders and sprayers. The analysis covered the period 2011-2015.

RESULTS AND DISCUSSION

Manure fertilizers produced by a renowned polish manufacturer with seat in Brzeg was the first group of machinery that was analyzed. The company besides manufacturing machinery for spreading organic fertilizers is also engaged in production of other agricultural machinery such as trailers, manure fertilizers, ridging ploughs, diggers, drills, balers, and potato planters. Among the wide range of manures, four models were subject of analysis in the research work, that is: Apollo 14 with technical capacity of 11 tones, Tytan 10 Premium with technical capacity of 8 tones, Apollo 24 with technical capacity of 18 tones, and Titanium 24 with technical capacity of 18 tones. Table 1 presents detailed data on prices of these manures.

Table 1. Prices of manure fertilizers in the years 2011-2015

	2011	2012	2013	2014	2015	Price difference 2010-2015 in [PLN]
Apollo 14	81300	84900	87500	87500	91000	9700
Tytan premium 10	62600	78900	63300	63300	65200	2600
Apollo 24	129000	129000	132900	132900	138200	9200
Tytan 24	124200	129200	133100	138400	145300	21100



Fig. 1. Apollo 14 manure spreader

Source: own work

Over the last five years substantial increase in price of manures can be observed, the highest jump was recorded in 2015, and when comparing it to the year 2011 it was almost 17% increase in price in the case of Titanium 24 model. The average annual increase in the price of manures is about 2%. The exact price progress is illustrated in Figure 2.

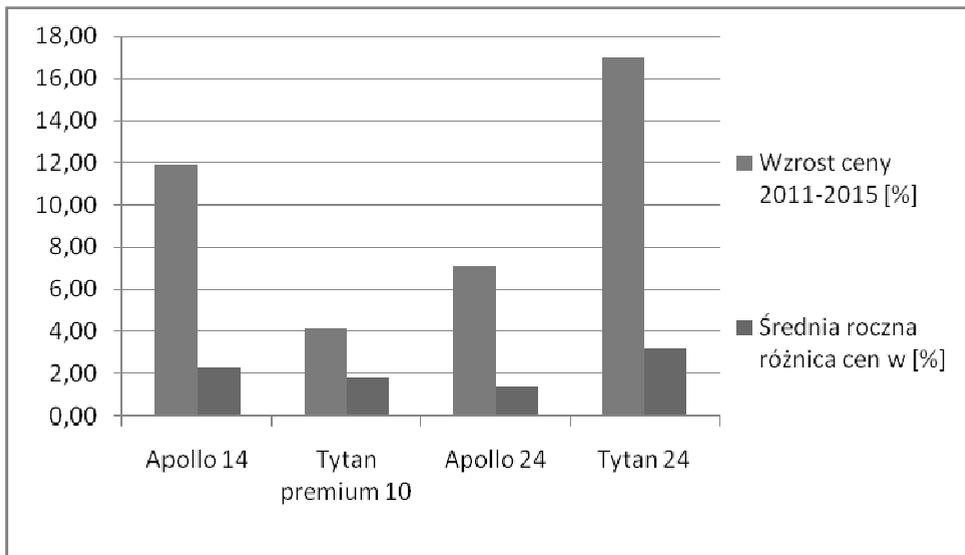


Fig. 2. Price changes of manure spreaders in the years 2011-2015

Source: own work

Another group of machinery being analyzed are stubble aggregates produced in Unia Grudziądz firm. The manufacturer offers a wide range of models from portable stubble cultivators on secured braking, through rigid and folded hydraulically stubble cultivators to spring breaking stubble cultivators. The manufacturer tagged this group of machines as Kos, and units with secured fuse were marked with the B symbol, while the spring breaking stubble cultivators with the S symbol. The working width was indicated by numbers, for example Kos 3.0 S model means a machine with spring break having 3-meter operating width. Unia Grudziądz firm is a leading polish manufacturer of machinery for soil preparation. Table 2 presents the changes in the price of Kos devices in the last five years.

Table 2. Prices of stubble cultivators during 2011-2015

	2011	2012	2013	2014	2015	Price difference 2010-2015 in [PLN]
Kos 2.1 S	12700	12700	13100	13100	13350	650
Kos 2.6 S	17400	17400	18000	18000	18350	950
Kos 3.0 S	19600	19600	20200	20200	20600	1000
Kos 3.7 S	25300	23300	24000	24000	24500	-800
Kos H 3.7 S	27500	27500	28400	28400	29550	2050
Kos H 4.5 S	38000	38000	39200	39200	37900	-100
Kos H 5.4 S	47800	47800	49300	49300	41900	-5900
Kos H 6.0 S	51900	51900	53500	53500	43900	-8000



Fig. 3. Kos 3.0 S stubble cultivator

Source: own work

The machines with a working width of less than four meters are the most commonly purchased ones, while the machines with wither working area are purchased less frequently. In addition, the Kos 3.7 S stubble cultivator, due to its large width and the inability of folding up (problematic for transportation) also has little buying popularity among farmers. As it can be seen in Table 2, machines with smaller widths became more expensive, however these changes are not so huge; over the past five years, the average increase in the price of these machines ranged PLN770.--. The prices of machines with large working widths decreased substantially. The 6-meter width machines' price has drop by PLN6000.--, when compared to the year 2014. The detailed analysis is provided in Figure No. 4.

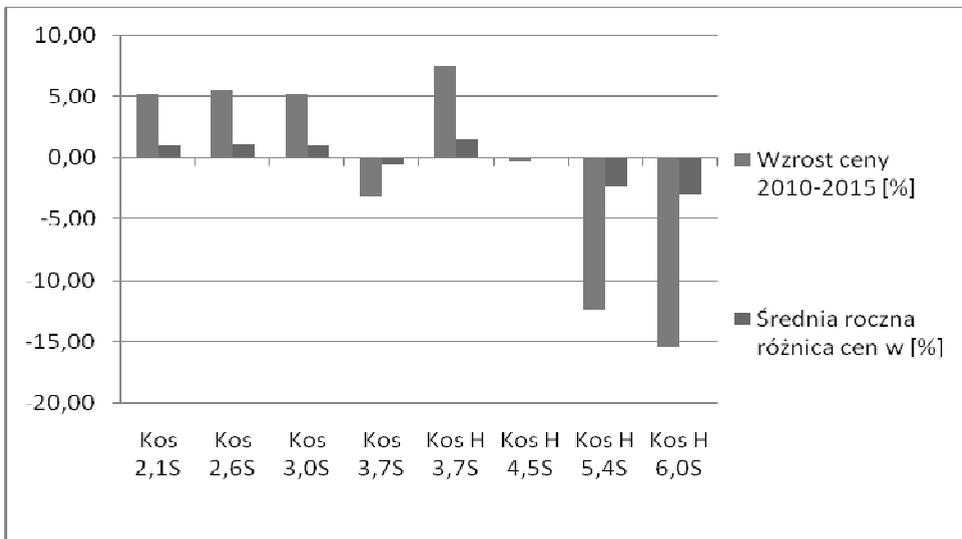


Fig. 4. Changes in prices of stubble cultivator in the years 2011-2015

Source: own work

Another group of the analyzed machines are balers manufactured by Famarol firm. Four models with belt variable chamber: DF 1.7Z, DF 1.7Zd, DF 1.9Z, DF 1.9Zd were subject of the analysis. Models designated with "Z" are balers without cutter, while the designation "Zd" indicates balers with cutter; the numbers stand for the maximum bale diameter, namely 1.7 means the ability of forming bales with the diameter ranging from 0.8 to 1.65m. Famarol produces also forage harvesting machinery, cultivation machinery, as well as seeding equipment; the detailed changes of prices over last five years are shown in Table 3.

Round balers are enjoying great interest among farmers, and this cause largely contributed to the price being significantly increased. The average increase in price of Famarol balers over five years amounted to more than 15%, while the average annual increase in price was less than 3 %. Price changes of balers over the last five years being expressed as a percentage are shown in Figure 6.

Table. 3. Prices of round balers in the years 2011-2015

	2011	2012	2013	2014	2015	Różnica cen 2010-2015 [zł]
DF 1.7 Z	78000	82700	84700	86400	89800	11800
DF 1.7 Zd	79900	83900	86900	88600	92100	12200
DF 1.9 Z	79900	83700	87700	89500	93100	13200
DF 1.9 Zd	83200	87200	89900	91700	95400	12200



Fig. 5. Famarol 1.7 Zd round baler (source: own work)

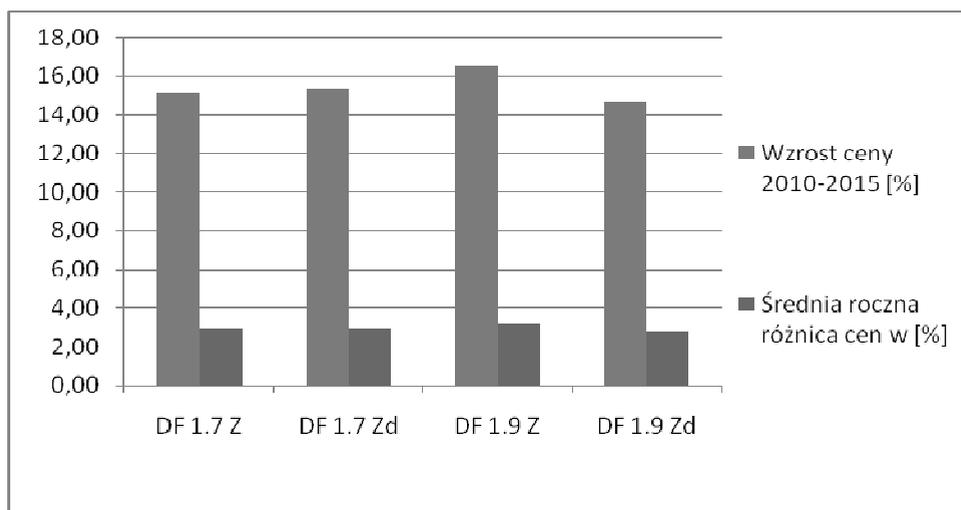


Fig. 6. Price changes of round baler in the years 2011-2015 (source: own work)

Subsequent group being analyzed was the traditional seeding equipment produced by the same manufacturer as in the case of the abovementioned balers. Particular models are designated in the same way; the first signs of the model stand for hopper capacity, while the following numbers indicate the working width expressed in meters. The symbol “D” means the machine is with disc coulters, while no designation determines that there are hoe coulters. For example, Poznaniak 33/2.5 D seeding machine is a seeder with a capacity of 330 dm³ and working width of 2.5 m. with disc coulters. As it can be seen in Table 4, from 2012 until 2014 Poznaniak seeders’ prices gradually increased. The year 2015 was a crucial year, when prices of seeders decreased sharply, even significantly below the prices from the year 2011; as it is reported by the manufacturer, the main cause of sudden price change was the use for production of other materials and the design change. Prices of the selected seeders’ models of the Poznaniak product range are shown in Table 4.

