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*Ladies and Gentlemen!*

In response to a significant interest in our scientific journal, Members of Editorial Committee decided that starting from 2011 The **INTERCATHEDRA** – a Scientific Bulletin of the Economics Departments of the European Universities, will be published regularly as a Quarterly.

We are pleased to invite you to the second number of *Intercathedra 2011*. This edition which publishes a range of scientific papers from universities resulted from co-operation of Central European academic research centers. Those papers primarily relate to economic issues in the following areas: economy, management and marketing, especially but not exclusively, in the forest and wood products industry as well as other related fields.

International scientific collaboration presented in *Intercathedra 2011* links a number of cities: Poznań, Zvolen, Warszawa, Kraków, Tarnow, Trnava, Žilina, Košice, Zagreb, Brno, Presov, and other Polish and foreign scientific centers.

This edition marked 27/2 includes, inter alia, papers presented at the “Economic Forum 2010”, held in Laski near Kepno (14-16<sup>th</sup> September 2010), which concerned the “*New Challenges in management of supply chains in wood industry enterprises*”. The main contents of the 27<sup>th</sup> edition of *Intercathedra* covers however scientific articles that will be discussed at this year's Economic Forum 2011 in Laski, near Kepno (the conference center of Poznan University of Life Sciences) on 13-15<sup>th</sup> September 2011. This time the topics will refer to “The conditions and development perspectives of wood industry enterprises in the situation of recovering from the economic crisis in Europe and the World”.

Academic conferences known as “Economic Forum” are taking place annually - since the early nineties of the 20th century. According to the tradition, Economic Forum 2011 is organized by the Department of Economics and Wood Industry Management in Poznan University of Life Sciences, in cooperation with:

- IATM - International Association for Technology Management,
- Forest Experimental Station in Siemianice,
- SITLID-Wood Section of the Association of Engineers and Technicians of Forestry and Wood Industry in Warszawa,
- Institute of Wood Technology in Poznań.

Economic Forum 2011 is the 27<sup>th</sup> international scientific meeting of the university staff conducting scientific work in common and related areas of research. This meeting gathers engineers, specialists in particular sectors, as well as young scientists and entrepreneurs. These initiatives are supported by IATM - International Association for Technology Management - an international scientific organization, which brings together universities of Central Europe that are conducting research in the field of economics and management in industry, in particular in the forest and wood industry.

In this *Intercathedra* we also publish articles resulting from the joint research undertaken by scientists from universities in Poznań and Zvolen, implemented within the EU program: “*Survey of Consumer Attitudes Towards Wood Products*”.

*Intercathedra 2011* is issued under the auspices of IATM, whose members have provided materials for the volume, were responsible for its review, and prepared both mentioned scientific conferences. They deserve our deep gratitude.

*Wojciech Lis*



*Josef Drábek, Martina Merková<sup>1</sup>*

## **GROWTH OF ENTERPRISE PERFORMANCE DUE TO INVESTMENT**

**Abstract:** Enterprise which wants for its development use not only own financial resources, must permanently evaluate its economic activity. Therefore, for business evaluation applies certain procedures, methods, indicators, models. However, each investor who provides capital prefers its methodology, which allows him to characterize the performance of the enterprise as well as its reserves, problems. The paper in general presents the approach for the evaluation of business performance using selected traditional and modern methods for evaluating the company performance.

**Key words:** enterprise, measuring indicators of the enterprise performance, investment

### **INTRODUCTION**

Currently, when economists, analysts in banks and investment firms note the beginnings of economic recovery /circa 3 years after the crisis are necessary to continue to identify real possibilities and opportunities of increasing the present performance of businesses. This performance is certainly conditioned to their existing competitiveness particularly in EU markets. The competitiveness of enterprises should be considered as a general condition for business success. One of the main competitive advantage is the maximization of the business performance what leads the companies to increase their efficiency and overall effectiveness. It is necessary to know businesses actual and real performance and know how to exploit effectively the business opportunities that the market environment creates. Everyone, not just a successful enterprise entity often put a fundamental question: "How to achieve the higher efficiency and economic effectiveness of business?" For the qualified and correctly answer is the first necessary to determine what is the current and real business performance, and which appropriate and objective indicators use to measure this performance. The collected information - the values of the indicators are an important factor for decision making about future investment in companies. Appropriately allocated investment is a contribution to the growth of business performance and its competitiveness, which we present in our work.

### **1. ENTERPRISE PERFORMANCE MEASUREMENT OPTIONS**

Between representatives of the theory, consulting firms and businesses conducts nowadays "a lively discussion on the relevance of the application of selected indicators for measuring the businesses performance". Different opinions and views are based on the two facts as follows:

- normal, ordinary so far used performance indicators are related to the past and is highly questionable whether they sufficiently reflect the company's future competitiveness,
- used indicators do not sufficiently reflect the quality of customer relationships.

It can be concluded that the economic experience quite often realizes the financial management based on the accounting profit and common indicators such as profitability or activity ratios. These indicators are presently considered as insufficient, which is also one of the reasons for the significantly poor competitiveness of enterprises. Traditional methods of measuring business performance are based primarily to maximize profits /which is also in line with the objectives of business activity/. To measuring the performance are used absolute and relative indicators (Kislingerová, 1999). However, in recent years can be seen objections to the traditional performance measurement indicators such as profitability. According to experts the biggest concerns include the insensitivity of traditional indicators to risk for owners and investors, as well as the absence of the

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time value of money and the fact that the profit from an accounting perspective takes into account only the value of foreign financial resources (Jakubec et al. 2005).

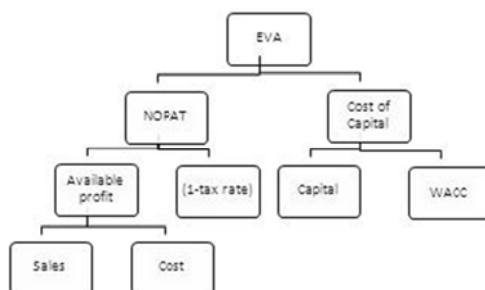
At the end of the 20<sup>th</sup> century was at the first time used the difference between operating profit and cost of invested capital by the company Stern Stewart & Co. The estimated actual value the company called Economic Value Added - EVA and registered it as trademark (Žilka 2004). The modern measuring method of the business performance is the result of the efforts of investors who try to prefer those companies that would guarantee that their investment will have also required evaluation in future. The method is based on economic profit. Economic profit opposite the accounting profit accepts all the costs of capital employed, ie the cost of debt capital and also own capital /equity/. EVA indicator is based on:

- net operating profit minus interest
- total invested capital
- average cost of capital

Indicator EVA combines essentially the most important factors such as efficiency, amount of invested capital and its value. Economic value added respectively true economic profit can be determined as follows:

/ 1 /

where: NOPAT – Net Operating Profit After Tax  
WACC – Weighted Average Cost of Capital  
C – Capital



Picture 1. Structure of the indicator EVA

If the calculated result of the EVA indicator in the company reaches a positive value - the company wealth is growing, respectively it means that the company appreciates the capital at a higher value than is capital cost. On the other hand, if the indicator EVA is negative, it means that the wealth of the company decreases, respectively capital costs are higher than real capital appreciation. Indicator EVA is therefore an absolute indicator and is consequently influenced by the size of the company. Methodological information about possibilities of performance measuring through indicator EVA describes the literature (Jakubec et al. 2005, Pavelkova 2009).

Market Value Added (MVA) is related to economic value added. MVA expresses the difference between the enterprise market value and the amount of invested capital. It determines how the market (until the moment when the firm is evaluated) changed the original shareholders' capital. The result is a wealth of business owners (Meet, 1999). If the calculated values declare that the enterprise market value is greater than the capital invested into the business, it means the created shareholder value and the company's shares are traded with a premium. However, if the business profitability is lower than the cost of capital, it means the company "destroyed" the shareholder value and the shares are traded with a discount. MVA can be expressed as follows:

- $MVA = \text{market value of the company} - \text{capital invested}$

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Assuming that the market and book value of debt are equal, then:



- $MVA = \text{market value of the equity} - \text{book value of the equity}$  / 3 /
- $MVA = \text{present value of all future EVA}$  / 4 /

To evaluate business performance is also suitable by the principle of the time value of money (Net Present Value). Any acquisition of company assets should therefore considered with the rule of net present value. If this rule is respected, acquired asset should bring for the company in the future higher earnings than the cost associated with the investment. This rule is expressed with respect  $NPV > 0$ , where  $NPV = - \text{Investment} + PV$  (Present Value - the present value of future profits) (Kislingerová 1999).

Modern strategic system for measurement of business performance is the Balanced Scorecard /BSC/. The advantage of the BSC is ability to evaluate the reality comprehensively and also individually according to specific indicators. The BSC has to ensure the efficient use of financial resources aimed to long-term recovery of the shareholder's equity. The BSC concept is interested in the key factors which have the impact into the creation of the final value, taking into account factors such as:

- customer view,
- internal company processes, procedures and events,
- perspective of the growth,
- continuous creation of the financial value.

The BSC should give particular emphasis to financial and non-financial indicators as a part of an information system that will be available to employees at all corporate levels. The BSC is used mainly by innovative companies to the realization of critical management processes, namely:

- to identify the business vision and strategy and to implement it into specific objectives,
- the linking and communication of individual strategic business plans,
- the planning, setting targets and harmonizing of strategic incentives,
- to improve strategic feedback and learning processes (Kaplan, Norton, 2002).

Among other indicators (Kislingerová 1999), which make it possible to measure the profitability of the company include:

- return On Net Assets (RONA),
- cash Return On Gross Assets (CROGA),
- cash Flow Return On Investment (CFROI).

## 2. VERIFICATION OF THE EVA INDICATOR IN THE ENTERPRISE

For the calculation of the indicator is necessary to follow a methodological process to calculate the indicator correctly and thus obtain the required meaningful value. The first important calculation is the indicator NOPAT that we get through the profit before tax and before interest.

Tab. 1. Calculation of NOPAT in the enterprise

NOPAT calculation	2009	2008
EBIT (Earnings Before Interest and Taxes)	784	810
t – income tax	19 %	19 %
NOPAT	635.04	656

After calculating NOPAT follows WACC calculation - the average cost of capital, ie the weighted average cost of the capital that is determined by the following formula:

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where:  $r_d$  – cost rate of debt,  
t – income tax rate,  
D – Debt capital,  
C – Capital ( $C=E+D$ ),  
 $r_e$  – cost rate of equity,  
E – Equity.



In calculating the WACC should be observed the following:  
 $r_d$  - the cost of debt capital means interest rate that can be determined as a weighted average of the concluded loan and debt agreements,  
 $r_e$  - the cost of equity is determined on the basis of the CAPM (Capital Asset Pricing Model), which is given by:

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where:  $r_f$  – non-risk return,  
 $\beta$  – the systematic market risk ( $\beta$  coefficient),  
 $(r_m - r_f)$  – risk premium.

To determine  $r_e$  is necessary to meet the following:

- 1)  $r_f$  – for the non-risk return is usually used the risk-free interest rate, which is determined from the 10-year government bonds.
- 2)  $\beta$  –  $\beta$  coefficient determination is based on the fact that the debt of the company operates in the value of  $\beta$ .
- 3)  $(r_m - r_f)$  – risk premium is determined as a rating credit of the Slovak Republic by the rating agency (Jakubec et al., 2005).

To calculate the coefficient  $\beta$  should be carried out following sequence of points:

- 1) for calculating the coefficient  $\beta$  takes into account the debt of the company. In the first step the rate is based on the real corporate financing by the debt capital and also by the equity in the previous period (last year).

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- 2) the second step is based on the current period. The determining the value  $\beta_z$  is based on values that are published by the stock exchange and scientific literature.

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Tab. 2. Calculation of the coefficient  $\beta$  in the enterprise

Coefficient $\beta$	2009	2008
Debt capital/Equity (D/E)	0.20257	0.19290
t – income tax	19%	19%
$\beta_n$	0.32432	0.30755
$\beta_z$	0.37534	0.35801

The non-risk interest rate was determined on the base of the 10-year government bonds issued by the National Bank of Slovakia and their value was for the year 2009 at the level of 4% and in the year 2008 at the level of 5,5%.

Tab. 3. Calculation of the Cost of Equity in the enterprise

Cost of Equity	2009	2008
$r_f$ – non-risk interest rate (%)	4	5.5
$\beta$ – systematic market risk (coefficient $\beta$ )	0.375	0.358
Risk premium ( $r_m - r_f$ ) (%)	6.4	6.4
t – income tax (%)	19	19
$r_e$ – cost rate of equity	6.40	7.79

Tab. 4. Calculation of the WACC in the enterprise

WACC calculation	2009	2008
$r_d$ – cost rate of debt (%)	4.4	4.4
$t$ – income tax (%)	19	19
D – Debt capital	1607	1625
C – Capital	7933	8424
$r_e$ – cost rate of equity	6.40	7.79
E – Equity	6326	6799
WACC	5.826	6.9747

Tab. 5. Calculation of EVA in the enterprise

EVA calculation	2009	2008
EBIT (Earnings Before Interest and Taxes)	784	810
$t$ – income tax (%)	19	19
NOPAT	635	656
WACC	5.826	6.975
C	7933	8424
EVA	172.8	68.4

Given that the indicator EVA means an economic profit that is generated after the payment of foreign and own costs, the company generates this value at the level of 172.8 millions EUR. A positive value documents the successful business - the production of high added value. This means that EVA indicator for the enterprise is evolving in a positive direction, ie company has sufficient resources for investment, and thus it is possible to evaluate the advantage of investing - if suitable investment increases the enterprise performance.

Tab. 6. Calculation of NPV in the enterprise

	Period	Income	Discounting for rate $i = 0.05826$	Discounted
	1	51.52	0.945	48.686
	2	53.44	0.893	47.722
	3	61.19	0.844	51.644
	4	63.14	0.797	50.322
Present Value of Cash Flow (mill. EUR)	198.374			
Invested Capital (mill. EUR)	124.656			
Net Present Value (mill. EUR)	73.718			

To assess whether the considerable investment project is acceptable or unacceptable, we decided to evaluate the investment project by NPV method. Calculating of the Present Value of Cash Flow was based on the fact that it is possible for the discount rate to appoint the weighted average cost of capital (WACC), which was calculated with the method of EVA. The calculations were based on the year 2009. In 2009 the company capital investment incurred in the amount of 124.656 millions EUR and the value of the WACC was 5.826, lifetime of investment was 4 years.

The calculation of NPV declares that the project contributes to the growth of business performance, ie invested capital for the company ensures to fulfill the objectives in the expansion of production capacity and the required appreciation, as well as this investment project increases the market value of the company.

## CONCLUSION

The analysis of the company through the traditional performance indicators found that the company showed almost all the traditional performance indicators positive values moving around the optimal values, which declares table 7.



Tab. 7. Evaluation of the enterprise by traditional indicators

The return indicators	2009	2008
ROA (Return On Assets)	9.88%	9.59%
ROE (Return On Equity)	9.83%	9.41%
ROCE (Return On Capital Employed)	10.53%	10.13%
ROS (Return On Sales)	22.54%	20.44%
RC (Return On Cost)	30.95%	26.62%
The debt ratios	2009	2008
Total debt	20.26%	19.29%
Self-financing	25.40%	23.90%
The liquidity ratios	2009	2008
Current liquidity	1.33	1.66
Immediate liquidity	0.66	0.68
Net working capital	475.00	590.00
The activity indicators	2009	2008
Liabilities turnover period	210.78	161.32
Liabilities turnover	1.71	2.23

Indicators of profitability for the company reported increasing in 2009 compared to 2008, which means the positive direction of the company. Important is the return on sales, which is relatively high at the level of 22.5% although the minimum required rate of return on sales is over 2%. Consequently have been evaluated debt ratios by the company and the results were also positive, because the total debt ratio of the company is only around 20%. Results for liquidity ratios in the company informed of the fact that in 2009 the value of current liquidity was at an optimal level and in a positive trend, as in the previous year 2008 the given indicator did not reach optimal value required by the enterprise.