Table. 4. Prices of seeders in the years 2011-2015

	2011	2012	2013	2014	2015	Price difference 2010-2015 in [PLN]
Poznaniak 330/2.5	16850	17300	19050	19400	15300	-1550
Poznaniak 330/2.5 D	22000	22650	23350	23800	19900	-2100
Poznaniak 370/2.7	18700	19250	19850	20250	16200	-2500
Poznaniak 370/2.7 D	22900	23550	24400	24900	21000	-1900



Fig. 7. Polonez 550/3D seeder

Source: own work

Seeders' price in 2015 compared to 2014 decreased by an average of 22%. The difference in price in the amount of fifth price of the entire machine for the benefit of buyers is quite rare case occurring in the industry of agricultural machinery. The exact percentage changes in prices of Poznaniak seeders over the last five years are shown in Figure 8.

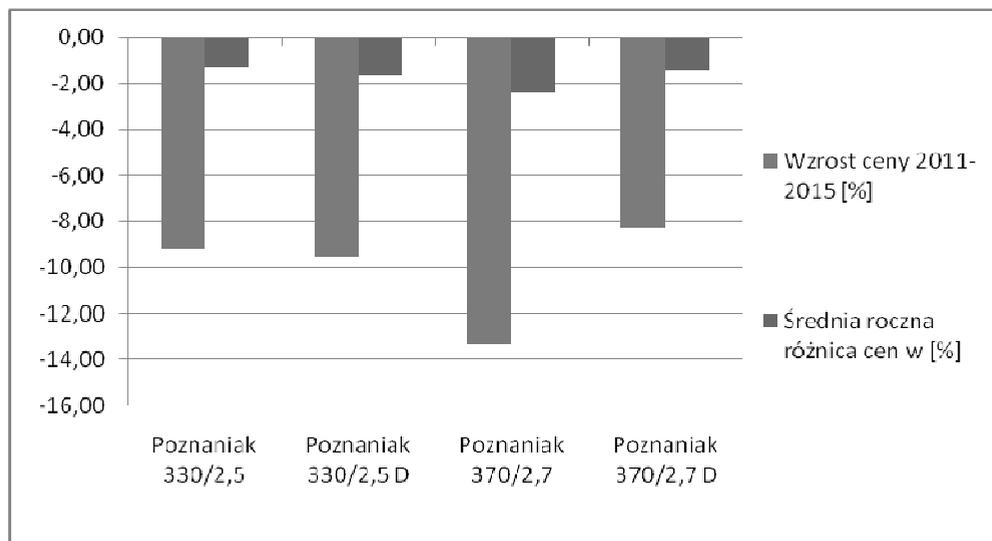


Fig. 8. Changes in prices of seeders in the years 2011-2015

Source: own work

The last group of the analyzed machines are agricultural sprayers. The study were described selected models of sprayers produced by one of the largest in Poland companies specializing in manufacturing machines for plant protection. Pilmet brand name is also noticed on the markets of Western Europe. The manufacturer designated single group of models by placing in the symbol of the machine also its name, namely: ECO, LUX, REX, PLUS, EUROPE, etc. These names consists of groups of machines structurally similar. Subsequent symbols stand for the main tank capacity and rigid field beam operating width. Model LUX 815 is a simple construction of suspended sprayer with capacity of 800 dm³ and operating width of 15 m. Production of Pilmet sprayers were moved to Agromet in Brzeg. Table 5 presents the analyzed sprayers according to their price changes in the last five years.

Table 5. Prices of sprayers in the years 2011-2015

	2011	2012	2013	2014	2015	Price difference 2010-2015 in [PLN]
LUX 815	18500	18500	20400	20400	21000	2500
REX 1018	36400	37850	38800	38800	40400	4000
PLUS 1618	46400	48250	45600	49900	51950	5550



Fig. 9. Pilmot Plus 2018 sprayer

Source: own work

Sprayers - regardless of their size and equipment - record annual rise in price at an average of more than two percentage points. This may prove a high stability of sales of these machines. Figure 10 shows the percent change in the price of Pilmot sprayers in the last five years.

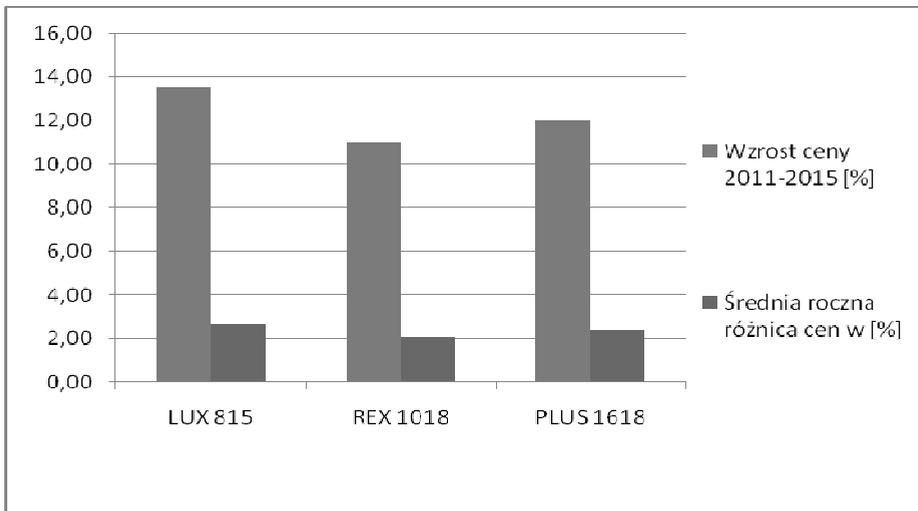


Fig. 10. Price changes of sprayer in the years 2011-2015

Source: own work

The second most important group of costs, next to the above outlined investment costs in machines and equipment, are operating costs, which include maintenance and operation costs (1). On the basis of methodology for determining the amount of costs [Romaniuk 1996; Szulc 2009],

which are of decisive meaning and impact on - among others - the height of the unit production costs of milk, meat, eggs, etc., the value of individual components of operating costs for selected devices should be considered. On this basis, the utility costs (3) include repair costs (K_n), labor (K_{rob}), costs of consumable materials (K_m), electricity (K_{ee}), and water for production purposes (K_w); and in turn, the cost of maintenance (2)- affects the costs of depreciation (K_a), insurance (K_{ub}), and construction costs (K_{bud}). The individual components of operating costs are very often referring to the number of hours (W_h):

$$K_e = K_{ut} + K_{u\dot{z}} \quad [PLN] \quad (1)$$

$$K_{ut} = K_a + K_{ub} + K_{bud} \quad [PLN] \quad (2)$$

$$K_{u\dot{z}} = K_n + K_{ee} + K_w + K_{rob} + K_{mat} \quad [PLN] \quad (3)$$

The amount of repair costs shall be based on the type and kind of machinery or equipment, and are based on current repairs and maintenance, being performed at a certain time period [Muzalewski, 1999].

Depreciation costs allow for asset restoration in terms of value of a particular machine. During its exploitation period for a fixed number of years [T-years] – the depreciation costs are equal to the value of the purchased machine- C_m . Insurance costs K_{ub} are adopted in accordance with the real data provided by farmers and owners of facilities being subject of the analysis.

$$K_{aj} = \frac{C_{mj}}{T_{lat} \cdot W_{rj}} \quad [z\dot{t} \cdot h^{-1}] \quad (4)$$

Electricity costs $keej$ are the product of the electricity being consumed $Weej$ by the equipment being subject of the analysis in the j-th property, and the price of $1kW_h$ ($C_k W_{hj}$). The consumption costs of water for washing the installation were determined by multiplying a given amount of cold tap water WWJ and its unit price of $1m^3$. Costs of consumables and ancillary materials K_{mat} come from, among others, the use of additional expenditures, such as chemicals for cleaning the equipment and machines, and minor treatments during their everyday use.

CONCLUSIONS

The conducted research study and detailed analysis of results allow concluding the following proposals:

1. The price analysis of spreaders, sprayers and round balers shows that the machinery having the greatest interest among farmers record annual price increase rate of approx. 2-3%.
2. On the basis of “Kos” stubble aggregates, it can be concluded that the rise in prices of agricultural machinery is mainly caused by the demand, and their production cost do not play a significant role.
3. Changing the design and materials used to construct the machinery can significantly affect the price decrease of the finished product, which can be confirmed on the example of various “Poznaniak” seeders.

REFERENCES

1. Durczak K., 2011: System oceny jakości maszyn rolniczych. Rozprawa Habilitacyjna, Poznań.
2. Lorencowicz E., 2008: Zmiany w wyposażeniu technicznym wybranych gospodarstw rolnych po przystąpieniu Polski do Unii Europejskiej. Inżynieria Rolnicza, 5(103), pp. 73-79.
3. Muzalewski A., 2000: Aktywność inwestycyjna i wyposażenie gospodarstw w środki mechanizacji. Problemy Inżynierii Rolniczej, 3, pp. 95-102.
4. Muzalewski A., 2007: Model optymalizacji wyboru pomiędzy zakupem maszyny a najmem usługi. Inżynieria Rolnicza, 2 (90), pp. 197-203
5. Osuch A., Rybacki P., Buchwald T., Staszak Ż., Ratajczak J. 2015: Analiza stanu wyposażenia gospodarstw rolnych w ciągniki rolnicze. Aktualne problemy Inżynierii Biosystemów. Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu, pp. 91-101.
6. Pasyniuk P., 2005: Nowe ciągniki w polskim rolnictwie - sprzedaż i ceny. Wieś Jutra. N° 85/86, pp. 25-26.
7. Piwowar A., 2013: Analiza cen wybranych maszyn i urządzeń rolniczych w latach 2008-2012. Technika Rolnicza - Ogrodnicza - Leśna, N° 4, pp. 5-8
8. Piwowar A., 2012: Zmiany na rynku rolniczych usług mechanizacyjnych w Polsce w latach 2004-2009. Journal of Agribusiness and Rural Development, N° 4, pp. 62-71.
9. Romaniuk W. 1996. Wpływ funkcjonalno-technologicznych rozwiązań obór na energochłonność i koszty produkcji mleka w gospodarstwach rodzinnych. Rozprawa habilitacyjna. Prace Naukowo-Badawcze IBMER, Warszawa
10. Rybacki P., Rzeźnik C., Durczak K., 2011: Wyniki badań dynamiki odnowy parku maszynowego w rolnictwie. Technika Rolnicza Ogrodnicza Leśna, 1, pp. 20-21. ISSN 1732-1719.
11. Rybacki P., Rzeźnik C., Durczak K., 2011b: Wyniki badań odnowy parku maszyn gospodarstw rolnych w aspekcie ich jakości. Journal of Research and Applications in Agricultural Engineering, N° 56(1), pp. 121-123.
12. Rybacki P., 2012: System oceny jakości serwisowania maszyn rolniczych. Rozprawa Habilitacyjna, Poznań.
13. Rybacki P., Durczak K., 2013: Koncepcja wykorzystania metody AHP w procesie decyzyjnym zakupu ciągnika rolniczego. Journal of Research and Applications in Agricultural Engineering, N° 58(2), pp. 136-140, 1642-686X 5.
14. Skudlarski J., 2006: Optymalizacja decyzji zakupu maszyn rolniczych na przykładzie ciągników rolniczych. Inżynieria Rolnicza, N° 4, pp. 173-180.
15. Szewczyk J., 2010: Wyposażenie gospodarstw indywidualnych w maszyny rolnicze w Małopolsce. Acta Scientiarum Polonorum, Oeconomia, N° 9, pp. 105.
16. Szulc R. 2009. Ocena systemu odzyskiwania ciepła podczas mycia urządzeń udojowych - rozprawa habilitacyjna. Warszawa, p. 156
17. Zając S., Izdebski W., Kusz D. 2010: Podaż i popyt ciągników rolniczych w Polsce. Roczn. Nauk. SERiA N° 12/4, pp. 393-397.

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APPLICATION OF RELATIONAL DATABASE IN DETERMINING RHYTHMIC PRODUCTION PARAMETERS

Abstract: The article discusses a computational procedure for the determination of organisational parameters of rhythmic production, typical e.g. of medium and larger enterprises in the furniture and machine industry. Based on the computational procedure a computer programme was developed in the form of a relational database. The designed database structure is presented: tables, queries and forms. The proposed solution accelerates computations during planning and facilitates analysis of numerous organisation variants for rhythmic production at a considerably reduced labour consumption of such activity in comparison to computations performed using a calculator or spreadsheets. The developed programme may be a useful planning tool in the departments in charge of production setup in enterprises with the lot production system.

Key words: rhythmic production, lot production system. computer programme, relational database

INTRODUCTION

In industrial enterprises, in which products are manufactured in the lot production system, two basic production organisation forms (systems) are applied: non-rhythmic (non-direct line, non-duplicate, non-stable) and rhythmic (direct-line, duplicate, stable). These forms are distinguished based on the manner of interaction (cooperation) of work stations, on which successive operations are performed (specifically: detailed operations) of the production process. Cooperation between work stations consists in the transfer of parts to the work station, on which the next detailed operation will be performed in accordance with the flowchart of the production process. In each production cycle the next work station within the pair of cooperating work stations may be different – for the non-rhythmic type, or the same – for the rhythmic type, respectively [Brzeziński 2013].

Rhythmic production is characterised by stable cooperation of production work stations. Allocation of detailed operations to work stations is permanent and planned. The flow of parts has a clearly specified route and direction. Parts are transferred from the previous work station onto the allocated, successive work station in accordance with the flowchart. Transfer of parts from one work station to the next is uniform and continuous. Production of the same parts is repeatable, which facilitates application of model (duplicate) schedules of production. Manufacture is performed in production units limited to specific objects. Work stations are distributed in accordance with the flowchart of the production process, creating a production line. The direct-line system is most frequently used in medium-lot, large-lot and mass production systems [Wróblewski 1993, Brzeziński 2013]

Characteristics of direct-line production, particularly its rhythmic flow, require adequate planning. Planning is based on calculated organisational parameters of production. The procedure of their determination comprises around a dozen steps and is labour-consuming when performing the calculations using a calculator or spreadsheets.

The aim of the presented study was to develop a computer programme using a relational database, supporting the determination of organisational parameters of rhythmic production. The application of a database makes it possible to obtain a complete set of results immediately after the

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data are entered. The application was constructed using the Microsoft Access 2007 database management tool. This system is one of the most common and widely available [Mendrala 2007, Tabert 2010]. There is no publication in available literature on the subject, which would discuss a solution analogous to that proposed in this paper. Principles of planning rhythmic production and a computational procedure were developed based on a publication by Wróblewski [1993] and Brzeziński [2013]. In the computational procedure presented in this paper, definitions of data and variables used in the application as well as their indexing were specified more precisely. The presented computational procedures were referred to the principles of operation of furniture industry enterprises.

COMPUTATIONAL PROCEDURE – CHARACTERISTICS OF INPUT AND OUTPUT PARAMETERS OF RHYTHMIC PRODUCTION

The production (target) programme of an enterprise is a set of types and numbers of final products as well as types and numbers of their parts¹⁹: elements, subassemblies and assemblies, which were specified to manufacture in the planned period. In furniture and machine industry enterprises volume in the programme is expressed in pieces or sets, much less commonly in other natural units, e.g. such as pairs, square meters, kilograms or tons.

The production programme of final products is created based on analyses of market needs for products manufactured by employees of the enterprise or by specialist external firms commissioned by the producer. Results of analyses are referred to production capacity of the enterprise. Final products selected for the programme meet three simultaneous conditions: there is adequate demand for them on the market, the company has technical capacity to produce them and they are economically viable for the enterprise. The first two conditions have to be met at least on the satisfactory level, while the third criterion is used to select the most profitable products. Numbers of final products are planned in so that they meet market needs and facilitate possibly the greatest utilisation of production capacity of the company.

Production programmes for parts are established based on explosions of the design or material structure²⁰ of final products planned to be manufactured in the specified period. Analytical and graphic methods or appropriate computer programmes are used for this purpose. As a result we obtain lists of elements, subassemblies and assemblies in terms of types and numbers and in different explosions: single-, multi-level and summary [Chen et al. 2012, Tabert 2012 a, Tabert 2012 b]. Production programmes for parts are based first of all on summary explosions.

Thus specified production programmes of parts listing their types and numbers give the number of final parts, i.e. those being qualitatively adequate, and on which the required manufacture process has been completed. They are output production programmes, also called production in-flow programmes. However, in the course of individual technological operations of the production process apart from good quality parts, defective parts (spoilage) are also produced. They reduce the number of manufactured production transferred to the next stages of the manufacturing process. Thus quantitative performance of output programmes requires determination of adequate input programmes. These programmes take into consideration the formation of spoilage so that as a result the number of correct parts is manufactured, as specified in in-flow programmes. Input programmes of parts, also called production setup programmes, are calculated by adjusting in-flow programmes

¹⁹ In this study the term “parts” is used a common term for: elements, subassemblies and assemblies, which are production units e.g. in furniture enterprises. In literature on the subject other terms are also used: workpieces, jobs, products, components, details.

²⁰ The design structure of a product specifies types of parts, numbers and combinations, which constitute the final product. The material structure specifies types of materials and parts, their combinations and numbers in the final product.



using a standardised, fractional or percentage index (level) of spoilage assumed for the planned period, following the formulas:

$$PUC_j = PSC_j \cdot (1 + WBU_j)$$

(1a)

or

$$PUC_j = PSC_j \cdot (1 + WBP_j / 100),$$

(1b)

where:

PUC_j – production setup programme for j-th type parts, calculated for the planned period [pcs/period],

PSC_j – production in-flow programme of j-th type parts (number of good quality parts), specified for the planned period [pcs/period],

WBU_j – standardised index of spoilage for i-th type parts expressed as fraction [-],

WBP_j – standardised index of production spoilage for i-th type parts expressed in percent [%],

j – number of j-th type parts, to be manufactured in the planned period, at $j = 1, \dots, m$.

The standardised spoilage index (fractional or percentage) is set based on statistical data on the number of manufactured quality and defective parts in previous planning periods for the same type of parts or parts similar in terms of design and technology, manufactured under comparable conditions. Formulas (1a) and (1b) are respectively applied in calculations depending on the form, in which spoilage indexes were developed by production setup teams of the enterprise.

For the period included in planning the primary measure (parameter) characterising a work station (work stand, work-place) is the time, in which it may be used (operated) in manufacturing processes. Time is expressed using available standard hours of operation of a machine or a device, with which the work station is equipped. There are four types (levels) of the available standard hours: calendar, nominal, effective and actual²¹.

Calendar available standard hours of a work station refer to the number of days (24h) calculated as the difference between the initial and final date of the period, for which organisation of the production process is planned, increased by one. Most frequently this period is a year, but it may also be half-year, quarterly or monthly periods. If the calendar available standard hours are to be expressed in hours, then the fixed number of days is multiplied by 24 h.

The basis for the determination of nominal available standard hours of a work station for the planned period is the number of working days (LDP), which is established as the difference between the number of days of the calendar available standard hours and the number of days off work. In turn, the number of days off work (LDW) is the total number of Sundays, Saturdays and holidays, except for those which in the planned period come on Sundays. For example, assuming the planned period is the year 2014, we obtain 52 Sundays, 52 Saturdays and 13 days of public holidays²² (holidays). In the analysed period two holidays fall on Sundays and two - on Saturdays. For holidays coming on Saturdays workers are entitled to a respective number of days off work. In the case of holidays falling on Sundays no such principle is applied. Thus for a one-year period

²¹ The actual available standard hours are established as the product of effective available standard hours and the index (coefficient) of utilisation of effective available standard hours. This volume of available standard hours is calculated after the completion of the production process. It is not used when planning the organisational parameters of the production process. Thus it is not discussed in further parts of the study.

²² In accordance with the Code of Labour (Journal of Law Dziennik Ustaw of 1974 no. 24, item 141, with later amendments) and the Act on days off work (Journal of Law Dziennik Ustaw of 1951 no. 4, item 28, with later amendments).

(referring to 2014 only) $LDW = 52 + 52 + 11 = 115$ days off work, while $LDP = 365 - 115 = 250$ working days.

In the above example the number of working days of the work station was established for standard working conditions – from Monday to Friday, and assuming that working time of the work stations is the same as working time of workers operating them. As a result of the introduction to the Code of Labour of the principles allowing flexible settlement of working time of employees²³ by employers, in some enterprises appropriately modified rules may be applied to determine the number of working days for the work station in relation to the principles, on the basis of which the calculations given in the example were performed.

The volume of nominal available standard hours for a work station is calculated by multiplying the number of working days by the planned number of shifts²⁴ (in furniture enterprises typically it is only one shift) per 24 h and by the nominal number of hours in a shift (standard 8 h). Calculations are made using values assumed for the planned period, in accordance with the formula:

$$NFC_k = (KFC_k - LDW_k) \cdot LZR_k \cdot LGZ_k,$$

(2a)

and including the formula for the calculation of days off work we obtain a formula:

$$NFC_k = (KFC_k - LND - LDS - LWS) \cdot LZR_k \cdot LGZ_k,$$

(2b)

where:

NFC_k – nominal available standard hours for k-th work station, calculated for the planned period [h/period],

KFC_k – calendar available standard hours (number of calendar days) of k-th work station, determined for the planned period [24 h/period],

LDW_k – number of days off work per work station of k-th type, calculated for the planned period [24 h/period],

LGZ_k – nominal number of hours in a shift, assumed for operation of k-th type work station [h/shift],

LZR_k – standardised number of shifts per 24 h, assumed for operation of k-th type work station [shift/24 h],

LND_k – number of Sundays in the planned period [24 h/period],

LDS_k – number of holidays except for holidays falling on Sunday in the planned period [24 h/period],

LWS_k – number of Saturdays off work in the planned period [24 h/period],

k – number of k-th type work station, for which the value of NFC_k is determined in the planned period, at $k = 1, \dots, s$.

The volume of effective available standard hours of a work station is the quotient of nominal available standard hours and standardised index (coefficient) of time of planned downtime of the work station²⁵, assumed for the planned period. Values of the available standard hours are calculated from a formula:

$$EFC_k = NFC_k \cdot WCR_k,$$

(3a)

and next after substitution in formula (3a) the value of NFC_k with formula (2a) or (2b) we obtain the following formulas:

²³ New regulations on flexible working time have been binding in Poland since 23.08.2013.

²⁴ The number of shifts is referred to as shift system.