After calculating the EVA indicator for the enterprise was found that the observed enterprise achieves high economic value added, which has a positive trend. In 2008 the company achieved EVA at 68.4 million EUR and in 2009 economic added value increased more than twice to the value of 172.8 million EUR.

In calculating the NPV the indicator is highly positive for the company, which means that investment is suitable to realize. The investment generates financial resources for business development and further growth of the business performance. Given the achieved results, the company reported positive values in all indicators and company should try to keep this status as long as possible.

#### REFERENCES:

1. Drábek J., Polách J. 2008: Reálne a finančné investovanie firiem. Zvolen. Technická univerzita vo Zvolene, 271 s. ISBN 978-80-228-1934-3.
2. Fotr J. 1999. Podnikateľský plán a investiční rozhodování. Praha. Grada Publishing. 214 s. ISBN 80-7169-812-1.
3. Jakubec M. a kol. 2005: Riadenie hodnoty podniku. Bratislava Kartprint. 280 s. ISBN 80-88870-48-8.
4. Kaplan S., Norton D. 2002: Balanced scorecard: Strategický systém měření výkonnosti podniku. Praha. Management Press. 267 s. ISBN 80-7261-063-5.
5. Kislíngrová E. 1999: Oceňování podniku. Praha C.H.Beck. 304 s. ISBN 80-7179-227-6.
6. Pavelková D., Knápková A. 2009: Výkonnost podniku z pohledu finančního manažera. 2.aktualizované a doplnené vydání. Praha. Linde, 333s.ISBN 978-80-86131-85-6.
7. Učeň P. 2008: Zvyšování výkonnosti firmy na bázi potenciálu zlepšení. Praha. Grada. 192 s. ISBN 80-24724-72-0.

8. Zalai K. 2002: Finančno-ekonomická analýza podniku. Bratislava Sprint. 305 s., ISBN 80-88848-94-6.
9. Žilka M. 2004: EVA vyjadruje schopnosť firmy tvoriť novú hodnotu. In *eTREND* [online]. Bratislava: Trend Holding. ISSN 1335-0684. [cit. 10.12.2010] <http://podnikanie.etrend.sk/podnikanie-riadenie/eva-vyjadruje-schopnost-firmy-tvorit-novu-hodnotu.html>.

**Magdalena Herbec<sup>2</sup>**

## THE WOOD SECTOR IN POLAND – RECOVERING FROM ECONOMIC CRISIS

**Abstract:** The aim of this paper is to evaluate condition of the wood sector in Poland and lines of changes occurring within it on its way to recovery from crisis. The situation which occurred in 2007 on the mortgage credit market in the United States had a bearing on almost every sector of the global economy. As a result, the year 2008 witnessed a decrease in activity in the global economy which was reflected by lower growth rate of GDP and lower growth rate of exports and imports dynamics. The situation of the wood sector in Poland was evaluated based on dynamics of sold production and foreign trade in main wood products, and profitability indices and financial liquidity indicators characterising companies of this sector.

**Keywords:** economic crisis, GDP, foreign trade, condition of the wood sector, wood products

### ECONOMIC SITUATION IN THE WORLD

In recent years the global economy has been under the influence of the economic crisis whose strongest impact, reflected inter alia by a decrease in macroeconomic indices, was recorded in the period 2008-2010. To a great extent economic situation of particular countries was improved by counter-crisis actions taken by the governments of those countries. The aim of those actions was to minimise consequences of the crisis, stabilise the financial sector and mitigate the fall in consumer expenses [Mroczek 2010]. As a result, in 2010 the global economic growth rate reached a level similar to the pre-crisis level, and in the case of some countries (e.g. Japan, Canada, Germany) it was even greater than that value (Table 1). The prognostic data of the European Commission shows that in 2011 and 2012 the global economic growth rate will be approximately 4%.

Table 1. GDP dynamics – world, European Union and selected countries 2007-2012

	GDP [yearly rate in %]					
	2007	2008	2009	2010 <sup>a</sup>	2011 <sup>a</sup>	2012 <sup>a</sup>
World	5.4	2.9	-0.6	4.9	4.0	4.1
EU	3.0	0.5	-4.2	1.8	1.8	1.9
Poland	6.8	5.1	1.7	3.8	4.0	3.7
Brazil	6.1	5.1	-0.2	7.5	4.4	4.3
China	14.2	9.6	9.1	10.3	9.3	9.0
Japan	2.4	-1.2	-6.3	3.9	0.5	1.6
Canada	2.2	0.5	-2.5	3.2	3.1	2.7
Germany	2.7	1.0	-4.7	3.6	2.6	1.9
Russia	8.5	5.2	-7.9	4.0	4.5	4.2
United States	1.9	0.0	-2.7	2.9	2.6	2.7

<sup>a</sup> forecast

Source: Author's own study based on: [European Economic ... 2011].

In many countries export was assumed the main factor of economic revival. It was so, for instance, in the United States where a National Export Strategy that assumes stimulation of exports

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growth in order to double its volume by 2015 was approved [Informacja dotycząca rezultatów ... 2010]). China, that also saw the greatest threat to its economy in a drop in exports resulting from weaker foreign demand, introduced the whole range of financial incentives that were to support national exporters. Among other addressees, that aid was targeted at the most labour consuming industries, such as the light industry and the petrochemical industry, and consisted in application of export reliefs. Another important thing for the Chinese economy was reduction of fiscal burdens for small and medium-sized enterprises and making it easier for them to apply for government export credit guarantees [Informacja dotycząca rezultatów ... 2010; www.pb.pl]. On the other hand, countries that could not afford financing of counter-crisis support programmes, compensated for that by higher activity of government administration in the field of exports promotion – mainly on the non-European markets [Informacja dotycząca rezultatów ... 2010]. In some countries the above-mentioned actions resulted in reduction of exports and imports decrease scale already in the second quarter of 2009. As a result, in the following year the exports growth rate was similar to the level of 2007 (Table 2). Moreover, in Central and East European countries exports was the only category that reached the pre-crisis level by the third quarter of 2010. It is forecasted that in the near future dynamics of both exports and imports will fall to approximately 7% annual equivalent rate.

Table 2. Foreign trade dynamics – world, European Union and selected countries 2007-2012

	Exports [yearly rate in %]						Imports [yearly rate in %]					
	2007	2008	2009	2010 <sup>a</sup>	2011 <sup>a</sup>	2012 <sup>a</sup>	2007	2008	2009	2010 <sup>a</sup>	2011 <sup>a</sup>	2012 <sup>a</sup>
World	9.4	3.9	-11.9	12.0	7.5	7.4	6.7	3.3	-11.5	12.2	7.3	7.4
EU	5.5	1.5	-12.4	10.7	7.3	6.5	5.7	1.1	-12.3	9.7	5.6	5.7
Poland	9.1	7.1	-6.8	10.2	7.7	7.6	13.7	8.0	-12.4	10.7	8.5	7.5
Brazil	7.8	3.1	-3.4	13.3	7.6	8.0	14.0	6.5	-12.6	31.8	12.2	10.4
China	36.0	5.9	-11.5	18.0	12.4	11.2	10.3	7.1	1.4	19.4	12.3	12.0
Japan	8.4	1.6	-23.9	24.2	1.0	3.8	1.6	0.4	-15.3	9.3	4.5	3.7
Canada	1.2	-4.6	-14.2	6.5	7.3	7.4	5.9	1.2	-13.9	11.0	8.0	8.0
Germany	7.6	2.5	-14.3	14.1	7.6	6.5	5.0	3.3	-9.4	12.6	7.5	7.2
Russia	6.3	0.6	-4.7	12.1	7.7	4.5	26.2	14.8	-30.4	11.7	7.7	7.0
United States	9.3	6.0	-9.5	11.9	7.8	9.3	2.7	-2.6	-13.8	12.7	6.7	9.3

<sup>a</sup> forecast

Source: Author's own study based on: [European Economic ... 2011].

## ECONOMIC SITUATION AND CONDITION OF THE WOOD SECTOR IN POLAND

Since the global economic and financial crisis, the most difficult period for the Polish economy was the turn of 2008 and 2009. In that period, due to a decrease in foreign demand, the level of economic activity of Polish companies fell significantly [Koniunktura gospodarcza...2011]. At the same time the uncertain situation of the global economy resulted in withdrawal of foreign investors from the capital market in Poland, which contributed to weakening of the demand for national currency. That phenomenon was important for competitive position of Polish companies on the international market, and as a result had a bearing on slowing down the decrease in exports dynamics. That positive change in trade balance strongly influenced the economic growth rate which was 3.8% in 2010. According to forecasts in the near future GDP growth rate should remain at a similar level.

The wood sector in Poland, permanently influenced by foreign demand, construction industry development, and foreign capital, is one of the industries that are most exposed to negative effects of the situation on the global market. It concerns particularly the furniture industry and the wood-based panel industry [Szostak, Ratajczak, Bidzińska, Pikul-Biniak, Lorenc-Michalska 2009]. Therefore, the greatest fall in sold production of the wood sector industries was recorded in 2008 in the furniture industry and the wood industry (in both cases the fall was around 7% in relation to the previous year) – Table 3. On the other hand, the pulp industry proved to have been less susceptible to economic conditions. It may be assumed that a net gap in domestic production observed in this

industry, that is filled with imports, plays an important role in it [Szostak, Ratajczak, Bidzińska, Pikul-Biniak, Lorenc-Michalska 2009]. Hence in 2008 sold production of paper and paper products, despite general decrease in economic activity in Poland, increased by more than 10%. Moreover, it should be noticed that in recent years sold production in the pulp industry has been rising continuously. As a result, in 2010 this index approximated the volume characteristic of sold production of the furniture industry, which hitherto had been the most important in the industry structure of discussed sector.

Table 3. Sold production of the wood sector\* in Poland 2007-2010

Detailed list	Unit	Sold production			
		2007 <sup>a</sup>	2008 <sup>b</sup>	2009 <sup>b</sup>	2010 <sup>b</sup>
Wood sector	M PLN	66098.7	64459.3	65388.6	69790.8
	%, the previous year =100%	112.8	97.5	101.4	106.7
Manufacture of products of wood, cork, straw and plaiting materials **	M PLN	22639.5	21034.8	20426.2	22591.6
	%, the previous year =100%	112.7	92.9	97.1	110.6
Manufacture of paper and paper products	M PLN	16959.2	18767.8	19715.0	23590.6
	%, the previous year =100%	108.4	110.7	105.0	119.7
Manufacture of furniture <sup>c</sup>	M PLN	26500.0	24656.7	25247.4	23608.6
	%, the previous year =100%	108.8	93.0	102.4	93.5

\* in business entities employing more than 9 people

\*\* meaning: the wood industry

<sup>a</sup> According to the Polish Classification of Activities 2004.

<sup>b</sup> According to the Polish Classification of Activities 2007.

<sup>c</sup> According to CN (Combined Nomenclature): chapter XX, section 94, items 94.01 and 94.03.

Source: Author's own study based on: [Biuletyn statystyczny 2008]; [Biuletyn statystyczny 2009]; [Biuletyn statystyczny 2010]; [Biuletyn statystyczny 2011] and estimates of the Wood Technology Institute.

Along with economic situation improvement an increase in sold production volume in the wood sector and simultaneously return to the pre-crisis level were recorded in 2010.

The economic crisis and decline in economic conditions in countries that are major trade partners of Poland had a direct bearing on the Polish foreign trade, including the trade in the wood sector [Herbeć 2011].

The greatest decrease in wood product exports dynamics was observed in 2008 and 2009 and it concerned mainly sawn softwood (28% in 2008), sawn hardwood (38% in 2009), wood pulp (33% in 2009), wood-based panels, especially particleboards (33% in 2009), and veneers (29% in 2009) – Table 4. As late as in 2010 the sale of wood products to foreign markets increased. At that time, in most cases, dynamics of exports of those products exceeded the level of 2007. On the other hand, the greatest fall in imports was recorded in 2009, but already in 2010 imports returned to the level of the previous year. Such fast restoration of imports was favoured by factors like an increase in export sector's demand, gradual revival of domestic demand, and strengthening of national currency compared with the previous year [Analiza sytuacji gospodarczej... 2011].

Distinct from industrial manufacture and foreign trade, the economic crisis had no unambiguous bearing on the economic situation of the wood sector companies. However, the change in economic conditions caused fluctuations in profitability rates characterising economic situation of the wood sector. The greatest drop concerning profitability rate of net turnover was recorded in the wood industry in 2008 (Table 5).



Table 4. Dynamics of foreign trade in wood products\* in Poland 2007-2010

Detailed list		Exports [%]				Imports [%]			
		2007	2008	2009	2010	2007	2008	2009	2010
Sawnwood	softwood	108.0	72.0	95.0	132.0	179.0	129.0	78.0	101.0
	hardwood	89.0	95.0	62.0	117.0	122.0	94.0	59.0	113.0
Wood-based panels	veneers	109.0	97.0	71.0	104.0	128.0	99.0	84.0	99.0
	plywood	108.0	90.0	87.0	113.0	139.0	97.0	76.0	118.0
	particleboards	92.0	99.0	67.0	88.0	100.0	114.0	85.0	102.0
	fibreboards	119.0	102.0	94.0	103.0	124.0	107.0	68.0	91.0
Pulp		59.0	183.0	67.0	96.0	120.0	129.0	101.0	105.0
Paper and paperboard		106.0	96.0	106.0	113.0	110.0	100.0	95.0	107.0
Furniture <sup>a</sup>		122.0	112.0	80.0	119.0 <sup>b</sup>	135.0	129.0	72.0	95.0 <sup>b</sup>

Note: Calculations are based on quantitative data, and in the case of furniture on value data expressed in USD.

\* According to CN (Combined Nomenclature).

<sup>a</sup> According to CN: chapter XX, section 94, items 94.01 and 94.03.

<sup>b</sup> Dynamics calculated based on H1.

Source: Author's own study based on data from: [www.fao.org] and Industry Department of GUS and estimates of the Wood Technology Institute.

Table 5. Economic situation of the wood sector companies in Poland 2007-2010

Detailed list	Profitability rate of net turnover <sup>a</sup> [%]				Profitability rate of sale <sup>b</sup> [%]				Index of cost level <sup>c</sup> [%]			
	2007*	2008**	2009**	2010**	2007*	2008**	2009**	2010**	2007*	2008**	2009**	2010**
Manufacture of products of wood, cork, straw and plaiting materials***	7.2	1.1	2.9	1.9	8.3	4.3	5.6	4.0	91.7	98.3	96.6	97.3
Manufacture of paper and paper products	7.7	5.2	8.2	6.3	8.5	7.5	9.5	7.1	91.2	93.7	90.8	92.7
Manufacture of furniture	3.6	1.2	5.2	5.1	4.6	2.8	7.5	6.3	95.8	98.2	93.8	93.9

<sup>a</sup> The relation of net financial result to revenues from total activity.

<sup>b</sup> The relation of financial result on sale of products, goods and materials to net revenues from sale of products, goods and materials.

<sup>c</sup> The relation of cost of revenues from total activity to revenues from total activity.

\* According to the Polish Classification of Activities 2004.

\*\* According to the Polish Classification of Activities 2007.

\*\*\* meaning: the wood industry

Source: Author's own study based on: [Biuletyn statystyczny 2009]; [Biuletyn statystyczny 2010]; [Biuletyn statystyczny 2011] and estimates of the Wood Technology Institute.

A decrease in this rate by over 6 basis points may suggest relatively lower profitability of revenues from activity of companies operating in this industry. As a result, it has an influence on the level of net financial result obtained by those companies, and in consequence on the level of sale profitability rate that also decreased in 2008 to 4.3% (compared with 8.3% in 2007). The impact of the economic crisis on economic situation of the wood industry companies also was reflected by fluctuations in the cost level index. Its increase by over 6 basis points in 2008 indicates a relative increase in cost share in companies' revenues. Until 2010 the wood industry companies did not manage to come back to the pre-crisis profitability level.

A fall in profitability rate of net turnover also was recorded in the furniture making (from 3.6% in 2007 to 1.2% in 2008). However, it was not a long-lasting change, for already in the following year that rate reached a level of over 5%. A similar situation concerned the sale profitability rate that after a drop in 2008, exceeded the pre-crisis value in the following years. This suggests relatively higher profitability of the sale of products compared with 2007. The relatively well economic condition of the furniture industry companies also is confirmed by the cost level index that has been decreasing in recent years. In comparison with other wood sector industries, the pulp



industry is characterised by the highest values of discussed profitability rates and the most favourable value of the cost level index. The reason for that may be the above-mentioned less dependence on exports, and thus less susceptibility of this industry to fluctuations in the economic conditions.

To assess the economic situation of the wood sector companies it is necessary to look at the financial liquidity indicators, i.e. at the relation of short-term investments to short-term liabilities. In order to ensure proper operation of a company, the first degree financial liquidity indicator should oscillate between 20-25% or, according to other sources, 10-20% [www.muratorplus.pl]. The greatest fluctuations in that indicator were observed in the pulp industry (Fig. 1). In this case a fall in the liquidity indicator from 41.9% in 2009 to 16.7% in 2010 may indirectly reflect total phenomena occurring in that industry in recent years, including among other things an increase in sold production dynamics and greater decrease in exports dynamics than in imports dynamics. Despite such a big change, the level of current liquidity ratio in the pulp industry indicates that companies operating within this industry are able to pay their short-term liabilities.

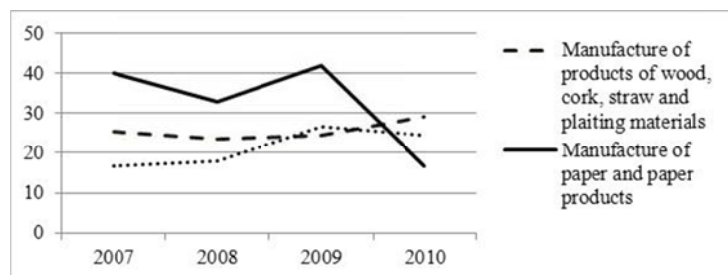


Fig. 1. The first degree financial liquidity indicator in wood sector companies in Poland 2007-2010

Source: author's own study based on: *Biuletyn statystyczny 2009, 2010, 2011 and estimates of the Wood Technology Institute.*

## CONCLUSIONS

Currently we see revival of economic activity in the world. To a great extent it is so because of counter-crisis measures taken by the countries. However, the number of factors that have to be taken into account to evaluate effectiveness of those measures, such as their time-span (usually a few years) and this year's events in Japan, Greece and North African countries, call for carefulness about forecasting future lines of changes in the economy.

The phenomena observed in the world also had their bearing on the Polish economy. The global revival of economic activity in 2010 was a factor that especially speeded up restoration of economic growth rate in Poland. Due to the fact that the wood sector is still under permanent influence of the economic branches that suffered the most from the crisis, i.e. the finance and construction sectors, the economic condition of the wood sector companies is worse compared to their condition three years ago. The above discussion shows that the economic and financial crisis had the worst bearing on the wood sector companies that until today have not reached the profitability level of 2007, despite an increase in foreign trade dynamics. The negative consequences of the crisis also were observed in the furniture industry. However, current value of chosen indices characterising economic situation of the furniture industry companies suggests an improvement of the situation on the furniture market. It was a favourable phenomena that in the analysed period the furniture industry was characterised by the greatest increase in profitability rate of net turnover and profitability rate of net sale. On the other hand, the pulp industry recorded the smallest fluctuations in discussed economic indices, and that fact allow us think that the pulp industry companies suffered less from the effects of the economic crisis.

Despite still ambiguous economic situation in the world, the line of changes occurring in the Polish economy may be considered quite positive. It is mainly due to the increased economic activity in Europe, and especially in the main trade partner of Poland, i.e. Germany. At the same time, this may contribute to the improvement of the wood sector's situation in the near future.

#### LITERATURE

1. Analiza sytuacji gospodarczej w krajach Europy Środkowej i Wschodniej [2011], NBP, Institute of Economics, Bureau of World Economy and European Economic Integration, Warszawa.
2. Biuletyn statystyczny [2008], nr 11, GUS, Warszawa.
3. Biuletyn statystyczny [2009], nr 12, GUS, Warszawa.
4. Biuletyn statystyczny [2010], nr 12, GUS, Warszawa.
5. Biuletyn statystyczny [2011], nr 5, GUS, Warszawa.
6. European Economic Forecast. Spring 2011, European Economy no. 1, European Commission.
7. Herbec M. [2011]: Foreign trade in wood products in Poland after crisis compared to global trends on the wood products market, Marketing and trade, Zvolen
8. Informacja dotycząca rezultatów działań anty kryzysowych podejmowanych w wybranych państwach świata oraz ich wpływu na dynamikę sektorów gospodarki i perspektywy współpracy z Polską [2010], Ministry of Economy, Warszawa.
9. Koniunktura gospodarcza w wybranych krajach w okresie kryzysu finansowego, Departament Analiz i Prognoz [2011], Ministry of Economy, Warszawa.
10. Mroczek W. [2010], Handel Unii Europejskiej w 2009 roku, European communities, no. 3 (202).
11. Szostak A., Ratajczak E., Bidzińska G., Pikul-Biniak J., Lorenc-Michalska M. [2009]: Analiza funkcjonowania polskiego sektora leśno drzewnego w warunkach integracji z Unią Europejską w latach 2004-2008, Wood Technology Institute, Poznań.
12. [www.fao.org/corp/statistics/en/](http://www.fao.org/corp/statistics/en/).
13. [www.pb.pl/Default2.aspx?ArticleID=98072a85-5618-42b5-9889-3956e2df87e9](http://www.pb.pl/Default2.aspx?ArticleID=98072a85-5618-42b5-9889-3956e2df87e9).
14. [www.muratorplus.pl/biznes/raporty-i-prognozy/rentownosc-w-gospodarce-i-jej-gownych-dzialach-raport-i-porocze-2007\\_61576.html](http://www.muratorplus.pl/biznes/raporty-i-prognozy/rentownosc-w-gospodarce-i-jej-gownych-dzialach-raport-i-porocze-2007_61576.html).
15. [www.opracowania.info/readarticle.php?article\\_id=3375](http://www.opracowania.info/readarticle.php?article_id=3375).

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#### METHODOLOGY OF MOTIVATORS ANALYSIS IN ENTERPRISES WITHIN PROCESS RESTRUCTURALIZATION

**Abstract:** Employees' motivation is a topic number one in the most companies today. There are never enough employees who achieve excellent job performance so we have to motivate all of them properly. Motivation plays one of the most important roles in a system of company human resources management. Team work and suitable motivation is the key element of success. The most important task of human resources management is to ensure so-called positive employees behaviour or moral. We are talking about behaviour of employees the result of which leads towards plant strategy execution and effective achievement of its goals and aims. To reach such effective employees behaviour is based on their systematic or methodical motivation and motivational processes resulting from it. Different motivational factors influence motivation of employees. The area of employees' motivation is often downgraded in many companies and is perceived only as

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something that is generally true but not necessary in practice. Also its internal nature and meanness on one side and its effective generality on the other side is not respected. But employee motivation is one of the most important tasks how to manage employee behaviour or moral. In this paper we suggest methodology how to analyze employee motivation. Through the use of the defined questionnaire and analysis of level of motivation in a particular enterprises and based on cluster analysis we are able to differ groups of employees which are similarly motivated according to their motivation. Then in the future it is possible to work out differentiated motivational or incentives programmes for analysed groups.

**Key words:** Analysis of motivation, employee motivation, motivational factors, real aspect of motivation, cluster analysis.

## 1 INTRODUCTION

One of the most important tasks of human resources management is to ensure so-called positive employees behaviour or moral. We are talking about behaviour of employees the result of which leads towards plant strategy execution and effective achievement of its goals and aims. To reach such effective employees behaviour is based on their systematic or methodical motivation and motivational processes resulting from it. Different motivational factors influence motivation of employees. The area of employees' motivation is often downgraded in many companies and is perceived only as something that is generally true but not necessary in practice. Also its internal nature and meanness on one side and its effective generality on the other side is not respected. But employee motivation is one of the most important tasks how to manage employee behaviour or moral. It is possible to ensure complex and balanced approach towards human resources and to connect aims in this area with general strategic aims of the company including changes based on its internal and external environment only when the development of human resources is based on job analysis and assessment of all processes and results. Creation of human resources management systems based on its development plans should become an inseparable part of progressive plants management.

## 2 MATERIAL AND METHODS

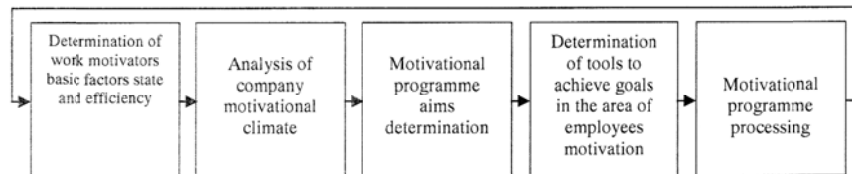
### 2.1 MOTIVATIONAL PROGRAMME OF AN ORGANIZATION

Reviews of employee motivational structure should accept general knowledge concerning the theory of work motivation (theory of needs, predicted attitudes) and should be one of the first sequential steps in creation and definition of organization motivational programme. Together with other methods of psychological and sociological reviews they enable the assessment of initial level in the area of human potential, strengths and weaknesses of management system and its motivational impacts. Without this basic knowledge the process of construction and proposals of arrangements and measures is only the chance one. In literature we can find a lot of methods and processes how to create and define motivational programmes. Most of them are based on activities of a qualified expert, usually psychologist or expert in management methods, especially when it is necessary to interpret results and prepare suggestions concerning corrective measures and further processes.

Motivational programme of the company represents integrated collection of arrangements in the area of human resources management, which in connection with other operative activities of management is aimed at active influence of work behaviour (performance) and creation (or consolidation) of positive attitudes of all plant employees (Blašková 2003). It is concerned reinforcement of employee interests identification with the interests of the company (loyalty towards own company) and formation of employee interest in the development of his/her own abilities, skills and knowledge, their active utilization in working processes. It results from the assumption that the development of creative abilities of plant human potential and its involvement in favour of the company is the best guarantee of successful achievement of its basic goals and

survival in complicated conditions of market environment. Company strategy presents aims definition and statement of tools (measures and procedures) utilized to reach this aim. Realization of the total strategy assumes creation of many derived partial strategies, which specify the aims of company strategy in their own area of activities (e.g. marketing, investment, product development, financial area). Total company strategy defines basic goals and aims from the long term view, such as company development, basic product strategy, range of production, sort of services, obtaining (keeping) a particular market share, ensuring sources for development (capital coverage) etc.

All company activities are executed through people activity. To realize any strategy employees of a particular structure (number, professional and qualification structure) and of a particular quality (abilities, knowledge, skills) are required. They should be willing to provide good performance and it depends on the level of employee motivation and their attitude towards the company. Definition of these needs, finding sources for their satisfaction (attracting employees and forming of their „quality“) makes the content of personnel plant strategy and a programme of motivation should be included in it. Here we offer one of possible procedures of motivational programme creation (picture 1).



Picture 1. General procedure of motivation programmes creation

Source: authors

- Determination of work motivation basic factors state and efficiency and factor of work satisfaction and dissatisfaction (can be solved by means of questionnaires, personal interviews, analysis of signals of work motivation level in behaviour of employees in individual categories and their assessment). In this area most companies requires assistance of experts (qualified psychologists and expert advisers for people management).
- Characteristic of basic motivational company climate, where we follow finding of fact and specify causes if work satisfaction or dissatisfaction and total internal plant climate in the area of human relations and relations toward the company.
- Motivational programme aims determination – determination of the state and level of individual aspects of work motivation and employees attitudes which must be met if we want to achieve company goals.
- Determination of tools to meet goals in the area of employees motivation – they are tools, measures, procedures whose aim is to increase company potential through the development of employees activities and interests. If the programme of motivation is to be efficient, it must cover all basic factors that influence human aspect of company performance. Creation of successful climate in a company and related company culture contain a lot of measures not only in the area of material incentives, such as remuneration and system of other social needs satisfaction but also in the area of qualified selection, assessment, employees allocation, increase of their expert and work abilities by means of management of employees personal development and strengthening of awareness of personal perspectives connected with the company. Suggested measures can be divided into the following areas:
  - a) improvement of employees assessment and selection required for next procedure of professional development and career,
  - b) definition of efficient salary structure, accepting qualities of individuals and employees performance based on objective methods of assessment,

- c) system of social benefits and services for company employees, including free time activities (individualized system of benefits and advantages provision),
  - d) measures in the area of employees development (training and educational activities, development of managing employees social skills),
  - e) measures in the area of improving relations towards the company (company identity, company culture),
  - f) in connection with previous tools - processing of system of employees participation in company results and their participation in the decision making process concerning important tasks of company development.
- Elaboration of programme of motivation as integrated conceptual document, determination of the realization procedure, time schedule and responsibility for its execution.

Realization of motivational programme predicts that all employees will be informed about its results and instructed about the forms and ways of response to the found facts concerning the areas of employees development, basic areas of company personnel work and employees preparation for realization of motivational evaluating interviews with their subordinates. Nowadays motivational interviews become one of the instruments of personnel work in the advanced world countries. They combine the principle of employee assessment (with utilization of the principle of self-assessment) with the motivational influence and perspectives and goals determination of individual development.

## 2.2 COMPANY MOTIVATORS ANALYSIS

The most important assumption of employee performance, their willingness and satisfaction is the fact that employees execute the work that is meaningful, important for the company, interesting for employees, challenging enough and work that provides opportunities for personal development. Furthermore employees have the perspective and particular opportunities for their professional and functional promotion, they are awarded for their work in the way that is equal to the quantity of quality of the work done and their expectations, employees are informed about all company matters that are important for them and last but not least that they work in conditions of suitable company climate and are managed in the way whose characteristic feature is tolerance and respect in relations with individual employees.

Survey of motivational employee structure accepts general knowledge concerning theories of work motivation and together with determination of employees motivational profile makes it possible to find out information about strengths and weaknesses of company management system and its motivational impacts. Without these basic knowledge the proposals of measures would be a chance process and its impacts would miss the aim if they do not respond to employees priorities. Determination of the order of individual motivators is not usually based on objective or unprejudiced decision. It is influenced by a current situation of a person providing responses that depends on his/her psychological frame of mind, company economy and atmosphere, where he/she works. Review of employee motivational structure should be executed after we know and are able to evaluate all facts that really influence company operation, willingness (motivation) to work and employee performance. Sometimes it is important to find out information about:

- technical and organizational work conditions,
- social – demographic and qualification characteristics of company employees,
- information concerning characteristics of work environment, working conditions and social equipment of working places ,
- utilized systems of assessment and remuneration,
- utilization of system of personnel management and company personnel work itself,
- utilization of system of social welfare and employees benefits in the company,

- gathering and analysis of so-called soft data (information concerning characteristics about employee satisfaction or dissatisfaction, his values orientation, aspiration, relation towards work, supervisors, colleagues and the company as a whole).