²⁵ Most frequently the values adopted for this index are 0.94 – 0.96, Brzeziński M. (2013): Organizacja produkcji w przedsiębiorstwie [Organisation of production in an enterprise]. Wyd. Difin SA, Warszawa, s. 65.

$$\mathbf{EFC}_k = (\mathbf{KFC}_k - \mathbf{LDW}_k) \cdot \mathbf{LZR}_k \cdot \mathbf{LGZ}_k \cdot \mathbf{WCR}_k$$

(3b)

and

$$\mathbf{EFC}_k = (\mathbf{KFC}_k - \mathbf{LND} - \mathbf{LDS} - \mathbf{LWS}) \cdot \mathbf{LZR}_k \cdot \mathbf{LGZ}_k \cdot \mathbf{WCR}_k,$$

(3c)

where:

\mathbf{EFC}_k – effective available standard hours of k-th type work station, calculated for the planned period [h/period],

\mathbf{WCR}_k – standardised index (coefficient) of time of planned downtime for k-th type work station [-]. The other denotations as for formulas (2a) and (2b).

Using formulas produced from two or more input values, which characterise: parts, work station, operations and detailed operations we calculate values of output parameters.

The hourly task (job) denotes the number of j-th type parts, which should be manufactured within each hour of effective available standard hours for the k-t type work station in order to complete the assumed production programme in the planned period. Formulas with which the hourly task is calculated, take the form:

$$\mathbf{ZGC}_{jk} = \mathbf{PUC}_j / \mathbf{EFC}_k$$

(4a)

or by substituting values of \mathbf{PUC}_{jk} and \mathbf{EFC}_{jk} with respective formulas (1b) and (3c) we obtain:

$$\mathbf{ZGC}_{jk} = \mathbf{PSC}_j \cdot (1 + \mathbf{WBU}_j) / ((\mathbf{KFC}_k - \mathbf{LND} - \mathbf{LDS} - \mathbf{LWS}) \cdot \mathbf{LZR}_k \cdot \mathbf{LGZ}_k \cdot \mathbf{WCR}_k),$$

(4b)

where:

\mathbf{ZGC}_{jk} – hourly task to manufacture j-th type parts to be completed at k-th type work station [pcs/h]. The other denotations as in formulas (1a) and (3c).

A characteristic feature of direct-line production is its rhythmic nature. Its measure is the production pace (working pace) of parts. It is the time, which passes between the manufacture (between in-flow) of two successive parts of the same type to the k-th type work station. The production pace is determined by the formula:

$$\mathbf{TPC}_{jk} = \mathbf{EFC}_k / \mathbf{PUC}_j,$$

(5)

where:

\mathbf{TPC}_{jk} – production pace of j-th type parts to k-th type station [h/pcs]. The other denotations as in formulas (1a) and (3c).

The number of pieces of parts, which may be manufactured during ij-th type detailed operation at k-th type work station, is defined by the hourly capacity of the work station. It is established based on standardised unit performance time of ij-th type detailed operation and the index (coefficient) of output rate. The output rate index adjusts the planned unit time of detailed operations by including actual conditions for the performance of a detailed operation at the work station. It is established based on the arithmetic mean of performance of the same tasks in previous planning periods. The hourly capacity is determined from the formula:

$$\mathbf{MGS}_{ijk} = \mathbf{WWN}_{ijk} / \mathbf{CID}_{ijk},$$

(6)

where:

\mathbf{MGS}_{ijk} – hourly capacity of k-th type work station to perform ij-th type detailed operation [pcs/h],

\mathbf{WWN}_{ijk} – index of output rate at k-th type work station, assumed for the planned period [-],

CJD_{ijk} – standardised unit time for the performance of ij-th type detailed operation (i-th type operations on a single j-th type part) at k-th type work station [h/pcs].

The value which characterises simultaneously a detailed operation and a work station is standardised unit time for performance of a detailed operation (standardised labour-consumption of unit detailed operation, calculated unit time). It is the duration of a production operation (technological or auxiliary operations) on a single part, manufactured at the work station of a specific type, assumed in the calculations for the planned period. The duration of this time is determined by the work standard.

Load factor of the k-th type work station for a detailed operation of the ij-th type is established based on the formula:

$$WOS_{ijk} = ZGC_{ijk} / MGS_{ijk}$$

(7a)

or after substitution of the value of ZGC_{ijk} and MGS_{ijk} with respective formulas (4a) and (6) we obtain:

$$WOS_{ijk} = \frac{PUC_j \cdot CID_{ijk}}{EFC_k \cdot WVN_{ijk}}$$

(7b)

where:

WOS_{ijk} – load factor of k-th type work station with a ij-th type detailed operation [-]. The other denotations as in formulas (4a) and (6).

Based on the load factor values the type of production organisation is specified for the analysed work station. The following situations are distinguished:

1. $WOS_{ijk} = 1$ – the work station is allocated the complete task (detailed operation). Then it is allocated mass production. In the planned period this work station will be changed over only once (at the beginning of task performance). Only one ij-th type detailed operation will be performed at the work station in the planned period.
2. $WOS_{ijk} > 1$ – for the completion of a detailed operation more than one machine or device will be needed at the k-th type station in the planned period. In such a case production will be conducted as a multi-stream process²⁶. The number of uniform machines or technologically equivalent devices is established based on the formula:

$$LMZ_{ijk} = INT(WOS_{ijk}) + 1,$$

(8)

where:

LMZ_{ijk} – the number of machines or technologically equivalent devices, constituting equipment of the k-th type work station, on which the ij-th type detailed operation is performed simultaneously in the planned period [pcs].

$INT()$ – function of $INT(\text{value})$ – returns the integer part of the given number. The other denotations as in formulas (7a) and (7b).

3. $WOS_{ijk} < 1$ – planned task (detailed operation) does not utilise all effective available standard hours of the work station, thus in order to increase the load of the work station it may be assigned additional detailed operations, then the work station will be changed over more than once and so a variable stream will be formed.

²⁶ The multi-stream character refers to simultaneous (parallel) performance of the same ij-th type detailed operation at the k-th type work station by more than one machine or device, to which a batch of production is allocated uniformly.

Allocation of additional detailed operations to a work station, within the organisation of a complex stream, has to include the dependence expressed in the aggregate index of work station load, described by the formula:

$$WOS_k = \sum_{ij=1}^{nm} WOS_{ijk} \leq 1, \quad (9)$$

where:

WOS_k – aggregate index of load for the k-th type work station with a group of nm detailed operations [-]. The other denotations as in formulas (7a) and (7b).

The aggregate index of load for a work station is established based on the number of the k-th type work station, required for the performance of the task, expressed by the total of detailed operations allocated to the work station, according to the formula:

$$LST_k = \begin{cases} INT(WOS_k) & \text{jezeli } WOS_k - INT(WOS_k) = 0 \\ INT(WOS_k) + 1 & \text{jezeli } WOS_k - INT(WOS_k) > 0, \end{cases} \quad (10)$$

where:

LST_k – number of k-th type work stations required for the performance of nm detailed operation [pcs]. The other denotations as in formulas (8) and (9).

At the work station operating in the variable stream of production parts are organised in batches of production and successive detailed operations are performed on them. After each performed ij-th type detailed operation on the production batch the work station is changed over. Next another type of detailed operation is conducted at it on another production batch. The same detailed operations are performed at the k-th type work station as the section of time, called repetition period or production rhythm. The smallest time interval, in which the changeover time of a work station may cover the time of its insufficient load, is the minimal repetition period, which expresses a dependence (including an additional number of work stations):

$$NOP_k = \frac{\sum_{ij=1}^{nm} CPZ_{ijk}}{1 - WOS_k / LST_k}, \quad (11)$$

where:

NOP_k – minimal repetition period for a group of nm detailed operations performed at a k-th type work station [h],

CPZ_{ijk} – standardised changeover time of a k-th type work station allocated to i-th type operations on the batch of j-th type parts [h/batch]. The other denotations as in formulas (9) and (10).

Standardised changeover time (set-up – completion time) for a work station simultaneously characterises a detailed operation and a work station. It denotes the time allocated to the preparation of a work station to initiation of operations on a batch of parts and it is allocated to works completing the task at the work station. This time is used e.g. for such activities as collection of tools and their mounting (replacement) in the device, setting parameters of the machine, verification of operating accuracy of tools at the work station and return of tools and ordering of the work station after completion of operations. The duration of changeover time depends on the type of equipment (machines, devices and tools) at the work station and the type of production operations to be performed at this work station. The length of changeover time is not influenced by the number of parts comprised in the production batch. In planning calculations it is found as a standardised value assumed for the planned period.

Minimal repetition period is established for all s (k = 1, ..., s) types of work stations comprising the primary unit, for which organisational parameters are calculated. Next from such a

set of minimal repetition periods the maximal period (production rhythm of production unit) is established according to the formula:

$$MOP = \max_k \{NOR_k\}$$

(12)

where:

MOP – maximal repetition period of the production unit comprising *s* work stations [h]. The other denotations as in formula (11).

For organisational reasons the repetition period of the production unit selected as the maximal period is increased to the whole number of hours in the shift of the entire week, month, etc. In this manner we obtain the planned repetition period (POP) applied for the production unit.

Calculations described by formulas (1-12) constitute the basis for the development – in the analytical and/or graphic form – of a model (repetitive, periodical) schedule of production unit operations. These calculations may further be the starting point for the preparation of a schedule of work station operation by workers, as well as a schedule of supplies of materials and parts to work stations, inspections and repairs of work stations etc.

STRUCTURE OF TABLES IN THE PROGRAMME “DETERMINATION OF PARAMETERS OF RHYTHMIC PRODUCTION”

In the programme called “Determination of parameters of rhythmic production”, developed in the form of a database, four tables (objects) were created: Types of parts (RCZ), Types of work stations (RST), Types of operations (ROP) and Types of detailed operations (RDO). In these tables input values were given following the principles of relational database. They form fields (columns) of tables, constituting their attributes. Allocation of individual values to respective tables of the programme is presented in table 1.

Table 1. Allocation of input values of rhythmic production to tables of relational database

Symbol of parameter	Description defining the role of parameter	Location of parameter
1. NRC	Name of type of parts	Fields of table: RCZ
2. PSC _j	In-flow programme of j-th type parts, established for planned period [pcs/period]	
3. WBU _j	Standardised index of spoilage j-th type parts expressed as fraction [-]	
4. NRS	Name of type of work station	Fields of table: RST
5. KFC _k	Calendar available standard hours of k-th work station, established for planned period [24 h/period]	
6. LND _k	Number of Sundays in the planned period [24 h/period]	
7. LDS _k	Number of holidays (24h) in the period, except for holidays falling on Sundays in the planned period [24 h/period]	
8. LWS _k	Number of Saturdays off work in the planned period [24 h/period]	
9. LGZ _k	Nominal number of hours in the shift, assumed for work at the k-th type work station [h/shift]	
10. LZP _k	Standardised number of shifts per 24 h, adopted for work at k-th type work station [shift/24 h]	
11. WCP _k	Standardised index of planned downtime for k-th type work station [-]	
12. NRO	Name of type of operations	
13. CPZ _{ijk}	Standardised time of changeover for k-th type work station for i-th type operations on a batch of j-th type parts [h/batch]	Fields of table: RDO
14. CJD _{ijk}	Standardised unit time for performance of i-th type operations on a single j-th type part at k-th type work station [h/pcs]	
15. WWC _{ijk}	Standardised index for performance of a unit ij-th type detailed operation at k-th type work station, adopted for planned period [-]	

Source: Own study.

Figure 1 presents a screenshot of the form in the database to enter data required for the performance of calculations of output values for organisational parameters in rhythmic production. Buttons in the lower section of the form facilitate rapid transfer to reports with data and results.