After analysis and assessment of the above mentioned social-economic information it is possible to define high quality employee motivational programme. Responses to questions in questionnaires provide information of ordinal qualitative marks character. From the methodological point of view it is a standard multidimensional matrix of type objects x monitored marks utilized on condition that some regulations concerning application of multidimensional statistical methods are met. From a large number of clustering techniques it is suitable to choose hierarchical (full-tree) clustering by so-called Ward's method that can measure the level of similarity of responses of individual people in the simplest way – by means of so-called Euclidean distance. This method is used because it enables investigation of a chance to create several types of motivational programmes, it means possibilities of creation of unified motivational programmes for groups of employees with similar motivational profile. The aim is to find out if - based on measurement of similarity of responses of main inquiry - it is possible among employees at different working post to differ groups with similar structure of motivators. Then it would be suitable to develop proposals of motivators for unified motivational programmes aimed at their simplification and higher effectiveness when the motivational programmes are utilized in practice. Apart from that cluster analysis is also used for detailed review of structure and the order of importance of motivational criteria. The whole process is chosen so that it is suitable for qualitative, non-metric values (motivational factors) defined in a unique scale (level of importance 1-5 or 1-9). Now we offer the proposal of individual motivators, we can choose from for questionnaires and that can be updated and added. It is also suitable to provide brief characteristic of motivational factors that can be used in questionnaires.

### **3 RESULTS**

#### **3.1 SUGGESTION OF MOTIVATORS ANALYSIS METHODOLOGY IN PRODUCTION PLANTS**

Based on results of analysed companies and experience we got we are able to provide a suggestion of methodology of motivators analysis in production plants and companies. In our opinion this methodology can be divided into three basic phases.

1st phase – questionnaire creation; during this phase we define a type of questionnaire, number of motivators, evaluative scale and the questionnaire is worked out. it should suit the group it is aimed for. when we try to find out opinions of participators of individual motivators it can also be used for analysis of general information concerning participators. from the psychological point of view participators feel free and their opinions concerning motivators are more objective.

2nd phase – realization of data gathering: here we have to obtain maximum amount of information required for our questionnaire, we do our best to get the answer sheets back. it is recommended to process all the data by means of spreadsheet processors or directly in statistical programme since it will be easier scored.

3rd phase – statistical data evaluation: from the point of view of methodology this is the most important part of analysis. when all data are gathered and processed in a statistical programme it depends on experience of an analyser if he/she is able to interpret the results and determine groups of employees based on their similar motivators. when employees are properly classified then we can summarize their answers and opinions of individual motivators. Here we can use spreadsheet processors again since there we can find initial information from answer sheets. By means of simple summarization we find out the order of importance of individual motivators for each group of employees we identified through cluster analysis. (Klein, Bahýl, Vacek 1997). When we worked out the analysis we can now propose motivators and they are to be included into a motivational company programme.

#### 4 CONCLUSION

Human potential is the most important factor that determines company performance. That is why we pay attention to it. Employees can possess abilities, the best technique but it does not mean that their performance will be high if they are not willing to work hard. And here important phenomena can play its role and it is motivation. It really is motivation that should ensure that employees want to work and provide the best performance, not because they are asked to do so but because they want it themselves. Motivation should guarantee that work does not only ensure subsistence cost of living but brings pleasure and internal satisfaction. We should be aware of the fact that our employees are live human beings; they have their own desires, wishes and personal goals. So each company should at first know them well, transfer them into motivational factors, that will be utilized in daily practice. So in this way motivation will bring benefit for the company – its staff will be satisfied and efficient, since employees own needs will be satisfied at work and at the same time it helps to reach company goals. Motivation should ensure employees identification with their duties and will associate their personal goals with the company ones, they will look forward to going to work and their relation towards the company they work for will be positive. So companies should realize this fact and pay enough time and attention to motivation of their employees.

Proposal and introduction of economically effective motivational programme is one of the key roles and tasks of every company. If the motivational programmes are proposed and applied in a wrong way they influence employees negatively and do not motivate them to provide maximum performance. (Mihok, Dolný, Trebuňa 2004). Nowadays employee motivation in most companies does not cover all needs of employees. Based on our analysis and results we can say that in the companies we have analysed there is a possibility to create motivational programmes for individual categories of employees for individually differed groups in a unique way. At the same time it is necessary to stress the requirement of continuous updating of motivational programmes in dependence on development of employees values orientation that can be changed after some time and possibility of potential individualization of general motivational programme by the means of motivators related to self-realization and personal ambition of individual employees.

Motivational programme is a tool of practical effect on change of behaviour at work with the aim to increase employee performance and the growth of total company effectiveness (*Zámečník, 2000*). Development and realization of motivational programme presents investment of the company to human potential. As for other investments also here the company tries hard to achieve - through the higher satisfaction of its employees and improvement of their attitude towards work - other effects that will be seen directly in company economic results. It is necessary to develop motivational programmes in close connection with company goals and its financial, marketing, personnel and information strategy (Potkány 2004). Since we are aware of existence of different types of people to work out motivational programme based only on questionnaire results would not bring the effect companies wish to get. Application of cluster analysis enables us to define dependency between motivational factors and to define groups of employees with similar structure of motivators. Then it is possible to create motivational programmes for such groups differently due to their needs.

Companies and people working there change. Their values and motives change as well. Companies have to realize that the process of motivational environment creation never ends. That is why it is necessary to analyze the motivational process regularly and dynamically enough but companies do not carry out it now. So then the possibility to cover and correct all changes that appear in the process of motivation is eliminated. Finally we want to stress that it would be very effective to include employees into creation of motivational programmes. This is the area they are directly related to so their opinions and ideas would present great benefit.

**LITERATURE**

1. Blašková M.: Riadenie a rozvoj ľudského potenciálu. Žilinská univerzita, Žilina 2003. ISBN 80-8070-034-6
2. Hitka M., Sedmák R.: Analýza motivačných faktorov zamestnancov vrcholového manažmentu v Doprastave, a. s. Bratislava. Ekonomické rozhľady 3/2002. ISSN 0323-262X.
3. Hitka M.: Zhluková analýza jako nástroj tvorby motivačných programov pre zamestnancov drevospracujúceho priemyslu. MVK „Ekonomika a riadenie v drevospracujúcom priemysle v treťom tisícročí“. Zvolen 2002. ISBN 80-228-1189-0
4. Hitka M.: Tvorba motivačných programov vo výrobných podnikoch s využitím viackriteriálnych štatistických metód. MVK CO-MAT-TECH Trnava. 2002. str. 61-64, ISBN 80-227-1768-1
5. Klein T., Bahýľ V., Vacek V.: Základy pravdepodobnosti a matematickej štatistiky. ES TU Zvolen 1997.
6. Koubek J.: Řízení lidských zdrojů – základy moderní personalistiky. Management Press. Praha 2001
7. Mihok J., Dolný R., Trebuňa P.: Smery vývoja ľudských zdrojov. In: Trendy v systémoch riadenia podnikov. Zborník 7. medzinárodnej vedeckej konferencie. Herľany 9-10.11 2004.
8. Potkány M.: Uplatnenie controllingu vo vnútro podnikovom riadení, personálnom manažmente a manažerstve kvality podnikov DSP. In: Vedecká štúdia 7/2004/B. TU Zvolen 2004, 92 s. ISBN 80-228-1427-X.
9. Zámečník R.: Motivation systems under conditions of Slovak firms. Development trends of processes management in wood processing industry and in forestry. TU Zvolen 2000, str. 245-250.

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**THE POSSIBILITIES OF ECONOMIC EFFICIENCY EVALUATION  
OF THE EQUIPMENT FOR REMOVAL OF CYANOBACTERIA  
FROM STANDING WATERS**

**Abstract:** The paper suggests to worldwide problem of standing waters eutrophication. It describes one of the possible solutions of the problem – design and application of the electrolytic equipment. It indicates effects of its application in practice. The second part of the paper deals with possibilities of economic efficiency evaluation of development and application of the equipment.

**Key words:** cyanobacteria, eutrophication, electrolytic equipment, economic efficiency

The issue of cyanobacteria treatment is actual topic in last years over the world. Increased interest is caused by negative influences which appear in the case of massive over-reproduction, which is closely related to the eutrophication process.

The main reason of eutrophication is high inflow of nutrients to the water reservoir. It causes the disruption of nutrient chain balance and high biomass concentration formed by phytoplankton in affected water layer. This situation has result in production of water bloom, which direct result is overconsumption of oxygen in the bottom part of water reservoir [1]. Large water blooms of

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cyanobacteria causes, that water reach unfavorable vegetation color, decrease of its utility and effluvial features. Besides this the water bloom produces toxic substances – cyanotoxins. These are the reasons why the contaminated water cannot be used for recreational purposes and as drinking water source. Contaminated water could cause death of cattle or wild life animals. It also causes different human diseases – e.g. liver and nervous system defects, immunity depression, activate allergic reactions as cold, lacrimation, oncoides, itching, skin firing and erythema, asthmatic attack, conjunctivitis and unpleasant headaches. In case of more sensitive humans could appear intestinal and stomach problems. Eutrophication is exhibiting the most markedly in standing waters, it means in lakes, ponds, silent bays and water reservoirs. Unfavorable occurrence is especially in reservoirs and streams, which serve as utility or drinking water sources or for recreational purposes.

Eutrophication is important water management problem not only in Slovakia but also in the world. Based on this there is an increasing need of searching for new possibilities of its elimination, deceleration and removal of its effects. Currently unfavorable expansion of plankton algae and cyanobacteria are treated in more ways, but there is still absent generally operating solution of eutrophication.

### THE EQUIPMENT FOR REMOVAL OF CYANOBACTERIA FROM STANDING WATERS

Research team on the Faculty of Mechanical Engineering (Technical University in Kosice) is dealing with the development of new, more effective and financially less demanding way of cyanobacteria elimination. The base of the solution is patented equipment (ÚPV SR č. 282 797/2002) (Fig. 1) which was experimentally used on small water reservoirs.

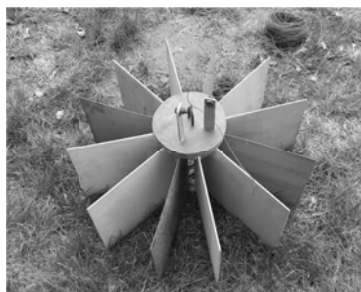


Fig. 1: Electrolytic equipment with star-shape electrodes [2]

One version of the equipment use for reduction of water eutrophication consists of bearing skeleton, bearing rope, electrodes, source of direct electric current and etc. (Fig. 2).

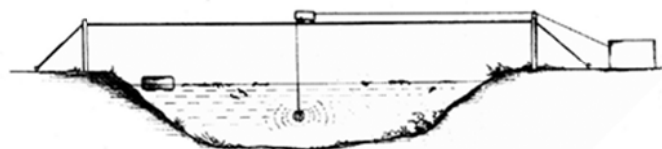


Fig. 2: Stationary equipment for elimination of cyanobacteria in standing waters [6]

The effect of the equipment should be that algae (including cyanobacteria) will be paralyzed and they rise to the water table in thin layer, while macro-life (fishes, etc.) will survive without any problems. Thin layer of paralyzed algae (flotate) will need to be removed mechanically from the water table (e.g. by scumboard) and the rest of it, free of gas fractions, will coagulate on mineral particles and from the bottom will serve as nutrient.



Potentially positive characteristics of proposed solution are:

- relatively easy application,
- low energetic demand (in case of use of solar panels),
- positive influence on water macro-life,
- positive influence on possible use of water by humans,
- potential for automatic operating of the equipment.

Potentially negative characteristic of proposed solution are time demandingness of method and limitations regarding the dimension of water reservoir. The new, currently developing, version should have modified shape of electrodes, changed source of electric current, etc., which should enable its use also for larger water reservoirs.

## **2. APPROACHES TO ECONOMIC EFFICIENCY EVALUATION OF THE EQUIPMENT DEVELOPMENT AND APPLICATION**

The base for evaluation of economic efficiency of any investments is to find out, in what time invested money in project will come back, and what will be their appreciation and what other revenues is possible to expect in future from their realization. The critical criteria are profitability, risk and liquidity. The evaluation procedure depends on if we deal with profit based or so called “non-profit” investment project.

In the case of profit based projects it is possible to explicitly identify revenues (by future revenues from sales) and costs in whole project life. To this group of projects belong investments to the new production equipment, introduction of new products and etc. They are evaluated by techniques of dynamic or static nature.

Investment projects of so called “non-profit” nature are projects, in which the economic gain is hardly identifiable. Typical examples are implementation of new information systems, the change of organizational structure of enterprise, implementation of quality control systems and also development of different equipment or products. In the case of non-profit projects it is also important to evaluate their resulting economic efficiency, but for its determination we need to use other methods as in the case of profit based projects. Usually in non-profit projects are easy to determine capital expenditures, but identification of their receipts (revenue) could be difficult, because direct revenues are usually not generated, or are hardly quantifiable. In these cases is suitable to apply cost-benefit analysis (CBA) or project benefit evaluation method.

*Cost-Benefit Analysis (CBA)* was primarily developed for evaluation of public investment projects e.g. construction of highways, renovation of city light system and etc. Currently this method has application also in business sector. Costs for these projects are relatively easy to identify (research and development costs, costs for procurement of long term assets, costs for external advisory services and etc.) However benefits (from increased quality of production, better information flow, improvement of the environmental parameters) are not directly reflected in economic information and often are hardly identifiable. This could lead in evaluation of economic efficiency of such projects to their rejection.

The core of the Cost-Benefit Analysis is detailed analysis of investment impacts on involved subjects, quantification of these effects and their conversion to uniform numeric unit, the best monetary unit. After the conversion of investment benefit to cash flows follows economic efficiency calculation by selected technique.

The key terms of this method are:

- benefits – any positive effect, which appear in result of project on any observed subject,
- costs - any negative effect, which appear in result of project on any observed subject. The term costs represent not only costs in accounting or financial view, but also different negative impacts on subjects.

The method is possible to divide to the three stages. The first stage is standard preparation phase of the project. In second stage there is the most complicated part of the analysis, where is a

need to convert intangible costs and benefits to the economic values presented by cash flows. There is often personal/subjective evaluation. In the third stage the standard steps applied in profit based project are followed.

*The project benefit evaluation method* is possible to apply in non-profit research and development projects. Its core is in effort to express benefits of the project realization in economic terms. The benefit indicator, which represents the added value, from the project realization, is observed.

To the costs of the project are included direct and also indirect costs related to project realization. Project revenues could show themselves directly or indirectly. As direct revenues from realized project we can consider for example: the ratio on implemented innovation, new technology, new product or new service, increase of work productivity or costs minimization. To the indirect revenues we can assign for example decrease of negative influence on the environment and etc.

## CONCLUSION

Finally we can conclude, that in the theory and practice of financial management exist a several methods, which serve for economic efficiency evaluation of the projects. No method is absolutely suitable for non-profit projects or especially research and development projects. All described methods have its limitations. For the selection of suitable method is so important to look on economic analysis goal and consider specific characteristics of a project.

## LITERATURE

1. Fargašová A.: Eutrofizácia. In: Enviro-edu, človek, príroda, krajina. 2007. [www.enviro-edu.sk/?page=environmentalne\\_problemy/eutrofizac](http://www.enviro-edu.sk/?page=environmentalne_problemy/eutrofizac)
2. Fedorčáková M., Šebo J., Malega P.: Koncept implementácie technológie na znižovanie výskytu siníc. In: Trendy a inovatívne prístupy v podnikových procesoch: 13. medzinárodná vedecká konferencia. Košice 2010: Zborník príspevkov. TU 2010. ISBN 978-80-553-0570-7.
3. Janeková J.: Hodnotenie ekonomickej efektívnosti ziskových a „neziskových“ investičných projektov. In: Trendy a inovatívne prístupy v podnikových procesoch. 13. medzinárodná vedecká konferencia. Košice 2010. Zborník príspevkov. TU, 2010. ISBN 978-80-553-0570-7.
4. Landa M.: Finanční plánování a likvidita. 1. vyd. Brno. Computer Press, a. s., ČR, 2007. 180 s. ISBN 978-80-251-1492-6.
5. Scholleová H: Investiční controlling. Jak hodnotit investiční záměry a řídit podnikové incestice. 1. vyd. Praha. Grada Publishing, a.s., ČR, 2009. 288s. ISBN 978-80-247-2952-7.
6. Šebo D., Stavníkovičová D., Frimer R.: Equipment for disposal of cyanobacteria in standing waters, In: Konferencija održavanja "KOD - 2008" pp. 195-200 (2008).

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*Janusz Janiszkiwicz, Mieczysław Szczawiński, Justyna Biernacka<sup>5</sup>*

## VALUATION OF PINE LOGS INTO FLITCH ELEMENTS PROCESSING

**Abstract:** The valuation of the pine logs into flitch elements processing was made on the basis of the method of calculation established by Szczawiński [Szczawiński, 2005]. This paper serves as an example of a practical implementation of a method of the valuation which was used in the timber factory PPD POLTAREX Sawmill in Nowa Wieś and which is based on the actual figures obtained in a test sawmill process conducted on 16 November 2010. The test results prove the usefulness of the proposed method of valuation. It turns out that the highest profitability rate is achieved by using proper method of woodworking of the lower quality of timber.

**Key words:** value of the timber, sawn timber, test sawing process, profitability.

### 1. INTRODUCTION

Sawmills in the market are between the roundwood suppliers, in Poland usually Lasy Państwowe (National Forests) and buyers, that further process timber. The timber valuation is therefore dependent on the prices of raw material that sawmill pays to roundwood and sawnwood supplier and equally the price that client can pay for the sawnwood.

The system of roundwood sale established by Lasy Państwowe causing price instability (Figure 1). Taking care of customers financial capacity companies are forced not only to make the decision of wood purchasing at prices offered by Lasy Państwowe. They are forced to constantly verify of wood processing profitability and value sawn materials in order to achieve an expected operating margin.

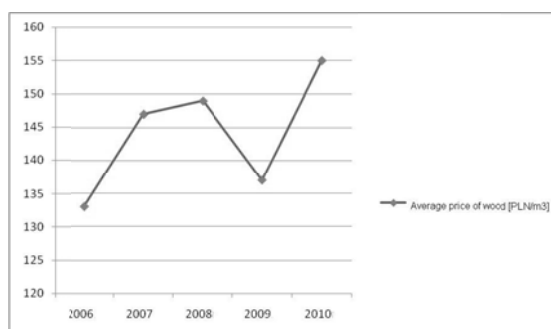


Figure 1. Average prices of wood in selected years [PLN/m<sup>3</sup>] (source: GUS statements)

This paper continues results presentation of work on the issue of raw timber and the wood-derived materials valuation in wood manufacturing process.

The proposed formula can and should find a practical use in the wood manufacturing companies, because managers are familiar with economic data in their companies. And access to company data for external workers/experts limits trade secrecy.

### 2. THE OBJECTIVE

The objective of this paper is to propose a calculation method of raw material value in wood manufacturing industry and its practical verification based on the results of the experimental pine logs sawing. Experimental logs sawing was carried on 16<sup>th</sup> November 2010 in Poltarex Sp. z o.o. sawmill, Nowa Wieś Człuchowska. Therefore, the paper is an example of the valuation method to

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be used in a specific wood sector company, where the necessary figures are usually a company's secret.

### 3. METHODOLOGY

Valuation of round wood in the industrial process is determined by following algebraic formula:

$$W_i = A_i - B_i + C_i,$$

whereas:

- $A_i$  – discounted value of sales revenues of  $1\text{m}^3$  of „i” grade wood-derived materials [PLN/ $\text{m}^3$ ];
- $B_i$  – the unit costs of transportation, sawing and drying of raw material (grated) with the freezing capital costs in the production cycle [PLN/ $\text{m}^3$ ];
- $C_i$  – the unit net income from the sale of waste from raw material manufacturing process [PLN/ $\text{m}^3$ ].

Discounted value of sales revenues of  $1\text{m}^3$  „i” grade round wood can be determined as follows:

$$A_i = \frac{P_i \pm \Delta Z_{pk}}{(1+r)^j (1+m)Q},$$

whereas:

- $Q$  – quantity of raw material sawing [ $\text{m}^3$ ]
- $j \in \langle 1, d \rangle$  - number of the liabilities recovery cycle for the supply of sawn;
- $r$  – discount rate per one day of capital freezing on the basis of two-year Treasury bond rate (4%). Exceeding the maturity of receivables from customers over one month causes statutory interest, but this case was not included in the calculation.
- $P_i$  –total net revenues from sawn products sales [PLN]:

$$P_i = \sum_{k=1}^s T_{ki} C_k,$$

whereas:

- $T_{ki}$  – the raw material quantity from sawing „i” grades logs [ $\text{m}^3$ ];
- $C_k$  – the price of „k” grade product from sawing logs [PLN/ $\text{m}^3$ ]
- $\Delta Z_{pk}$  - the difference in stocks of „k” grade sawing products [PLN];
- $m$  –assumed level of gross profitability from the sale of sawing materials
- $j \in \langle 1, d \rangle$  - number of days of liabilities recovery: assumed  $d = 30$ , because this point exceeding causes statutory interest for late payment.

Unit costs of raw materials transport, sawing and drying, including costs of capital interest in the production cycle

$$B_i = \frac{a_i}{a_{A1}} \left[ k_t + k_p + k_s + 0,5 \sum_{d=1}^{q_1} r_d (k_p + k_s) + \sum_{d=1}^{q_2} r_d \frac{P_i \pm \Delta Z_{pk}}{Q} \right],$$

whereas:

- $a_i$  – efficiency for “i” grade wood materials processing;
- $a_{A1}$  – efficiency indicator of material processing demand for highest grade;
- $k_t$  – the unit raw material transport cost from the forest storage to the company [PLN/ month],
- $k_p$  – unit raw material sawing cost per  $1\text{m}^3$  of logs;
- $k_s$  – unit sawn materials drying cost per  $1\text{m}^3$  logs [PLN/  $\text{m}^3$  logs],
- $d \in \langle 1, q_1, q_2 \rangle$  - number of day of capital allocation ( $q_1$ ) and timber storage ( $q_2$ ).

In the valuation formula the efficiency of raw material with reference to the quality grade is particularly useful in the manufacturing of round wood on high-processed materials according recipient requirements.

Unit net income from sale of waste from raw material manufacturing process (without income taxes):

$$C_i = f(1 - a_i)C_0,$$

whereas the value of the waste from manufacturing process of 1m<sup>3</sup> raw material is counted to the calculated value as a component C<sub>i</sub> after excluding the cost of material preparation for sale and income taxes,

f – the indicator of company share in gross profit;

$$C_0 = U_{tr} \cdot (C_{tr} - k_{0tr}) + U_{zr} \cdot (C_z - k_{0zr}) + U_{kr} (C_{kr} - k_{0kr})$$

unit gross profit from sale of waste from raw material manufacturing process [PLN/m<sup>3</sup>];

U<sub>tr</sub> – share of sawdust;

C<sub>tr</sub> – sawdust sales price [PLN/m<sup>3</sup>];

k<sub>0tr</sub> – unit cost of sawdust preparation for sale [PLN/m<sup>3</sup>];

U<sub>zr</sub> – share of chips

C<sub>zr</sub> – chips sales price [PLN/m<sup>3</sup>];

k<sub>0zr</sub> – unit cost of waste processing into chips [PLN/m<sup>3</sup>];

U<sub>kr</sub> – share of bark

C<sub>kr</sub> – bark sales price [PLN/m<sup>3</sup>];

k<sub>0kr</sub> – unit cost of bark preparation to sale [PLN/m<sup>3</sup>].

#### 4. THE RESULTS

Data used in the calculations was taken from the results of experimental logs sawing carried on 16<sup>th</sup> November 2010 in Poltarex Sp. z o.o. sawmill, Nowa Wieś Czulchowska. The detailed data used in calculations are company's secret and were not shown in this paper. Figure 2 shows a scheme of gang of saws used for the experimental sawing.



Figure 2. Scheme of gang of saws used for experimental sawing

Table 1 summarizes quantities of timber used in experimental sawing and its prices.

Table 1. Quantities of logs, its prices and values of wood material used in experimental sawing

Number	The grade of timber (i)	Quantity of logs [m <sup>3</sup> ]	Share [%]	Price of 1m <sup>3</sup> of wood material	Value of wood material [PLN]
1	WB0 <sub>2</sub>	1,23	1,92	269	331
2	WB0 <sub>3</sub>	2,14	3,34	308	659
3	WC0 <sub>2</sub>	55,16	86,2	233	12852
4	WC0 <sub>3</sub>	5,45	8,52	265	1444
Total:	-	63,98	100	-	Average sale price: 239

Source: Authors' own calculations based on experimental sawing

Table 2 and Figure 3 shows type and quantity of materials from experimental sawing.

Table 2. Type and quantity of wood material from experimental sawing

Type of material and its dimensions [mm]		Quantity [m <sup>3</sup> ]
Main material 31,54m <sup>3</sup> (49,3%)	Unedged sawnwood (27mm)	10,75
	Edged sawnwood (27x 90mm)	20,79
Residual material 8,39m <sup>3</sup> (13,12%)	Unedged sawnwood I and II grade (25mm)	6,10
	Edged sawnwood III grade (25mm)	0,52
	Edged sawnwood I and II grade (25mm)	1,62
	Edged sawnwood III grade (25mm)	0,15
Edgings (17,97%)		11,50
Sawdust (19,5%)		12,47
Bark (0,1%)		4,54

Source: Authors' own calculations based on experimental sawing

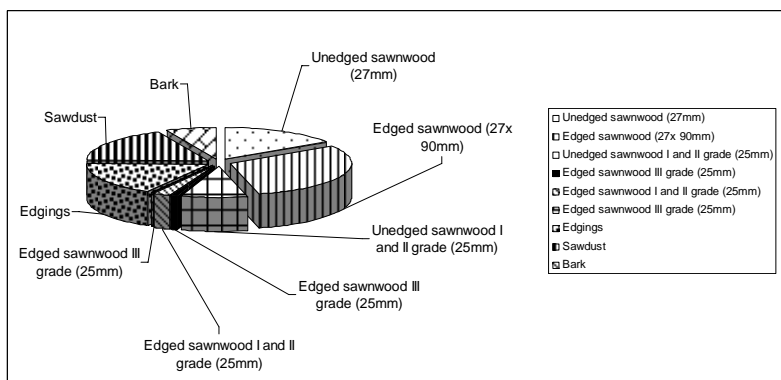


Figure 3. Share of wood materials in experimental sawing

Table 3 shows average sales prices of selected types of sawnwood in November 2010.

Table 3. Average sales prices of sawnwood in November 2010

Type of sawnwood	Average price [PLN/m <sup>3</sup> ]
Edged dry sawnwood (27x90mm)	750
Unedged dry sawnwood (27mm)	620
Unedged dry sawnwood I and II grade ( 25mm)	650
Edged sawnwood III grade (25mm)	350
Edged dry sawnwood I and II grade (25mm)	520
Edged sawnwood III grade (25mm)	220
Sawdust	110
Chips	145
Bark	130

Source: Authors' own calculations based on experimental sawing

This kind of sawing obtained high share of main material, which represents fitch elements: unedged sawnwood (27mm) and edged sawnwood (27x90mm).

The discounted values of sales revenues of sawnwood ( $A_i$ ) and expected level of profitability are shown in Table 4 and Figure 4.

 Table 4. Discounted values of sales revenues of sawnwood ( $A_i$ )

Expected profitability [%]	10	5	2	1	0
Discounted value of sales revenues of sawnwood ( $A_i$ )	393	408	418	422	425

Source: authors' own calculations based on experimental sawing

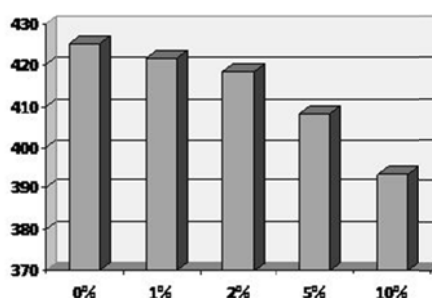


Figure 4. Discounted values of sales revenues of sawnwood in expected level of profitability

Based on data from experimental sawing the final real value of sales revenues were calculated:  
 $P_i = 10,750 * 620 + 20,793 * 750 + 6,101 * 650 + 0,520 * 350 + 1,623 * 520 + 0,150 * 220 = 27284$  PLN.

In order to calculate unit costs of raw materials transport, sawing and drying, including costs of capital interest in the production cycle the value  $\frac{a_1}{\bar{a}_{A_1}}$  were established as 1, because all grades of logs were processed without showing their efficiency and one gang of saws were used. The value of unit costs of raw materials transport, sawing and drying, including costs of capital interest in the production cycle ( $B_i$ ) reached 122 PLN/m<sup>3</sup>.

In table 5 unit costs of preparation for sale and sell prices of 3 types of wood processing waste were shown.

Table 5. Unit cost of preparation for sale and sell prices of selected types of wood processing waste

Type of material	Share [%]	Unit sell price [PLN/m <sup>3</sup> ]	Unit cost of preparation for sale [PLN/m <sup>3</sup> ]
Sawdust	19,50	110	0,50
Chips	17,97	145	2,50
Bark	7,10	130	5,00

Source: Authors' own calculations based on experimental sawing

Values presented in Table 5 were used to calculate the unit gross profit from sale of waste produced in raw material manufacturing process and the unit net income from sale of waste produced in raw material manufacturing process:

$$C_0 = 0,195 * (110 - 0,5) + 0,1797 * (145 - 2,5) + 0,071 * (130 - 5) = 56 \text{ [PLN/m}^3\text{]}$$

$$C_i = 0,81 * (1 - 0,624) * 56 = 17 \text{ [PLN/m}^3\text{]}$$

In table 6 values of roundwood into flitch elements processing and expected levels of profitability were presented.

Table 6. Values of roundwood into flitch elements processing and expected levels of profitability

Level of profitability [%]	0	1	2	5	10
Value of roundwood into flitch elements processing ( $A_i - B_i + C_i$ )	265	261	258	248	233
Average raw material value from experimental sawing: 239 PLN/m <sup>3</sup>					

Source: Authors' own calculations based on experimental sawing

The results analysis of pine logs value calculation shows low profitability of wood processing into the flitch elements – approximately 5%. The wood market price company pays for a raw material with a gross margin of approximately 5% is close to the calculated wood value.