Entering of data for work stations, operations, Parts and detailed operations

Parameters of detailed operations		Parameters of work stations	
NRS:	St1	NRS:	St1
NRO:	Op1	KFCk:	365
NRC:	C1	LNDk:	52
CPZijk:	5,0	LDSk:	11
CJDijk:	0,20	LWSk:	52
WWCijk:	0,90	LGZk:	8
Parameters of parts		LZPk:	3
NRC:	C1	WCPk:	0,95
PSCj:	1000	Parameters of operations	
WBUj:	0,10	NRS:	St1
Open report with input data		NRS:	St1
		Open report results of further work stations and detailed operations	

Fig. 1. A view of the form to enter data to the programme “Determination of parameters of rhythmic production”

Source: Own study.

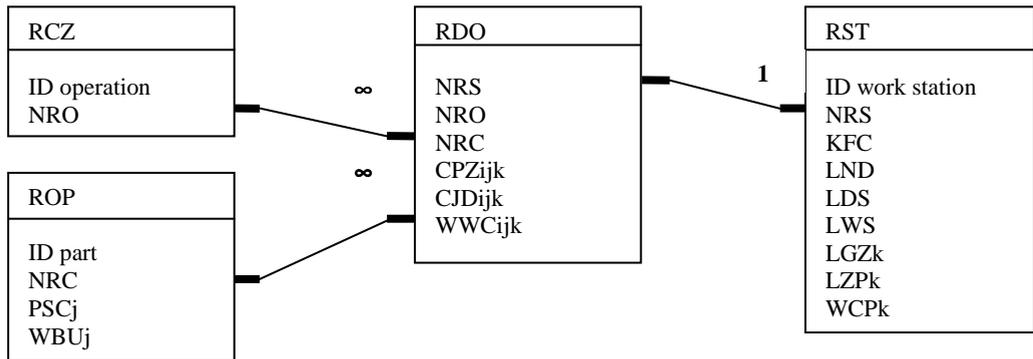
RELATIONSHIPS BETWEEN TABLES IN THE DATABASE

Three relationships were established between tables. All the relationships are of the one-to-many type. Three tables: Type of parts, Type of work stations and Type of operations are the main

tables in these relationships. They are connected with the table Type of detailed operations, which serves in these relationships the function of a subordinate table. Relationships between tables have the following characteristics:

1. Relationship of Type of parts – Type of detailed operations: each part of a specific type from the RCZ table may be comprised in more than one type of detailed operations in the RDO table; each detailed operation of a specific type from the RDO table may be formed by only one type of parts from the RCZ table.
2. Relationship of Type of operations – Type of detailed operations: each operation of a specific type from the ROP table may be included in more than one type detailed operation from the RDO table; each detailed operation of a specific type from the RDO table may be formed by only one type of operations from the ROP table.
3. Relationship of Type of work stations – Type of detailed operation: at each work station of a specific type from the RST table more than one type of detailed operation from the RDO table may be performed; each detailed operation of a specific type from the RDO table may be performed only at one type of work station from the RST table.

Diagram of relationships between tables of relational database are presented in Fig. 2.



ID operacji - ID of operation, ID stanowiska - ID of work station, ID części - ID of parts (ID – identifier)

Fig. 2. Diagram of relationships between tables in the database “Determination of parameters of rhythmic production”

Source: Own study

STRUCTURE OF QUERIES IN DATABASE

In order to establish values of output parameters four search queries were created: Kw1, Kw2, Kw3, Kw4. They incorporate, in accordance with the principles of relational database, fields required for calculations coming from respective tables and calculation formulas. Table 2 lists distribution of values, which are calculated using formed queries. The last but one column of table 2 gives the number of the formula, according to which calculation rules were constructed in individual queries. Formulas were presented when discussing the procedure of determination for parameters of rhythmic production.



Table 2. A list of values calculated using queries Kw1, Kw2, Kw3 in the programme „Determination of parameters of rhythmic production”

Symbol of parameter		Description defining the role of parameter	Formula No	Name of Query
1.	PUC_j	The programme for production setup for j-th type parts for the planned period [pcs/period]	1a	Kw1
2.	EFC_k	Effective available standard hours for k-th type work station [h/period]	3c	
3.	ZGC_{jk}	Hourly task for manufacture of j-th type parts to be performed at k-th type work station [pcs/h]	4a	
4.	MGS_{ijk}	Hourly capacity of k-th type work station to perform ij-th type detailed operation [pcs/h]	6	
5.	WOS_{ijk}	Load index for k-th type work station with ij-th type detailed operation [-]	7a	
6.	LMZ_{ijk}	Number of machines or technologically equivalent devices comprising equipment of k-th type work station, on which ij-th type detailed operation is performed simultaneously in the planned period [pcs]	8	
7.	WOS_k	Aggregate load index of k-th type work station with a group of nm detailed operations [-]	9	Kw2
8.	CPZ_k	Total changeover time for k-th type work station (CPZ_{ijk}) performed while performing group of nm detailed operations [h]	-	
9.	LST_k	Number of k-th type work stations required for performance of nm detailed operations [pcs]	10	Kw3
10.	NOP_k	Minimal repetition period for the group of nm detailed operations performed at k-th type work station [h]	11	
11.	MOP	Maximal repetition period of production unit grouping s work stations [h]	12	Kw4
12.	POP	Maximal repetition period for production unit increased to whole number of hours in a shift [h]	-	

Source: Own study

Query Kw1 includes calculated values, which refer to a specific type of parts, work stations or detailed operations. In query Kw2 aggregate values are determined, referring to work stations of a specific type and all detailed operations performed at these stations. Query Kw3 incorporates parameters characterising a work station of a specific type. In turn, the last query makes possible calculation of parameters characterising the entire production unit covered by planning of organisational parameters in rhythmic production. Figure 3 presents an example screenshot of calculated parameters of rhythmic production provided by query Kw1. The example concerns parameters of the production unit composed of four types of work stations manufacturing production batches of four types of parts. At the third work station production batch of parts C1 is manufactured in the multi-stream system – on two technologically equivalent machines. In turn, Fig. 4 presents a report with results of calculations based on queries Kw2 and Kw3. The repetition period for the entire production unit is $POP = 280 \text{ h} = 35 \text{ shifts}$.

NRS	NRO	NRC	PUC _j	EFck	ZGC _{jk}	MGS _{ijk}	WOS _{ijk}	LMZ _{ijk}
St1	Op1	C1	1100	5700	0,19	4,5	0,04	1
		C2	1320		0,23	3	0,08	
		C3	1650		0,29	2	0,14	
		C4	2200		0,39	1,33	0,29	
St2	Op2	C1	1100	3800	0,29	1,29	0,23	1
		C2	1320		0,35	0,5	0,69	
		C3	1650		0,43	1,13	0,39	
		C4	2200		0,58	1,29	0,45	
St3	Op3	C1	1100	1862	0,59	0,31	1,9	2
		C2	1320		0,71	1,8	0,39	1
		C3	1650		0,89	1,06	0,83	1
		C4	2200		1,18	1,95	0,61	1
St4	Op4	C1	1100	3200	0,34	1,8	0,19	1
		C2	1320		0,41	1,5	0,28	
		C3	1650		0,52	3	0,17	
		C4	2200		0,69	1,11	0,62	

Fig. 3. Results of calculations for parameters of rhythmic production using query Kw1

Source: Own study

Repetition periods NOP				
	CPZ _k	WOS _k	LST _k	NOP
St1	17,0	0,55	1	38,14
St2	14,0	1,76	2	114,82
St3	18,0	3,74	4	274,12
St4	15,0	1,26	2	40,31

Fig. 4. Results of calculations for parameters of rhythmic production based on queries Kw2, Kw3 and Kw4 # repetition periods

Source: Own study.

CONCLUSION

The programme “Determination of parameters of rhythmic production proposed in the form of relational database considerably accelerates calculations during planning of rhythmic production.

The programme is user-friendly. This application may be a useful planning tool in production setup departments of enterprises with lot production e.g. in furniture or machine industry.

The programme may be upgraded to include new calculation segments supporting planning works. Determination of organizational parameters in rhythmic production does not end the planning process in this respect. The most important identified parameter is the repetition period. It establishes the framework, within which planned loads of work stations are distributed. Based on calculated values a model schedule of loads for work stations in a production unit may be constructed using an analytical or graphical method. Calculations performed for this purpose may also be included in the structure of the presented relational database.

REFERENCES

1. Brzeziński M., 2013. Organizacja produkcji w przedsiębiorstwie. Wyd. Difin SA, Warszawa, ISBN 978-83-7641-994-7.
2. Chen H.Ch., Lu M.J., Liu Ch.,Ch., 2012. A Study of the Performance Improvement of Bill of Material Document Sign Flow System. *International Journal of Academic Research in Accounting, Finance and Management Science*. Taiwan, 2, 1, 65-79.
3. Mendrala D., Szeliga M., 2007. Access 2007 PL. Kurs. Wyd. HELION, Gliwice, ISBN 978-83-246-0835-5.
4. Tabert M., 2010. Access 2007. Ćwiczenia z baz danych. Wyd. Uniwersytetu Przyrodniczego w Poznaniu, Poznań, ISBN 978-83-7160-573-4.
5. Tabert M., 2012a. Explosion Bills of Materials of Products in Information of a Production Enterprises. *J. of Agribus. and Rural Dev.* No 4 (26), ISSN 1899-5241, Poznań, s. 115-128.
6. Tabert M., 2012b. Implosions of Materials and Component Structure of Products for the Needs of Production Planning and Control in Enterprises. *INTERCATHEDRA. Scientific Quarterly of the Economics Departments of the European Universities.* No 28/2, ISSN 1640-3622, Poznań, s. 76-83.
7. Wróblewski K.J., 1993. Podstawy sterowania przepływem produkcji. Wydawnictwa Naukowo-Techniczne, Warszawa, ISBN 83-204-1654-X.

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A QUALITATIVE AND DIMENSIONAL CHARACTERISATION OF ROUND WOOD VS SAWMILL COSTS

Abstract: The influence of variable indexes of material prices on costs in an enterprise is a significant element affecting the position of sawmill enterprises in the domestic wood industry. Apart from the price rise factor resulting from the increasing material deficit, the qualitative and dimensional characterisation of processed round wood is also significant. The influence of these factors is particularly important for medium-size enterprises concentrating on gradual technological development in order to maintain competitiveness on the market.

Keywords : round timber , market prices , the cost of works

INTRODUCTION

A vast majority of wood raw material on the Polish market is supplied to wood plants by road. The amount of wood raw material depends on the technological capacity and clients' demand. In order to maintain production continuity and full workload of machinery enterprises chiefly acquire wood from nearby Regional Directorates of State Forests (RDSF). The increasing demand for products combined with limited access to the material causes the need to use the material resources of forests belonging to private owners.

The volume of round wood sawn by domestic elemental processing plants ranges from nearly 1 thousand to 600 thousand m³ per year. On average medium-size enterprises process about 20 thousand m³ per year [Strykowski 2011]. These enterprises are characterised by considerable intensity in introducing processing and technological innovations [Czemko 2003, Ratajczak, Szostak, Bidzińska 2005, Bekas 2008]. Basic products include not only timber but also joinery, flooring materials, pallets, interior and exterior cladding materials, glued products, wooden architecture products, briquettes and pellets [Hruzik 2006]. RDSFs are the main suppliers of round raw material in the chain of wood flow [Lis 2014, Lis, Popyk 2005].