## 5. SUMMARY

The results of calculations of pine logs processing into flitch elements have shown low profitability of wood processing for this type of timber. The compiled values of the raw material



shows that we can expect a profitability level around 5-6%, while raw material will be composed mainly of classes WC0<sub>2</sub> and WC0<sub>3</sub> and with insignificant level of WB0<sub>2</sub> i WB0<sub>3</sub> classes. An increasing share of WB0<sub>2</sub>, WB0<sub>3</sub> and WA0<sub>3</sub> classes leads to a significant reduction of production profitability.

The costs of timber storage and freezing the capital in the production cycle are negligibly small especially for unit production, but the transport and drying costs have a significant impact on production profitability. The main costs having direct impact on profitability are material costs and general company expenses related with processing, material manipulation and inner-company transport.

A lack of a clearly defined level of raw material price brings instability in the planning of a production profitability. Paradoxically, the long-term agreement between client and company causes a risk of unprofitable production than certain fixed income. The long-term agreements may require ongoing contract negotiations with customers, which is unwelcome particularly by foreign contractors.

## 6. CONCLUSIONS

1. The value of pine logs processing into flitch elements is close to its average market price with a gross margin of about 5%;
2. High prices of raw material are the one of main factors related with unsatisfying production profitability. Presence of large number of producers in the market and import cheaper but lower quality timber from Asia limits increase of selling price;
3. The cost of capital freezing in liabilities is important, especially at higher values of production; in the production cycle is insignificant or zero;
4. The goal is to as far as possible reduce prime costs and optimal use of raw material.

## REFERENCES

- Dzbeński W., Laskowski K. [2005]: Effectiveness of further sawmill plant processing (a selected example). *Annals of Warsaw Agricultural University – SGGW. Forestry and Wood Technology*, no 56: 208-213
- Hruzik G. [2001]: Efektywność przerobu drewna w małych i średnich zakładach tartacznych. *Wood and Paper Review*, no 3: 5-7.
- Ratajczak E. [1998]: Rynek drzewny: Analiza struktur przedmiotowych, rozprawa habilitacyjna, Instytut Technologii Drewna, Poznań.
- Szczawiński M. [2008]: Wartość kłód dębowych w przerobie na deszczułki posadzkowe. *Drewno*, no 180: 117-123
- Szczawiński M., Biernacka J. [2010]: Valuation of experimental sawing of low-grade pine logs (WCO). *Intercathedra*, No 26, str. 127-129.

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## TRANSPORT OPTIMALIZATION AS A PART OF THE LOGISTICS CHAINS

**Abstrakt:** The paper indicated an example of solving traffic problems using mathematical tools. At present, logistic processes increasingly affect the overall cost of the enterprise. Part of the logistics processes is transport in the enterprise or transport as a element of the goods distribution.

**Key words:** logistic, organization, management, logistics costs.

### INTRODUCTION

Significant of logistics in last year's is increasing. Today, every company tries to respond swiftly to customer requirements, which practically mean quickly to fulfill their requirements by the manufacturer, respectively supplier. This requirement often means increased costs for the company, which is ultimately undesirable as it reduces the profit. This, at first sight contradictory phenomenon may seem unsolvable. This issue can be resolved, however, with using optimization methods, after which currently goes back more manufacturers. This fact prompted the creation of logistics centers, whose role is primarily to optimize transport costs in compliance with all requirements of customers.

### THE THEORETICAL ASSUMPTIONS

Logistics, as the term is historically encountered primarily in military terminology. The origin of the word logistics is derived from Greek (logistikon), respectively from French (logger). Later the term came into use in other areas of economic life. In literature, the developmental stages of the logistics are divided into three, respectively four stages (8).

Depending on how modifying opinion on what is logistics also changed its definition. As an example, we wrote some of them. Kortschak, B.H (6), defines logistics as follows: "Logistics is the science of the coordination of active and passive components business, in good time costs to improve its flexibility and adaptability to changing market conditions". Kubát (7) writes about the logistics of that: Logistics is a "special-purpose structure" composed of three elements: the material - includes all handling activities in the processes of securing raw materials, their storage and transmission of the end user in terms of implementation of material flow, information system - secures, stores, distributes information and data necessary for the implementation of material flow in the present and look to the future control system - whose task is to plan, manage, control and direct the material flow so as to ensure that the desired objective - the delivery of products and services in place destination on time and the required quality at optimum logistic and economic goals.

Interesting is Jünemanna (4) definition, which logistic defined as follows: "Logistics is all the activities that explore, plan, implement and optimize the logistics processes involved in the operations of transport, handling and storage of materials, people, information and energy. In the logistics process, objects are transformed from the initial to the final state with at least one change of system variables such as time, place, amount and type, and comes to an adverse change in the properties of objects".

From now follows that the main roles of logistics - the overall optimization of material flow in production and circulation. The current understanding of logistics system is not only thinking, but

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it's also a new organization of activities, with emphasis on the integration of processes in terms of their overall optimization.

Analyzing the views of individual authors, the essential characteristics of logistics can be characterized as follows.

Logistics is the subject of transport, handling, storing all types of materials and energy from entering the production process to delivery to the end user, is a logistics plan, organize, manage and control all business activities.

The main task is to optimize the logistics of movement of material in making incremental business activities - processes in all areas, ranging from supply, production and shipping of products, including the optimization of information processes.

From this perspective, logistics is not only systemic thinking, but also a new way of organizing the overall optimization of all business processes.

In the literature Kmec (2008 p.11) „logistics chain is formed by linking the downstream processes of the Council in meeting the final requirements. For more complex products requires not a linear supply chain. There is an after-branching and combining logistics chains to more complicated structures called logistic networks. In logistics networks are linked logistics chains and processes in different entities.” According to (1) transportation of the goods is itself just one of many activities of the logistics chain, which organizes other services - storage, loading, packaging, inspection, distribution, customs clearance, insurance etc. The contribution is focused on transportation as part of the logistics chain. Part of every decision and management is addressing issues affecting the costs associated with the implementation of specific activities. Every company tries to streamline performance and reducing costs associated with implementation of the required performance. In regard to ensuring logistics activities b we are talking about logistics costs.

„Logistics costs are costs incurred in implementing logistics activities. These costs affect the total cost of logistics system”(8).

Stamped (2002) sees the way to reducing logistics costs and release capital through more than reliable transportation. Reliable transportation can be defined as one that fully meets customer requirements, but at the transport company that realizes optimum performance incurring costs.

#### **THE ANALYTICAL PART**

It is obvious that transport is an important element which enters into a relationship the supplier - the customer whether through speed and flexibility or through transport costs, which ultimately affect the price of products.

In our case, we really focused on existing business that provides transport of goods for various customers, which can be divided into two groups. First group of costumers are permanent (regular) and a second group is a group of casual customers – irregular. We focus on customers with regular fixed-transport requirements goods. The aim was to highlight the possibility of optimizing the supply chain, respectively one of its parts - in particular transport service companies. To reach that objective was set following procedure:

- 1) analysis of the transport company,
- 2) evaluation of logistics chain,
- 3) design of optimal shipments of goods,
- 4) design of optimization solutions.

The analysis showed that the main problem is transport disproportionate to use of vehicles. When optimizing the supply chain was taken into account a number of requirements, whether they are customers of the time window, time loading, unloading, quantity, weight, volume and occupancy. The result was the optimal allocation of processing vehicles and runs their optimal utilization. For optimization calculations were used simplex method of linear programming method and the northwest corner. The principle of simplex method consists of iterative procedure for finding optimal solutions to problems of linear programming - LP (if such a solution exists). The



basic point of this algorithm is to find solutions to the basic default LP. If such a solution is available, then the simplex method at each step is always possible to calculate the new basic solution with a better or at least the same value of objective function. After the final calculation of this process leads to the discovery of the basic solution with the best objective function value or a finding that such a solution exists. This is the type of tasks: some arbitrary amounts of divisible goods are loaded HV centers. The chosen unit of time produces the  $i$ -th center and even units of quantity of goods. Goods are transported to the distribution centers, the  $j$ -th center sales calls per time unit under consideration  $b_j$  units of goods.  $C_{ij}$  rate is given by the transport unit quantities from the  $i$ -th center in the  $j$ -th Snack Bar. The task is to find a plan for transporting goods from the center into the sales center; the total transport costs are minimal. (11) Such tasks include the case here.

#### METHOD NORTHWEST CORNER

To compare the results of the method used was the northwest corner. It's approximate method of solving the distribution problem According to (5). "Method for the northwest corner of the auxiliary method and it can be used to construct the initial solution. Traffic routes (box) is filled from top left towards the bottom right corner (first to fill out the form in the first row to the limited capacity of the supplier) "

Fields begin to fill in the upper left corner of the transport table and proceed to the right, and each field occupies the highest possible transport capacity with respect to  $a_i$ ,  $b_j$  and requirements already filled fields every step will occupy one row (column), occasionally two rows. This means that the solution we get in the way described will be filled up fields. In this method does not consider the amount of freight rates, which is the weak point of this method, the performance in the implementation and planning of transport can not be ignored. (Transport costs). In this method, the transport undertaking after the first try loading the goods meet the immediate requirements of the first landing, but in accordance with the capacities of the supplier (what loaded).

In solving challenges of transport was used the following notation:

$n$  – number of loading, where the transport be carried,

$N_1, N_2, \dots, N_n$  – suppliers, loading of goods,

$v$  – capacity landings, where the goods are imported,

$V_1, V_2, \dots, V_v$  – consumers, unloading of goods,

$a_i$  – quantity of products to be imported from the  $i$  supplier,

$b_j$  – quantity of products to be imported to individual consumers,

$c_{ij}$  – transport costs (rates, prices) per unit quantity of products transported from  $i$  supplier to the  $j$ -customer,

$x_{ij}$  – quantity of products to be transported from  $i$  supplier to the  $j$  customer.

This symbolism can be represented as follows.

Tab. 1. The transport problem

Load locations	Locations landings			Suppliers capacity	
	$V_1$	$V_2$	.....	$V_v$	
$N_1$	$c_{11}$	$c_{12}$	.....	$c_{1v}$	$a_1$
$N_2$	$c_{21}$	$c_{22}$	.....	$c_{2v}$	$a_2$
.....	.....	.....	.....	.....	.....
$N_n$	$c_{n1}$	$c_{n2}$	.....	$c_{nv}$	$a_n$
Consumer requirements	$b_1$	$b_2$	.....	$b_j$	

Source: Kočkin Manažérske rozhodovanie

In our particular case we solving split into six sub problems, 6 of transport routes for regular customers. As an example calculation, we only present the calculation of transport costs for a single route. Other routes will be calculated similarly.

The equation has the form:

$$\begin{aligned} x_1 + x_2 + x_3 &= 16 \\ x_4 + x_5 + x_6 &= 16 \\ x_1 + x_4 &= 12 \\ x_2 + x_5 &= 15 \\ x_3 + x_6 &= 5 \end{aligned}$$

Objective function that we minimize has the form:  $f = 1 x_1 + 2 x_2 + 4 x_3 + 2 x_4 + 3 x_5 + 6 x_6$ , The resulting objective function value is output, in our case "tonne-kilometer" - t/km. When multiplied by the monetary unit - the price of 1 kilometer - € 5, we get the final output value.

Tab. 2. Method northwest corner

Load locations	Locations landings						Suppliers capacity - pallets
	V <sub>1</sub>		V <sub>2</sub>		V <sub>3</sub>		
	c <sub>ij</sub> - transport costs	x - quantity	c <sub>ij</sub> - transport costs	x - quantity	c <sub>ij</sub> - transport costs	x - quantity	
N <sub>1</sub>	1	12	2	4	-	16	16
N <sub>2</sub>	2	-	3	11	5	16	16
Consumer requirements - pallets	12		15		5		

Source: prepared by Tórková M. DP

Transport costs:  $12x_1 + 4x_2 + 11x_3 + 6x_5 = 83x_5 = 415$  monetary units (p.j.)

Tab.3. Simplexová metóda

Load Locations	Locations Landings						Suppliers Capacity - Pallets
	V <sub>1</sub>		V <sub>2</sub>		V <sub>3</sub>		
	C <sub>ij</sub> - Transport Costs	X - Quantity	C <sub>ij</sub> - Transport Costs	X - Quantity	C <sub>ij</sub> - Transport Costs	X - Quantity	
N <sub>1</sub>	1	-	2	X <sub>2</sub> 11	4	X <sub>3</sub> 5	16
N <sub>2</sub>	2	X <sub>4</sub> 12	3	X <sub>5</sub> 4	6	-	
Consumer Requirements - Pallets	12		15		5		
	12		15		5		

Source : prepared by Tórková M. DP

Transport costs:  $11x_2 + 5x_4 + 12x_2 + 4x_3 = 78x_5 = 390$  p.j.

Saving transport costs using the simplex method is 25 monetary units. Using optimization methods allow optimizing the itinerary in saving 25 monetary units. In a similar manner to carry out optimization and other regular means of transport routes. Total savings in the conversion of six regular of transport routes (1 for 3 weeks) was 605 monetary units as the equivalent of one year at a saving of approximately 10 000 monetary units, the enterprise can usefully spent in other ways.

## CONCLUSION

The article pointed out that optimization as one of the objectives of logistics management is possible and be justified in practice. It is wrong that a relatively large proportion of small businesses pay little attention to managing their businesses on the principles of logistics management.

## LITERATURE

1. Buková B., Kubasáková I., Dvořáková E.: Zasielateľstvo a logistické činnosti. Iura Edition, Bratislava 2008. 294 s. ISBN 978-80-8078-232-0.

2. Dupaľ A.: Logistická podpora výrobného procesu. Ekonóm, Bratislava 2002. 258 s. ISBN 80-225-1610-4.
3. Kmec J.: Logistika. Fakulta manažmentu Prešovskej univerzity v Prešove 2008. 89 s. ISBN 978-80-8068-754-0.
4. Junemann R.: *Materialfuss und Logistik Systemtechnische Grundlagen mit Praxisbeispielen*. Springer Verlag, Berlín 1989.
5. Kočkin P.: *Manažérske rozhodovanie. Praktikum*. Fakulta manažmentu Prešovskej univerzity. Prešov 2010. 74 s. ISBN 978-80-555-0239-7. 65.
6. Kortschak B.H.: *Was ist Logistik?* Wirtschaftsförderungsinstitut der Handelskammer, Manz, Wien 1991.
7. Kubát J.: K obsahu, úkolům a nástrojům logistiky. Manipulace, skladování, balení, č.4, 1989 s.102-104.
8. Liberko I. 2010. *Základy logistiky*. Prešov : Fakulta manažmentu Prešovskej univerzity. Prešov 2010.
10. Novák J.: *Orientačné úvahy o logistike, Manipulace, skladování, balení, č.7*. 1985 str. 193.
11. Plesník J., Dupačová J., Vlach M.: *Lineárne programovanie*. Alfa, Bratislava 1990. 320 s. ISBN 80-05-00679-9.
12. Šíra E., Huttmanová E.: *Konkurencieschopnosť drevospracujúceho priemyslu meraná cez vybrané indexy*. In: *Konkurencieschopnosť a riadenie rizík malých a stredných podnikov v podmienkach SR. Zborník vedeckých prác z riešenia projektu GAMA/10/2*. Prešov: Prešovská univerzita. Prešov 2011. ISBN 978-80-555-0348-6.
13. Töröková M.: *Diplomová práca FM PU v Prešove* 2011.