AIM AND ASSUMPTIONS OF STUDY

The aim of the study was to determine the influence of variability of raw material prices on the costs of a medium-size elemental wood processing enterprise under analysis. The assumption was that a model sawmill chiefly sawed softwood. According to the guidelines, the average yearly throughput of about 20 thousand m³ of raw material per year was assumed. The methodological assumptions were verified in the comparative period 2010-2014. The quantitative throughput of softwood was assumed at 96-99%. It resulted from the assumption that most enterprises processed pinewood and it was the type of wood characterised by the predominant percentage of volume. The following values were obtained as the percentage of pinewood volume in the total volume of wood

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processed: in 2010 – more than 93%, in 2011 and 2012 – about 98%, in 2013 – about 92%, in 2014 – 93% of round wood purchased from State Forests (SF).

The wood type structure as well as the qualitative and dimensional structure [assessed according to ‘The Technical Conditions for Large-Size Softwood, PN-92/D-95017, PN-92/D-95008] unquestionably influence the production process. At the same time, it is the main cost generated in the enterprise. The thickness classification of raw material is a significant and the most important element of the cost estimation referring to the purchase capacity. The qualitative classification considerably translates to the value of sawing material acquired and to the possibility of its use in secondary wood processing.

The wood type documentation was based on the purchased material structure. Table 1 shows the percentage of wood types in the material supplied to the sawmill during the period under investigation. The volume of purchased material includes both longer and shorter log wood.

Table 1. The volume of round wood processed between 2010 and 2014 with division into wood types

Type of wood	2010		2011		2012		2013		2014		medium	
	m ³ *	%										
PINE	19141	95,71	16995	84,98	17098	85,49	18476	92,38	18 526	92,63	18 047	90,24
SPRUCE	767	3,84	2598	12,99	2328	11,64	1241	6,21	1032	5,16	1 593	7,97
OAK	21	0,11	78	0,39	184	0,92	95	0,48	390	1,95	154	0,77
BEECH	16	0,08	94	0,47	192	0,96	77	0,39	0	0,00	76	0,38
BIRCH	55	0,28	235	1,18	198	0,99	111	0,56	52	0,26	130	0,65

Note: a volume of about 20,000 m³ per year was assumed for 2010-2014

Source: The author's compilation

RESULTS OF STUDY

The average price of material is a basic component in the overall cost accounting. According to the data provided by State Forests, the average sales price of all wood types and assortments was 154.65 zlotys per m³ in 2010 and 186.68 zlotys per m³ in 2011 (Table 2). According to the average price of wood obtained by forest divisions in 2012, the average sales price of wood was 186.42 zlotys per m³ in 2012 and 171.05 zlotys per m³ in 2013 (Table 2). In 2014 the average sales price was 188.85 zlotys per m³. As can be seen, during the five-year period prices increased by 22.11% [Table 2 based on the data of the Central Statistical Office 2010-2014].

Table 2 shows the percentage of wood types and average prices of wood material based on the quantitative data concerning material in the overall system of cost accounting resulting from the material purchased by the elemental wood processing enterprise (sawmill) with a medium-scale sawing capacity.

The results indicate a significant share of pinewood among softwood. The share dropped in 2011 and 2012, but it gradually increased in 2013 and 2014. This tendency could be observed in spite of the noticeable price rise in 2014.

Table 2. The average price of wood between 2010 and 2014

Type of wood	2010	c	2011	c	2012	c	2013	c	2014	d	medium
	zł/m ³	%	zł/m ³	%	zł/m ³	%	zł/m ³	%	zł/m ³	%	zł/m ³
PINE	215	20,47	259	-6,95	241	-5,39	228	9,21	249	15,81	238,40
SPRUCE	223	18,39	264	-7,20	245	-0,82	243	-4,12	233	4,48	241,60
OAK	391	40,15	548	-25,18	410	9,27	448	0,67	451	15,35	449,60
BEECH	189	32,28	250	-2,00	245	-17,55	202	-9,41	183	-3,17	213,80
BIRCH	159	0,63	160	6,88	171	7,60	184	-2,72	179	12,58	170,60
a	154,65	20,71	186,68	-0,14	186,42	-8,24	171,05	10,41	188,85	22,11	177,53
	M.P.10.78.970		M.P.11.970		M.P.2012.788		M.P.2013.828		M.P.2014.955		
b	156,64	20,19	188,27	-3,01	182,61	-6,51	170,73				174,56

Markings: prices: wood types – Rynek Drzewny 2010-2015 – at the end of December; a – published by Monitor Polski; b – published by Statistical Yearbook; c – price change, previous year = 100%; price change 2010-2014

Source: The author's compilation

In order to determine the wood-type-dependent influence of qualitative and thickness classes of material on the economic indexes of investments the percentages of wood type volumes were compared for the 2010-2014 period under analysis.

As results from the data in Table 3, wood class WC02 was the prevalent assortment (32-36%) in the predominant pinewood material processed from 2010 to 2013 (about 88% of the processed material volume). WC01 was the next assortment class in the qualitative classification of round pinewood (18-22%). It was followed by classes WB02 (13-16%), WC03 (8- 11%) and WB03 (about 4%-5%). The other pinewood assortments did not exceed 4% of the total pinewood material processed in the period under analysis. The material from classes WB02, WC02 and WC01 generates the main purchase cost of round wood.

As results from the data in Table 4, between 2010 and 2014 the spruce wood which was predominantly processed belonged to the assortment of the third quality class – WC02 made 30-39% of the share of round spruce wood. It was followed by class WC01 (24-30%) and class WC03 (10-17%). The use of the fourth quality class of spruce wood was noticeable, where the share of WD2 was 7-10% and the share of WD3 and WD1 amounted to about 3-5% each. The use of other spruce wood assortments belonging to thickness and quality classes WB02 and WB03 did not exceed about 7%. Similarly to pinewood, this proves that the WC0 quality class of spruce wood material generated the greatest costs, whereas the costs generated by the fourth wood quality class WD were minimal.

The quality of material and its thickness class are indexes affecting the level of rational wood processing. Apart from price relations, these indexes are significant to the use of round wood and achievable optimal throughput levels.



Table 3. The share of assortments according to the qualitative and thickness classification of pinewood between 2010 and 2014

Assortment	Participation in individual years					Participation in the costs	
						Net price	Share in the cost of raw material
	2010	2011	2012	2013	2014	2014	2014
	[%]					zł/m ³	[%]
WA1 3	0,0	0,0	0,1	0,0	0,0	600	0,0
WB1 1	0,1	0,1	0,1	0,1	0,1	330	0,1
WB1 2	2,9	1,7	0,8	2,2	2,6	406	3,2
WB1 3	3,5	1,4	0,5	1,0	0,9	486	1,3
WA0 2	3,5	4,2	3,6	3,0	3,5	454	4,8
WA0 3	3,8	3,4	3,0	2,5	2,3	563	3,9
WB0 1	2,1	2,8	2,0	2,3	3,7	294	3,3
WB0 2	13,6	15,3	16,4	15,1	17,2	370	19,3
WB0 3	4,2	4,5	5,5	4,7	5,3	427	6,9
WC0 1	18,2	21,6	21,2	18,7	31,1	264	24,9
WC0 2	35,8	32,2	34,8	36,5	23,5	315	22,5
WC0 3	9,4	8,0	8,4	11,0	7,5	363	8,3
WD 1	0,7	1,0	0,8	0,3	0,6	194	0,4
WD 2	1,7	2,1	2,0	1,2	0,7	214	0,4
WD 3	0,6	0,6	0,7	0,6	0,4	235	0,3
S2B	0,0	1,3	0,3	0,7	0,7	269	0,5

Source: Rynek Drzewny 2014, The author's compilation

Table 4. The percentage of assortments in the qualitative and thickness classification of spruce wood between 2010 and 2014

Assortment	Participation in individual years					Participation in the costs	
						Net price	Share in the cost of raw material
	2010	2014	2014	2013	2014	2014	2014
	[%]					zł/m ³	[%]
WA0 2	0,7	1,4	0,7	0,0	0,0	430	0,0
WA0 3	0,3	2,8	1,6	0,0	0,0	527	0,0
WB0 1	0,6	0,3	0,2	0,0	0,0	325	0,0
WB0 2	1,0	2,9	5,6	0,2	0,1	369	0,1
WB0 3	0,2	1,2	2,3	0,3	0,0	407	0,0
WC0 1	26,9	28,5	30,7	24,3	40,8	264	36,7
WC0 2	35,7	30,5	33,0	39,7	38,2	313	40,7
WC0 3	17,7	11,5	10,4	16,7	14,7	357	17,8
WD 1	3,6	5,5	4,4	4,4	1,3	199	0,9
WD 2	9,1	10,0	7,9	9,2	5,0	223	3,8
WD 3	4,3	5,5	3,4	5,2	0,0	263	0,0

Source: Rynek Drzewny 2014, The author's compilation

Table 5. The percentages of assortment volumes in the qualitative and thickness classification in the total throughput between 2010 and 2014

Assortment	Percentage of raw material in different years				
	2010	2011	2012	2013	2014
	%				
WA1 3	0,0	0,0	0,0	0,0	0,0
WB1 1	0,1	0,1	0,0	0,1	0,1
WB1 2	2,7	1,5	0,8	2,1	2,5
WB1 3	3,3	1,2	0,6	1,0	0,8
WA0 2	3,3	3,7	3,1	2,8	3,3
WA0 3	3,6	3,3	2,7	2,3	2,2
WB0 1	2,0	2,4	1,7	2,2	3,5
WB0 2	12,9	13,4	14,6	13,9	16,2
WB0 3	4,2	4,0	5,0	4,4	5,1
WC0 1	18,7	22,4	21,9	19,0	31,4
WC0 2	35,7	31,8	34,3	36,4	24,4
WC0 3	9,9	8,7	9,0	11,5	8,0
WD 1	0,8	1,6	1,3	0,6	0,7
WD2	2,1	3,3	3,0	1,9	0,9
WD 3	0,8	1,5	1,4	1,2	0,4
S2A	0,0	0,1	0,1	0,0	0,0
S2B	0,0	1,2	0,3	0,7	0,6

Source: The author's compilation

Table 5 compares the results of the analysis of the quantitative structure of wood material assortments sent to overall processing. As results from the data, logs of class WC02 were the predominant assortment (31-36%). It was followed by the assortment classes WC01 (18-22%), WB02 (13-14%) and WC03 (9-11%) as the main groups of round wood material to be sawn.

Table 6. The percentages of assortment volumes in the thickness classification in the total throughput between 2010 and 2014

Thickness class	Percentage of raw material in different years				
	2010	2011	2012	2013	2014
	%				
W1	22	26	25	22	35
W2	57	54	56	57	47
W3	22	19	19	20	17
S	0	1	0	1	1

Source: The author's compilation

As results from Table 6, which shows the percentages of thickness classes, according to the normative classification of PN-D-95000:2002, in the last four years the second thickness class W2 was predominant (middle diameter without bark 25-34 cm) with a share of 53-57% of the total volume sent for sawing in the enterprise. The assortments of thickness classes W1 and W3 fluctuated within a similar percentage range, where class W1 (21-26%) had minimal advantage over class W3 (18-21%). The percentage of medium-size material in the total wood weight was minimal and did not exceed 1.5% of the volume share during the period under analysis. In 2014 there was a noticeable increase of about 10% in the purchase of material of the first thickness class (up to a level of 35%). It is characterised by a lower index of quantitative material efficiency in comparable sawmill throughputs.

SUMMARY

The analysis of variable conditions affecting basic cost factors, i.e. relations between raw material prices and the type of wood processed, revealed that among softwood, which is predominant in the domestic elemental processing, there is a significant role of the material quality. The quality of wood affects the market price of material.

The selection of the quality of large-size wood becomes important when determining the share of raw material processed. The study showed that the third class made about 60% of the pinewood volume and about 80% of the spruce wood volume. This knowledge gives a possibility to determine cost indexes if we assume the predominance of class WC02 (about 24-36% in the pinewood weight and 30-40% in the spruce wood weight) at an average price level of about 240-262 zlotys per m³ (pinewood average price – 249-262 zlotys per m³, spruce wood average price – 233-264 zlotys per m³ in December 2014). The share of assortments from the second quality class WB0 and fourth quality class WD proves variability in the costs of raw materials. The study of the influence of thickness classes on cost variability points to the unquestionable predominance of the second class. This proves the noticeable increasing tendency in the share of material with larger diameters. It is the consequence of increasing the age class of acquirable tree stands. As a result, the processing technology will change significantly and it may have positive influence on the rational use of raw material.

REFERENCES

1. Bekas J. (2008): Linie i sortownie stają się niezbędne. *Gazeta Przemysłu Drzewnego* [5]: 17
2. Czemko B. (2003): Sytuacja i konkurencyjność polskiego przemysłu tartacznego na przełomie lat 2002–2003. *Rynek Drzewny* [4]: 5
3. Hruzik G.J. (2006): Zużycie surowca i materiałów drzewnych w wyrobach przemysłu tartacznego. *Drewno. Prace naukowe. Doniesienia. Komunikaty* [175]: 25–43
4. Krzosek S. (2013): Polskie tartaki. *Przemysł Drzewny*, nr 2/2013, s30-35
5. Lis W. (2014): Strategia sektora leśno-drzewnego w okresie koniunktury i dekonunktury na rynku drzewnym. Ekspertyza. *Narodowy Program Leśny, panel ekspertów „Rozwój”*. Instytut Badawczy Leśnictwa. Sękocin Stary 16-18 września, s. 30
6. Lis W., Popyk W (2005).: Tendencjes in demand and obtaining round timber in Poland. *Zeszyty Naukowe Akademii Rolniczej im H. Kołłątaja w Krakowie*, nr 419. Kraków, 2005. s. 441-448
7. Ratajczak E., Szostak A., Bidzińska G. [2005]: Innowacyjność przemysłu drzewnego i meblarskiego w Polsce. *Drewno. Prace naukowe. Doniesienia. Komunikaty* [173]: 5–33
8. Strykowski W. (2011): Drewno w gospodarce UE i w Polsce. III Europejski Kongres Gospodarczy Katowice, 16 – 18 maja.
9. Szostak A., Ratajczak E., (2008): Technika i technologia w polskim przemyśle tartacznym – wyniki badań empirycznych *Drewno. Prace naukowe. Doniesienia. Komunikaty* [180]: 83-106

10. <http://www.e-handeldrewnem.pl/rynek-drzewny/ceny/polska/ceny-drewna-okraglego/srednie-ceny-drewna-okraglego-na-ryнку-polskim-w-listopadzie-2013r>
11. <http://www.infor.pl/wskazniki/glowny-urząd-statystyczny/178,811,Srednia-cena-sprzedazy-drewna-w-2010-r.html>
12. PN-92/D-95008: Surowiec drzewny. Drewno wielkowymiarowe liściaste. Wspólne wymagania i badania
13. PN-92/D-95017: Surowiec drzewny. Drewno wielkowymiarowe iglaste. Wspólne wymagania i badania
14. Zarządzeniem nr 72/2013 Dyrektora Generalnego LP: Warunki techniczne na drewno wielkowymiarowe iglaste



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GDP GROWTH AS A MEASURE OF GROWTH AND LEVEL OF SOCIO-ECONOMIC DEVELOPMENT

Abstract: National accounts and utilization of GDP by macro-economic decision-making was in the twentieth century one of the greatest inventions. The evolution of the methodology of GDP surrenders economic concepts to political goals. GDP ceases to reliably measure the economy, but rather presents the created image, with better relation of budget deficit and public debt. It provides higher contributions to international organizations which are calculated as a percentage of GDP. Such creative national accounts cannot be the basis for effective economic policy of the country.

How to explain the growth of GDP, with a simultaneous increase in unemployment, increase in rates of poverty, with higher expenditures on social assistance, and higher rate of public and private indebtedness. But such a picture of Polish economy is seen in statistical data for the last six years. This article attempts to explain the lack of any correlation of GDP growth and a lack of decline in the unemployment rate in Poland.

Keywords: national income, gross domestic product, GDP methodology, the SNA 2008, ESA 2010, GDP growth, standard of living, unemployment

GENESIS AND EVOLUTION OF NATIONAL ACCOUNTS METHODOLOGIES

The forerunner of research on national income was William Petty. One of the most versatile contemporary thinkers - a philosopher, an economist, a statistician, a doctor, an artist.

As the main overseer of Cromwell, in his actions guided by the objective to increase the tax revenue of the state with ultimate goal of increasing military spending, he estimated income and expenditure for England and Wales for the years 1660 and 1680. He pointed out that besides the ground - fields and mines, the source of income is work.

When the work will be taxed it will bring income to the state. He wrote that the counting of national income is necessary in the conduct of business and decision-making in politics [E. Lipinski, 1958, pp. 482-493].

Another contribution - recorded by the history of economic thought - to the study of national income is Francois Quesney's economic board created in 1758. This method is a first scheme of circular flow movements in the economy, and allows assess the state of health or disease in the community. It was to be the basis of scientific approach in economics and compass, by which the government should govern, especially during the "terrible crisis". During periods of stagnation in the economy, the advent of which in France is inevitable according to the author [E. Lipinski, 1981].

Emergence of the Great Depression in the thirties of the twentieth century has prompted the US government to take full estimates of national income. The most important role in these works played Simon Kuznets. National accounts have proved to be an interesting field of research for economists and statisticians, and a useful tool for economic policy. John Maynard Keynes, the founder of theoretical foundations of contemporary US economic policy also saw importance of national accounts. The first calculation of national income was presented to the public in the US in 1947. As it was during World War II, national accounts were used to conduct economic policy during the so called "Cold War". It was the tool used in the rivalry between East and West [M. Drozdowicz-Bieć 2012].

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National accounts methodology was permanently changed. At the beginning it was the concept of gross national product (GNP). Next it was the concept of gross domestic product (GDP), which takes into account the impact of international trade, further it was expanded to the calculation of GDP per capita in purchasing power parity. However, these changes were dictated by the needs of the current politics. Replacement of GNP by commonly used today GDP as a measure in national accounts had its roots in necessity to alleviate the deepening of differences in the level of national product between highly developed countries and developing countries. It was done to conceal real causes of these differences, which are: post-colonial expansion of former colonial powers. National product of the country represent the sum of the income of the factors of production owned by the citizens of the country. GDP is the monetary value of the finished goods and services produced in a year in the country. The value of output should be equal to the revenue the factors of production bring when used for its manufacture in the country. And these are the source of income for expenditure in the country.

GDP is then calculated as the sum of consumer spending, investment, government spending, and spending abroad on domestic goods and services, net of imports of the same. The monetary value of final goods and services received from such aggregation of a country in a given year includes not only consumption expenditure incurred from income or savings, but financed with a loan. Similarly, for investment as a component of GDP, does not make a distinction between paid and unpaid expenses. It captures all government spending, and therefore those financed by budget deficit. GDP includes spending on consumption and investment, quite apart from their economic efficiency. Simon Kuznets in the sixties of the twentieth century, warned: in the adopted approach to national accounts people disappeared. We didnt see people as workers, farmers and businessmen. They are treated as consumers ... Faded was the difference between quality and quantity of economic growth, expenditures and profits associated with economic growth, and the growth became the parent category, even if we do not know the increase of what it is about [S. Kuznets 1965].

Keynes' macroeconomic theory of GDP growth became the basis for state intervention. Governments in different countries have begun to see in GDP is not only the basis for macroeconomic decisions, but also a tool to promote their own political successes or failures of economic policy to hide by changing the way the enumeration of its value. National accounts are in the realm of methodology detached from the real size of the macroeconomic environment.

SYSTEM OF NATIONAL ACCOUNTS

Global manual for the System of National Accounts, (SNA) is established internationally by a special committee involving experts from the major international organizations: the United Nations, the European Commission, the OECD, the IMF and the World Bank. Every few years, the SNA methodology is subject to revision. Last update SNA took place in 2008. The European Union uses the methodology of the regional European System of National Accounts (European System of Accounts, ESA). It shall be adjusted to changes in the methodology internationally. Adaptation to revised SNA 2008 Europe acts as ESA 2010. Poland, like all EU countries, have used ESA 2010 national accounts for 2014 years. This time also benefited from the policy of the extended calculations.

SNA 2008 as well as ESA 2010 shows in the GDP components as new items of expenditure items previously considered to be elements of intermediate consumption. The revision is a count as final products indicated in the SNA 2008 products previously recognized as indirect. In order to maintain the triple equality: production = income = expenditure, the SNA 2008 requires recognition in the national accounts of income from illegal activities. Increased by the amounts listed in the

SNA 2008 items of intermediate consumption and income illegal GDP gives a basis for higher contributions to the EU budget, the UN and other international organizations.

Introduced in national accounts methodology new rules for recognition of intermediate consumption, indicate that expenditure in the GDP will no longer be treated as an expense, and so thus will increase GDP. The most significant changes, with the biggest influence on the structure of GDP components, refer to the capitalization of expenditure on research and development and capitalization of expenditure on weapons systems. In both cases, these expenses will cease to be treated as current costs (intermediate consumption) and will be treated as gross fixed capital formation, stored in a formula as an investment. ESA 2010 treated similarly artistic works which are the subject of intellectual property rights, such as film and television productions. On the grounds that movies and TV series are shown repeatedly, even for decades, are exported abroad, they bring income to producers, copyright owners and operators of television.

Inclusion in the national accounts illegal activities around the world raised a lot of emotions and moral concerns in the first decade of the twenty-first century. In Poland, Central Statistical Office (CSO) according to changes in the ESA 2010 estimated the illegal activities associated with prostitution (only the activities of the protection / procurer), drugs and cigarette smuggling. Of course CSO did not carried out any primary research, because it is after all undeclared economy. In relation to the activities of illegal Central Statistical Office can not based on the Statistics Act request reports. To estimate the size of illegal activities were used police statistics on the number of crimes, reports the Ministry of Finance on the work of the customs services, publications of the National Bureau for Drug Prevention, reports of international organizations: TAMPEP (European Network for HIV / STI Prevention and Health Promotion among Migrant Sex Workers) Office of the United Nations. Drugs and Crime - United Nations Office on Drugs and Crime (UNODC), the European Monitoring Centre for Drugs and Drug Addiction - European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). According to the SNA 2008 quality data obtained by specialized centers it is sufficient to make the estimates on that basis. Prevention programs involve the collection of data useful in statistics, where are used for calculating the monitoring indicators (for example, to require police to record prices of drugs). The reports provide data about the scale of illegal phenomena, as well as prices on illicit markets. The analytical work are also important source of information about the organization of illicit activity and nationality of persons involved in illegal activities. A valuable source of knowledge are also press releases and internet services.