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## EVALUATION OF CONSUMER PREFERENCES WHEN PURCHASING WOODEN PRODUCTS

**Abstract.** The results of questionnaire study determining consumer preferences when purchasing wooden products or their substitutes made of materials other than wood were presented. Functional qualities of products were evaluated. Consumer preferences were determined within 5 groups of products: 1) woodwork, floor and mural materials; 2) buildings and construction materials; 3) furniture; 4) paper and packaging; 5) firewood. Wood despite its rather low fire-resistance and poor resistance to weather conditions, however due to significant functional features constitutes a valuable, universal and eagerly used material.

**Key words:** wood, preferences, substitute, consumers.

### INTRODUCTION

Wood is one of the basic raw materials used in numerous sectors of economy, especially in construction of houses and industrial building, in furniture sector and in wood as well as pulp and paper industries. It also constitutes material very often used in households. In recent years wood has become popular as an ecological and efficient source of renewable energy playing an ever larger role in national energy balance. Despite the universality of wooden products in everyday life the range of its usage is being limited. Wood is substituted with other materials which attractiveness stems from features which are hard to obtain in case of wood. Moreover, frequently they are cheaper in specific applications. A dynamic development of technologies of materials other than

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wood, which are widely used in areas where so far wood was mainly used, takes place [Lis 2009, 2011].

Intensive technical and technological development and advanced product innovations change consumer behaviour. Generally they select products made of materials other than wood. In the future the growth in material competitiveness has to be taken into consideration also in those sectors where so far wood was used. Usage of wood substitutes (plastics, concrete, steel, aluminium, gypsum, glass, ceramic products, natural stones etc. in houses and industrial construction, including the production of woodwork, floor and mural materials and even in furniture production will undeniably have a negative impact on the market of wooden products as well as financial results of enterprises of wood and forest sectors. [Goliwaś 2003, 2004].

The future of wood and forest sector will depend on the ability of enterprises to adjust to changeable and gradually changing consumer demands and on active and effective operations popularizing and promoting wood as well as on overcoming the barriers limiting wider usage of wooden and wood-based materials in areas where they have not yet been used.

Financial decision making process in enterprises is based on information coming from the market and its surrounding. The most significant are: demand for specific products their requirements and qualities which combined with adequate price make certain goods attractive for consumers. Appropriateness of offer of wood industry enterprises and their position on consumer market also depends on market trends, fashion and consumer preferences. It is important not only to recognize consumer habits and needs but also to enhance the level of their satisfaction with offered services and goods as well as to amaze them by presented offer.

Theory of consumer choice deals with their preferences, it is a branch of microeconomics which describes recipients' behaviour in various circumstances in which the choice is being made. The study of buyers' preferences generally speaking is concerned with getting to know the whole system of subjective evaluations reflecting the needs and tastes on the basis of which clients make purchasing choices [Mazurek-Łopacińska, Sobocińska 2008].

#### **MATERIAL AND STUDY METHOD**

The aim of statistical survey was getting to know what features of products made of wood are decisive in their advantage over the substitutes made of materials other than wood.

Analysis of consumer preferences when choosing products for their qualities has a significant meaning for economic decisions in enterprises especially those decisions concerning their offer. Analysis of client choices plays a crucial role in case where the prices of products which are selected stay at similar level or are quite varied.

Survey for gathering data was made in a form of a questionnaire where the expected answer for a single choice question was closed.

Questionnaire comprised of questions concerning demographic and behavioural (preferential) data. Respondents provided single answers in accordance with their preferences. Questions concerned preferences of purchasing wooden products and their substitutes made of materials other than wood. Products' functional features constituted selection criteria. Five groups of products were evaluated [Paluś 2011]:

- 1) woodwork, floor and mural materials,
- 2) buildings and construction materials,
- 3) furniture,
- 4) paper and packaging,
- 5) firewood.

Direct form of used questionnaire excluded incomplete and unclear answers, and selected group which was making the evaluation gave a full and clear picture of consumer preferences and requirements concerning preferred features characteristic for certain groups of products.



The survey embracing the whole country was carried out on the population of 114 randomly selected people. Socio-demographic characteristics of population under the study on the basis of answers from the questionnaire was presented in table 1.

Table 1. Socio-demographic profile of the consumer panel

Demographic data		Consumers	
		Quality	[%]
Sex:	female	45	40
	male	69	60
Age (years):	20 – 25	42	37
	26 – 60	64	56
	>60	8	7
Education:	primary	1	1
	secondary	4	3
	higher (undergraduate)	66	58
	higher (postgraduate)	43	38
Monthly net income (PLN):	< 1500	31	27
	1500 – 2500	48	42
	> 2500	35	31

source: own elaboration

Male respondents outnumbered female ones and constituted 60% of all respondents. In the group of consumers under analysis 58% had secondary education and 38% of respondents had higher education.

In study sample 56% of respondents were between 26 and 60 years old and 37% of people were between 20 and 25 years old. Older people, those over 60 constituted only 7%.

As far as monthly net income was concerned - domineering group of 42% was made of people whose earnings stayed between 1500 zł and 2500 zł. The share of people with income below 1500 zł and income above 2500 zł was comparable. It amounted to 27% and 31% respectively.

Table 2. Consumer preferences - products features (group of products: windows, doors, flooring, wall facing)

Material properties	The share of people who prefer products [%]	
	wood	other than wood
Heat insulation properties	68	32
Natural defects of material	63	37
Aesthetic properties	77	23
Sound insulation properties	81	19
Ecological use of material	88	12
Fire resistance	49	51
Material contribution to the creation of enjoyable atmosphere and comfort	98	2
Easy renovation	71	29
Health and safety properties of material	98	2
Environmental appropriateness of material	100	0
Renewability of material	98	2
Naturalness of material	99	1
Uniqueness of material	85	15
Tradition in material use	92	8
Pest resistance	0	100
Durability, endurance, resistance (firmness) of material	61	47

source: own elaboration



Table 3. Consumer preferences -products features (group of products – furniture)

Material properties	The share of people who prefer products [%]	
	wood	other than wood
Versatility of product use	81	19
Material contribution to the creation of enjoyable atmosphere in a room	99	1
Natural defects of material	71	29
Aesthetic properties	98	2
Ecological use of material	89	11
Fire resistance	32	68
Durability, endurance, resistance (firmness) of material	58	42
Easy renovation	76	24
Health and safety properties of material	99	1
Environmental appropriateness of material	100	0
Renewability of material	100	0
Naturalness of material	99	1
Uniqueness of material	97	3
Tradition in material use	99	1
Pest resistance	0	100

source: own elaboration

## STUDY RESULTS

In the questionnaire respondents were asked: Which product (made of wooden or non-wood materials) would you like to purchase concerning a specific product feature?

The results of questionnaire study concerning consumer preferences when choosing wooden products or their substitutes in respect to their features are presented in tables 2 to 6. In table 2 features of products under study were presented divided into groups: windows, doors, flooring, wall facing. In table 3 - group furniture. In table 4 - group: buildings and building material. In table 5 - group: paper a paperboard as packaging material. In table 6 - group: use of wood and biomass for generating energy compared with fossil fuels. In all tables percentage share of respondents who made a certain choice of wooden products or their substitutes was determined.

Consumer preferences -products features. Share of people preferring specific products. From tables 2 and 3 it may be determined that for the domineering part of features under the study in groups of products embracing: woodwork, floor and mural materials as well as furniture the majority of consumers chose wooden products. The main disadvantage of wooden materials was their low resistance to pests. The share of respondents preferring other than wood materials in this respect amounts to 100%.

Among the significant features diminishing the choice of wooden materials by respondents one may name their low fire-resistance and the lack of resistance to external factors. As far as those features are concerned the share of people preferring non-wood products was between 57% and 78% and 48% and 52% respectively.

Among the features of products in the group: buildings and building material (table 4) respondents clearly showed the advantage of wooden products over its substitutes in respect to: comfort of usage, thermo insulating, acoustic and aesthetic features as well as ecological aspects and impact on health and safety of usage, environmental usage of the material, its sustainability, naturalness, uniqueness and universality of usage.



Table 4. Consumer preferences - products features (group of products: buildings and building materials)

Material properties	The share of people who prefer products [%]	
	wood	other than wood
Material contribution to the creation of enjoyable atmosphere	92	8
Low weight of material used for building	67	33
Easy workability and formability of material	67	33
Heat insulation properties	78	22
Sound insulation properties	78	22
Quicker and easier assembly of building components from material	51	49
Cost saving when living in the building	40	60
Natural defects of material	57	43
Aesthetic properties	92	8
Ecological use of material	100	0
Fire resistance	3	97
Durability, endurance, resistance (firmness) of material	4	96
Easy renovation	10	90
Health and safety properties of material	100	0
Environmental appropriateness of material	96	4
Renewability of material	100	0
Naturalness of material	98	2
Uniqueness of material	94	6
Versatility of material use	89	11
Tradition in material use	67	33
Pest resistance	0	100
Resistance against climatic conditions	4	96

source: own elaboration

Among the features favouring the choice of substitutes of wood there are fire-resistance, resistance to external factors both climatic and pests and the ease of renovation. Respondents also perceive wooden products as more expensive. When using them there are limited possibilities for cost reduction of construction investments. As to the possibilities of decreasing costs the share of respondents preferring wood amounts to 40% and those choosing non-wood products 60%.

When evaluated by respondents generally paper and cardboard packaging have a significant advantage over packaging made of non-wood materials (table 5). The choice of paper and cardboard packaging was made because they are harmless for people, universally used and adjustable to certain needs, with natural vices, aesthetical and ecological values, environmental usage sustainability and naturalness of material, its traditional appearance and the ease of manipulation and renovation. Among the features having negative impact on the choice of paper and cardboard packaging there are: perishability and low packaging resistance to deformation, low resistance to external factors, climatic factors and pests as well as low fire-resistance.

In energy applications wood and biomass are perceived by respondents as the fuel which is convenient for natural environment and of comparable with fossil fuel calorific value (table 6). Apart from that, the choice of wood and biomass as the source of energy was made due to such features as: the possibility of using and utilizing residue following burning process, the pace of renewing energy supplies and the possibility of reducing costs when using that fuel for energy production.

Table 5. Consumer preferences - products features (group of products: paper a paperboard as packaging material)

Material properties	The share of people who prefer products [%]	
	wood	other than wood
Easy renovation	67	33
Health and safety properties of packaging for people	87	13
Possibility to use packaging more time without reparation	4	96
Resistance of packaging material	11	89
Ability of material to keep the form of packaging	36	64
Easy to manipulate with packaging	57	43
Possibility to create different shapes of packaging from the material	74	26
Versatility of packaging use	80	20
Natural defects of packaging material	88	12
Aesthetic properties	92	8
Ecological use of material	100	0
Fire resistance	0	100
Environmental appropriateness of material	100	100
Renewability of material	100	100
Naturalness of material	100	100
Uniqueness of material	73	27
Tradition in packaging material use	90	10
Pest resistance	3	97
Durability, endurance, resistance (firmness) of packaging material	2	98

source: own elaboration

Table 6. Consumer preferences - products features (group of products: use of wood and biomass for generating energy compared with fossil fuels)

Material properties	The share of people who prefer products [%]	
	wood	other than wood
Environmental impact	97	3
Heating value of fuel	51	49
Cost saving in using fuel for energy production	68	32
Good availability of fuel	24	76
Easy storing and manipulation with fuel	18	82
Repeated use of fuel waste	97	3
Production of greenhouse gases when using fuel	6	94
Quick renewability of resource	100	0

source: own elaboration

In respondents' opinion fuel generated from wood and biomass is however not easily accessible. In this respect the share of people preferring fuel from wood and biomass amounts to 24%, and fossil fuel to 76%. Due to the ease of storage and transport the choice is clearly on the side of fossil fuels and 82% of those under study gave such answer. Difficult to understand however is pointing at fossil fuels as beneficial in respect to the production of greenhouse gases. This choice of respondents might have happened due to the misinterpretation of increasing share of liquid fuels made from biomass (biodiesel) or frequent disasters in a form of forest fires world-wide and explicit activities aiming at the reduction of carbon dioxide and other greenhouse gases emissions using fossil fuels in professional energy sector.

## CONCLUSION

The results of the survey concerning consumer preferences when making a choice of wood for the five selected groups of products show that it is highly appreciated due to its numerous positive functional features. Wood despite of its rather low fire-resistance and low resistance to weather conditions, because of its ecological, recycling and aesthetic features and the universality of applications constitutes a valuable and universal usable material.

Those advantages should become the background for the promotion of versatile forms of usage of wood and wood-based materials in everyday life, generally as a user-friendly material, and following its application period easy for utilization, what happens without excessive damage to natural environment.

Wood in its applications and due to its unique features is human-friendly from birth until the very end of our existence. Literally and figuratively from a wooden rattle, cot and cradle up to a wooden coffin, beginning from construction applications, durability and usability and ending with utilization which is harmless for natural environment.

## LITERATURE

Goliwaś E. (2003, 2004): Promocja drewna w budownictwie mieszkaniowym szansą dla sektora leśno-drzewnego. Przemysł Drzewny, cz. 1 - 54, 2; cz. 2 - 55, 2.

Lis W.: Drewno jako źródło energii odnawialnej. Ekspertyza. Dyrekcja Generalna Lasów Państwowych. Warszawa 25.07.2011, s. 58, tab. 21, ryc. 27, poz. bibl. 69.

Lis W. (2009): Podaż i ceny drewna w pierwszym półroczu 2009 roku. Przemysł Drzewny, 60, 7-8.

Mazurek-Łopacińska K., Sobocińska M.: (2008): Badania marketingowe. Marketing i Rynek, 15,12.

Paluš H., Lis W., Mařová H., Kaputa V., Popyk W., Parobek J. (2011): End users' preferences for joinery products and furniture. Intercathedra No 27. ISSN 1640-3622. Poznań 2011 (w druku)

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**Miroslav Malák<sup>8</sup>**

## INNOVATIVE APPROACHES TO MANAGING PRINCIPLE FOR ENTERPRISE KNOWLEDGE

**Abstract:** The paper is concerning the theoretical approaches to knowledge management of enterprise and concentrates attention for knowledge, which are the most valuable capital of enterprise. Expansion of globalization incline of enterprises deal also lesser important areas, which mean, that enterprises management must to concentrates attention not only for traditional developing sources (material, financial, labour power), but also up to now a lesser important and used source, that is phenomenon knowledge, which is nowadays known as the knowledge management.

**Key words:** knowledge management, knowledge, knowledge system

## INTRODUCTION

Managing corporate knowledge can be effective only if it is not declared as a concept, but it will become an active part of the people - their work habits, culture. Knowledge management has lead to staff each share acquired information and knowledge. But this is not so easy. Knowledge of „hip” people in their heads. They are the result of their training, experience and opportunities are paramount to their property, to which nobody can interfere. To achieve this, the workers voluntarily

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share their knowledge, the enterprise should first allow their employees to develop, improve and explain the importance of knowledge, not only for themselves but also for the enterprise as a whole.

### A KNOWLEDGE MANAGEMENT CORPORATE GOVERNANCE IN THE KNOWLEDGE

Knowledge management is becoming more common term. It is a natural revolutionary step, resulting in efficient use of existing and familiar information technologies that facilitate the collection, gathering, sorting, storage and presentation of relevant information in a knowledge-running establishment in a way that will help employees and managers gather important information from them required a specific area, such as to solve problems in investment decisions, strategic planning and the like. The role of knowledge management is to make knowledge within the company to those who need, them where they need, when they need it in a form in which they need to increase employee performance, but also the whole business.