The impact of such estimated value of the activity (illegal) on GDP was low. In the years 1995-2013 the share in GDP amounted to 0.48% to 0.79% [Implementation of the European System of National Accounts 2014 Central Statistical Office]. In other countries, new rules for counting also gave about 1% of GDP. In Poland, the results of earlier studies by Central Statistical Office (CSO) of undeclared work show at least a few percentage of its share in income. Research experts in this field show the importance of a greater share of the gray economy in GDP. According to the calculation Friedrich Schenider'a in 2014. Gray economy in the countries of the European Union (EU 28) accounted for 18.6% of GDP. The gray economy in Poland in 2014 accounted for 23.5% of Polish GDP. [F. Schneider 2015].

What is therefore legitimate share of undeclared activities: our work in households, volunteering, cultivation plots and gardens, fishing, revenues from online betting sportsbook, forrex market and others. Does it make sense to estimate the value which is incalculable. Including to national accounts estimates the value of illegal activities, does not increases GDP. It is in fact a social cost burden on the budget, redistributive consequence of socially desirable activities [E. Mączyńska 2013]. Shopping and spending in the gray economy are financed with income from legitimate economic activities. Income from the gray economy is used to finance purchases on the

markets of legitimate economic activities. Prostitution, drug smuggling and trade does not multiply GDP, but they have the impact on its redistribution.

Anything can be a component of GDP. Just identify and name the illegal activity.

This may be regarded as "dirty money laundering" by statisticians. This will not change certainly real size of economic and social realities. But it will bring positive consequences for governing politicians - improving relations of budget deficit and public debt to GDP, which will increase contributions to the EU budget, the UN and other economic organizations.

GDP GROWTH RATE AND UNEMPLOYMENT IN POLAND

In economic theory is known regularity showing the interdependence between economic growth, GDP growth rate and the rate of unemployment. This pattern is demonstrated empirically on the basis of the American economy by Arthur Okun [Okun A. 1962] Okun's Law indicates negative correlation of GDP growth and the unemployment rate [R. Hall, J. Taylor, 2007]. Okun's Law states that for every 2% decline in real GDP relative to potential GDP, the unemployment rate increased by 1 percent. Always when production increases by 2% faster than potential GDP, unemployment rate reduced by 1 percentage point. It shows that changes in unemployment rates can be well predicted on the basis of GDP growth. Followed by interchangeability decline in real GDP and an increase in unemployment. If, for example at the starting point we have GDP at 100% potential level, then down to 90%, the unemployment rate will increase by 1 percentage point, eg. From 6% to 7%. The actual GDP must grow at the same rate as potential output, that there is no increase in unemployment (to reduce them must grow faster).

The relationship between economic growth and unemployment presented by A. Okun has the form of a simple statistical relationship and gives rise to easily predict cyclical fluctuations in unemployment. Continuing research relationship with fluctuations in the unemployment dynamics of economic growth shows the complexity of this relationship, variability over time and variation among the economies [M. Drozdowicz-Bieć 2012]. In selected OECD countries growth rate needed to lower the unemployment is higher in the US economy and is about 3% per year, compared with Britain, France and the Netherlands - there is about 2% [P. Maleszyk, 2014, pp. 31-42]. These countries have different labor market models also differ persistent lowest unemployment rate - the level of unemployment at which there is a balance in the labor market and optimum utilization of labor (in the assumptions Okun's unemployment rate of 4%).

In the US, the condition of the economy is assessed on the basis of the unemployment rate. The main economic indicator is released monthly by the Department of Labor, the unemployment rate and the number of new jobs. In European countries, the economic situation commonly used indicator is the rate of GDP growth. Announced by governments at the end of the year the rate of growth is today the importance of more propaganda than economic. Lack of credibility, measured in GDP affect its quality - trust, peace, aesthetics [E. Mączyńska 2013]. Does GDP measures the standard of living in a situation when the statistics show the growth, while there is growth in unemployment and poverty, and the picture of the Polish economy comes out of statistical data for last six years (Table 1).

In the Polish economy in the years 2005-2008 the relationship between economic growth and unemployment is consistent with Okun's law. In the years 2009 -2013 there is a parallel growth of GDP and rising unemployment. The interpretation of this phenomenon requires a reference to the beforementioned unreliability of rate of GDP growth data and the turmoil in the Polish labor market. Economic growth in the second of the highlighted periods can occur due to increasing government spending, including EU funds. Infrastructure investments, including those relating to the organization of UEFA EURO 2012 football games, the LNG terminal in Swinoujście and many others, were an important component of the Polish GDP in this period. Implementation of many of

these investments has been entrusted by the government to foreign companies. What undoubtedly limited the opportunities for Polish companies subcontractors, suppliers and the creation of new jobs. The registered unemployment rate does not decrease until 2014.

Table 1. GDP and unemployment recorded in Poland Years

Years	GDP previous year=100%	The unemployment rate at the end of XII	GDP 2005 constant prices	Risk of poverty rate (after social transfers)
2005	103,5	17,6	100	20,5
2006	106,2	14,8	106,2	19,1
2007	107,2	11,2	114,0	17,3
2008	103,9	9,5	118,3	16,9
2009	102,6	12,1	121,7	17,1
2010	103,7	12,4	126,3	17,6
2011	104,8	12,5	132,2	17,7
2012	101,8	13,4	134,6	17,1
2013	101,7	13,4	137,0	17,3
2014	103,4	11,5	141,4	-

Source: <http://stat.gov.pl/obszary-tematyczne/rynek-pracy/bezrobocie-rejestrowane/stopa-bezrobocia-w-latach-1990-2015,4,1.html?pdf>;

http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/1772/1/5/roczne_wskazniki_makroekonomiczne_cz_iii.xls data dostępu 25.05.15r.

This means that in the registers of the unemployed in district labor offices in December 2014 was recorded 11.5% of participants in the Polish labor market. And even if the unemployment rate measured by economic activity of the population was one digit, it is the registered unemployment rate indicates the effectiveness of government policies on the labor market. Needless to say, this high level of unemployment recorded in 2009-2014 remained at an enhanced migration of Poles, according to data (2005-2009 Central Statistical Office half a million people, 60-70 thousand per year between 2011-13) [Information sizes and directions of Polish temporary emigration in the years 2004-2013]. The number of people registered at employment offices at the end of 2014 amounted to 1825.2 thousand. This was 332,7 thousands people less than in December 2013. At this point, we do not know how many people in 2013 left Poland seeking employment abroad.

Rising government spending did not limit unemployment. Many of government spending was not rational. GDP growth with unemployment continuing to be a dozen or so percent was possible thanks to imposition of more working hours and efficiency of work. One can calculate that more than 40% of GDP in the years 2005 to 2014 as restated, achieved at the expense of an extended working time, from the point of view of the individual redeemed by fatigue and stress. This increase did not reduce the risk of poverty, this indicator taking into account of social transfers is constantly, above 17%. There was a further polarization of income.

CONCLUSIONS

The author of this text shows the drawbacks of GDP as a measure of the rate of growth and the level of socio-economic development. However, this measure is used to analyze the economic growth in Poland in the years 2005-2014. Like most authors who write on the GDP, the author indicates imperfection of this measure and states that we do not have a better measure (indicator).

Certainly the rate of growth of GDP as a measure of economic growth is not viewed as universal measure nowadays. Conducting government's economic policy we have to use GDP, as well as inflation and unemployment.

GDP growth as the main tool of economic policy, if it is to be the basis for decisions in the economy it must be free from political influences. The methodology of collecting and processing data must be credible and reliable. Without the reliability of methodological approach GDP will be the basis for erroneous decisions of the government. Given the unreliability of domestic product measurement, the private sector should assess the growth of the economy rather on the basis of rates of return, industrial production and employment than on GDP growth.

To assess the level of human life, we can use the Human Development Index (HDI) where outside national income per capita is taken into account, average life expectancy, level of education and illiteracy among adults. Human Development Report (The Human Development Report) is published every year by the United Nations Development Programme. The document is intended to promote a common understanding of the social development in the world. According to the HDI ranking of Poland is a country at a very high level of development. In the first place in the ranking since many years is Norway, in 2014 Poland ranked 35 position. Such classification can now be verified in the opinion of residents, citizens of different countries drawing on knowledge of the world of direct observations during trips abroad now common and widespread source of knowledge via internet .

REFERENCES

1. Drozdowicz-Bieć M., *Cykle koniunkturalne i wskaźniki koniunktury*, Poltext, Warszawa 2012
2. Hall R., Taylor J., *Makroekonomia*, WN PWN, Warszawa 2007
3. *Informacja o rozmiarach i kierunkach czasowej emigracji z Polski w latach 2004-2013*, <http://stat.gov.pl/obszary-tematyczne/ludnosc/migracje-ludnosci/informacja-o-rozmiarach-i-kierunkach-emigracji-z-polski-w-latach-20042013,2,7.html> (dostęp 21.05.2015)
4. Kuznets S. *Economic Growth and Structure: Selected Essay*. New York: Norton 1965
5. Lipiński E., *Merkantylizm i początki szkoły klasycznej. Wybór pism ekonomicznych XVI i XVII wieku*, Warszawa 1958.
6. Lipiński E. *Historia powszechnej myśli ekonomicznej do roku 1870*, PWN, Warszawa 1981
7. Maleszyk P. *Analiza związków produktu krajowego i bezrobocia wybranych krajów OECD w okresie globalnego kryzysu gospodarczego*, *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego W Katowicach*, tom 166, 2014, [http://www.ue.katowice.pl/uploads/media/3_P.Maleszyk__Analiza_zwiazkow_produkту_krajowego_\(dostęp_21.05.2015\)](http://www.ue.katowice.pl/uploads/media/3_P.Maleszyk__Analiza_zwiazkow_produkту_krajowego_(dostęp_21.05.2015))
8. Mączyńska E., *Błędy pomiaru w gospodarce. Następstwa i przeciwdziałania*, 2013, http://owe.pte.pl/upload/files/ksiazki/03_Maczyńska.pdf (dostęp 21.05.2015)
9. Okun A., Potential GNP: Its Measurement and Significance, American Statistical Association, Proceedings of the Business and Economics Statistics Section 1962, s. 98-104; wznowienie: Cowles Foundation Paper No. 190; <http://cowles.econ.yale.edu/P/cp/p01b/p0190.pdf>
Wdrożenie Europejskiego Systemu Rachunków Narodowych i Regionalnych w Unii Europejskiej (ESA2010) do polskich rachunków narodowych. Zmiany metodologiczne oraz ich wpływ na główne agregaty makroekonomiczne.
http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5526/8/1/1/notatka_informacyjna_esa_2010-29_09_2014_28_09_2014_ostat_1.pdf (dostęp 21.05.2015)
10. Schneider, F., *Size and Development of the Shadow Economy of 31 European and 5 other OECD Countries from 2003 to 2015: Different Developments*, United Nations, 2015, <http://www.econ.jku.at/members/Schneider/files/publications/2015/ShadEcEurope31.pdf>