Human, knowledge capital is increasingly regarded as the most valuable capital for the company, but it is not the same. Not everyone is in the process of value-creating nature of creative capital, ie It goes into the business process as a crucial value-factor. The bearer of the knowledge capital can be agile as well as skilled worker or expert creative manager. It is not only a layer of higher education, titled academic staff, but they are people who use their knowledge to develop new products in their manufacture, sale, financing, for development of the company and so on, and leave things happening around me stand, changing them to actively participate. They are people who provide competitive advantage for your company.

Knowledge Capital worn by people in his head. This is a result of their training, experience and opportunities in their brains worked. It is a unique feature of its bearer, it is his property. No company can not privatize knowledge, buy, or simply take. But it may allow its employees to develop, improve and manage them in their environment. This is the knowledge capital in knowledge-driven enterprise knowledge portal and its structure is shown. (Fig. 1)

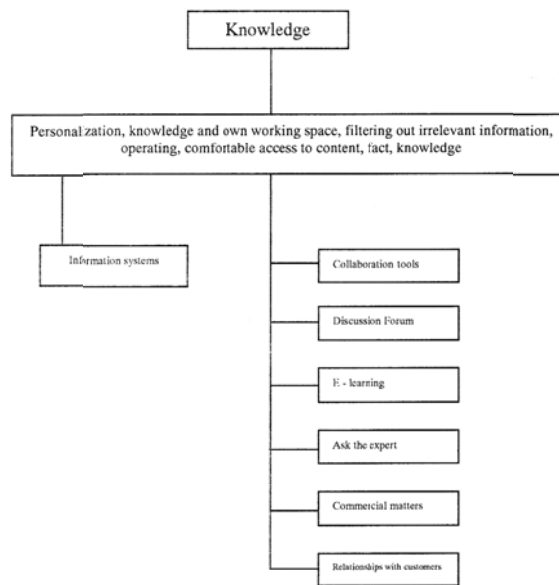


Fig.1 Structure of the knowledge portal



## **DRAFT OPTIMIZATION APPROACHES TO KNOWLEDGE MANAGEMENT COMPANY**

Knowledge management represents a technology which allows to capture, store, search, categorize and make available information and experience gathered in the company. Knowledge exists in enterprises and they are always scattered among the people, but not always controlled (technology supported) to allow for processing, storage, disclosure and dissemination. Therefore the successful management of knowledge in business, you need to think about by implementing the knowledge system in the enterprise.

Knowledge management involves:

- ✓ localization and identification of knowledge in business,
- ✓ definition of activities necessary for the knowledge management business,
- ✓ building a knowledge management system,
- ✓ use of techniques for knowledge management in knowledge management system.

## **OPTIONS LOCATED AND IDENTIFIED KNOWLEDGE IN ENTERPRISE**

Information between processes the information, which usually acquire good staff, with them coming into direct contact. The main source knowledge of each company in the minds of its employees and many of them in a structured or unstructured format imposed by information technology in its information systems databases. If we have knowledge of control is so important to know:

- ✓ knowledge about the existence and location,
- ✓ the owner's knowledge and what is their level of confidentiality and access to them.

### Forms and conversion of knowledge

Knowledge can be divided in terms of the form:

- ✓ the tacit,
- ✓ the explicit.

The nature of knowledge has an impact on the exchange.

- ✓ If the knowledge will be „more tacit“, the more should be focused on technologies that facilitate the direct sharing of people. It is good to try to express such knowledge of technology itself, or try them "in" technology store.
- ✓ On the contrary, if the knowledge is more explicit, the easier it will be stored in depots or technology in other more structured forms.

## **DETERMINING THE ACTIVITIES REQUIRED FOR CORPORATE GOVERNANCE KNOWLEDGE**

In a knowledge-based corporate governance is necessary to ensure the main activities related to the knowledge system, it is mainly the following activities:

- ✓ selection of a particular system of knowledge management,
- ✓ the creation of hardware and software structures for knowledge management system,
- ✓ the project for implementation and integration of knowledge management,
- ✓ to establish rules and procedures for creating a knowledge database,
- ✓ defining how the fulfillment database,
- ✓ define the access rights to knowledge,
- ✓ maintaining a knowledge database,
- ✓ evaluation of the use of costs and benefits associated with knowledge management system.

In addition, the difficult but necessary task is the integration of knowledge through a mediator, who represents a special process ensuring medziprocesovú communication.

## **BUILDING KNOWLEDGE MANAGEMENT SYSTEM**

In a knowledge-based corporate governance is essential to create a knowledge management system that can be classified as follows to:

- *Transaction System - Transaction Processing System TPS*

Its aim is to automate the processing of routine tasks, which include - bookkeeping, payroll and salaries, various registration systems, warehouse management, etc. Sometimes you also include systems for control of technological processes in real time. A typical attribute is the fact that a large part of the overall processing in this system is already carried out or when entering data respectively shortly thereafter. This type of system is currently the most developed and expanded mainly due to its clear specification and book character. In the event that the transaction system is a modular solution covering most of the areas of business activities (especially manufacturing, sales, finance and HR), called ERP - Enterprise Resource Planning - ERP system.

- *Management Information System MIS*

Its main role is to provide managers of various surveys and reports aggregated according to different temporal, spatial and other aspects, mainly to supply information to decision by him to facilitate process control subordinate units. An input the data from the transactional system. MIS system, like the TPS system belongs to the ERP system.

- *Decision-Support System DSS*

It is an extension of the MIS. It is intended mainly for a variety of analysis and their use in decision-making executives.

- *Executive Information System EIS - an information system for top management*

It covers all previous systems. We can say that, unlike previous systems is suitable for obtaining documents for strategic decision-making in financial and personnel areas. The term EIS is already rarely used and it gradually in this field replaces the concept of DSS. Although in practice often confused concepts of MIS, DSS and EIS (especially the concept of MIS is used in a broader sense, mainly because the concept of EIS into the Slovak language is sometimes incorrectly translated as MIS) is necessary to distinguish subtle variations between them. A relatively new concept, Business Intelligence, which includes the MIS, DSS and EIS.

## **THE USE OF TECHNIQUES FOR KNOWLEDGE MANAGEMENT IN KNOWLEDGE MANAGEMENT SYSTEM**

In the corporate knowledge management system uses a number of techniques that allow information processing. Frequently they are:

*The document management* - document management allows you to use data representing information in a structured or semi-structured form.

*Workflow* - Workflow technologies are used to control the flow of information through business processes. Applications of this type and keep records of changes to business processes. They can be divided into a collaborative production.

*Word processing* - word processing is an integral part of the knowledge system, mainly because that large amount of knowledge is stored in text form, for their rapid disclosure is necessary to have technologies that allow comprehensive set of process, or set of documents in order to locate relevant information within a reasonable time.

*Classification of knowledge* - large amounts of data require special way of mapping (imaging) according to defined criteria. This classification (taxonomy) allows you to quickly gather knowledge.

*Mining for knowledge* - to obtain information about functional dependencies between the information that was previously unknown and allows for better follow-up decision-making processes. This type of knowledge must be based on valid and correct data so that the knowledge gained could be used in decision making. It also acquired the following knowledge must be capable of application in business processes, which in turn will benefit.

## CONCLUSION

Without a continuous cycle of discovery, sharing and using knowledge is not an existing business in a turbulent environment to compete, because that knowledge is now one of the most valuable corporate assets. Present trends show a voluntary exchange of knowledge and awareness of the benefits of the trend of knowledge management by businesses. It was such a positive approach supports the process of transition to knowledge-based enterprise in which knowledge and intellectual capital will not only competitive advantage but also a precondition for the successful operation of a knowledge society. Creative potential of the company is a branch of the company, which together with other ingredients contribute to its overall success to its ability to produce and implement their products or services on the market.

The explosion of new knowledge, especially in the areas of communications, production technologies and marketing prepare any company, regardless of whether with us or anywhere else in the world of competitive edge, unless it is able to develop, adapt to, but above all to learn.

## LITERATURE

1. Malák M., Šebo J.: Application of innovation methods and techniques at projection of assembly systems. In: Intercathedra. No. 24 (2008), p. 159-162. ISSN 1640-3622.
2. Trebuňa P.: Use of risk as part of the decision-making. In: Upravenie ekonomikoj. Metody, modely, technologii. 10. mezdunarodnaja konferencija s elementami naucnoj skoly dla molodezi. Ufa, Ugotu 2010, p. 162-166. ISBN 978-5-904122-28-7.
3. Trebuňa P.: Modelovanie systémov výkonnosti podnikov. In: Strojárstvo. Strojírnoství. Roč. 15, č. 4 (2011), s. 4-6. ISSN 1335-2938.
4. Trebuňa P.: Uplatnenie modelovania v návrhu, riadení, výkonnosti a zlepšení produkčných systémov. In: Fórum manažéra - teória a prax v riadení podniku. Č. 1 (2010), s. 52-54. ISSN 1336-7773.
5. Kováč J., Kádárová J.: Selected innovative methods and techniques of the lean manufacturing. In: Intercathedra No. 26 (2010), p. 38-42. ISSN 1640-3622.
6. Kardoš F. [et al.]: Investigation of gaseous medium state change in pneumatic element of flexible shaft coupling. In: Pneumatyka. Vol. 62, no. 1 (2007), p. 34-36. ISSN 1426-6644.
7. Lis W.: Usability of cost – effectiveness analysis. In: Intercathedra. No. 22 (2006), p.91-93. ISSN 1640-3622.
8. Medvecká-Beňová S.: Návrh úprav prevodového mechanizmu pri zvýšení výkonu pohonu. In: Transfer inovácií. Č. 16 (2010), s. 197-198. ISSN 1337-7094.
9. Vidová J.: Using cost management to increase effectiveness of the company. In: Intercathedra. No. 21 (2005), p. 157-161. ISSN 1640-3622.

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## PROSPECTS OF PELLET MARKET DEVELOPMENT IN THE CONTEXT OF PRICE INCREASE IN CONVENTIONAL ENERGY SOURCES

**Abstract:** The increase in interest in firewood, wooden residue and post production by-products and timber fuels has been generated by growing ecological awareness of the society as well as conventional energy sources price rise. In recent years ever more significance has been gained by pellet due to high stability and the possibility of automation of co-firing process. Development prospects of that thoroughly modern ecological fuel to a large extend are conditioned

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by price of heat unit generated from it. In the article pellet price analysis on the domestic market between 2004 and 2010 has been carried out as well as increase in prices of other energy sources in the period between 2001 and 2010 have been presented. Following the calculation of useful exploitation cost of heat unit derived from various fuels profitability of their usage in relation to pellet has been determined.

**Key words:** ecological fuels, pellet, conventional energy sources, price of heat unit

## INTRODUCTION

One of the key reasons for interest in modern ecological fuels lies in the fear of exhausting conventional fuels as well as the undesirable impact the process of their burning has on biosphere. Non-trivial influence on the search for alternative sources of energy has also been played by an urge for at least partial independence from gas and oil import from unstable and price-wise unpredictable supply of those fuels and most of all a constant increase in prices of conventional fuels.

## PELLET PRICES ON DOMESTIC MARKET

Basic criteria taken into consideration by an entrepreneur when deciding on investment is production profitability analysis accounting for both investment costs and profits from sales determined by possible to obtain prices of the final product. In 2004 pellet production due to its low price (280 PLN/t) was rather unprofitable. Many entrepreneurs who undertook pellet production at the time had to abort their activities. Also limited number of consumers (consumption in 2004 - 6 000 t) favoured this type of investment. Some improvement took place in 2005 when pellet consumption grew four times, reaching 25 000 t [Wach 2006]. Visible growth in oil prices observed as of 2005 made pellet an attractive fuel. From May till November 2006 a very advantageous situation was created on Polish market similarly to the European market of pellet producers. Average pellet prices reached 650 PLN/t. High price and exceptionally mild winter season 2006/2007 lowered the pace of increase in pellet stoves and pellet itself. Due to that pellet market underwent some stabilization and pellet prices in December 2006 for the first time in 18 months slightly decreased. Declining trend was further strengthened from the first months of 2007, what is shown by data concerning pellet prices between January 2007 and December 2010, presented in figure 1.

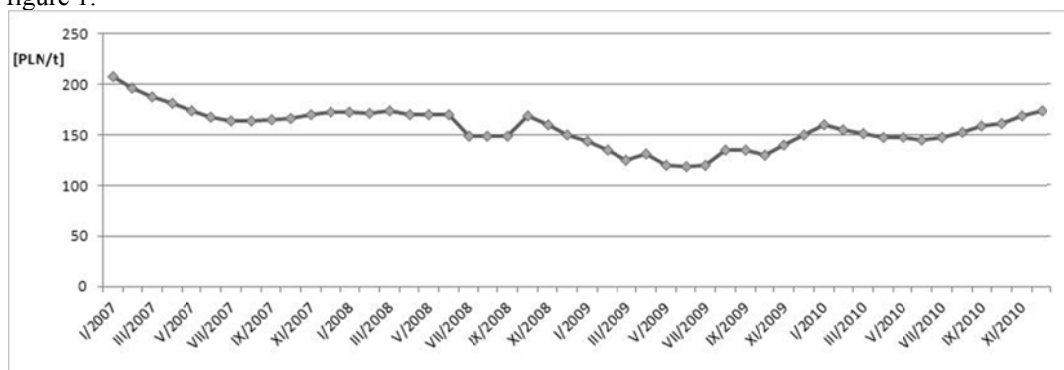


Fig. 1. Pellet prices in Poland from January 2007 till December 2010

*Source: own elaboration on the basis of data from [Pellet Market Data 2011]*

Subsequent months of 2007 in comparison with 2006 resulted in approximately 20% decrease in prices also caused by the end of heating season. Seasonal changes of pellet prices may be observed annually. Yet in winter of 2008/2009 due to world-wide economic slump pellet prices started to decrease in November. This tendency lasted till July 2009. In subsequent months gradual, seasonal increase in pellet prices was recorded further strengthened by exceptionally long and frosty

winter. Its price in January 2010 amounted to 160 EUR/t and was 11,1% higher than in corresponding period of the previous year. From February 2010 pellet prices began to decrease again reaching the level of 148 EUR/t in July 2010. Later in autumn increase in pellet price was further strengthened by the forecast of long and frosty winter and linked to it rise in prices of sawmill by-products – basic raw material for the production of pellet and wooden briquettes. As a result the most expensive pellet (174 EUR/t) from 2007 consumer purchased in December 2010 paying 15,2% more than in the previous year. In the following months of new year its prices still grew reaching the level of 185 EUR/t.

### INCREASE IN PRICES OF OTHER ENERGY SOURCES

Increase of interest in firewood, post production wood waste and timber fuels is caused not only by growing ecological awareness of the society but also the increase in prices of other energy sources. In current situation timber and timber fuels become a cheaper and more ecological alternative for numerous conventional sources of energy. This thesis is confirmed by the table of prices of selected fuels between 2001 and 2010. Data from table 1 shows that the lowest increase in prices embraced transport fuels: petrol by 45% and fuel oil by almost 67%.

Table 1. Prices of selected fuels between 2001 and 2010

Type of fuel	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2010
Electric energy [PLN/kWh]	0,36	0,38	0,4	0,41	0,42	0,44	0,45	0,5	0,54	0,59	163,89
Natural gas [PLN/m <sup>3</sup> ]	1,22	1,31	1,35	1,40	1,44	1,85	2,01	2,23	2,39	2,47	202,46
Liquified petroleum gas (LPG) volume 11 kg → 27,2 l*	2,8 (30,80)	2,57 (28,27)	29,37	31,51	36,1	39,98	40,41	44,10	54,40	61,47	199,58
Coal [PLN/t]	422,23	444,27	443,92	459,6	470,3	491,5	523,4	604,4	693,1	740,3	175,33
Petrol [PLN/l]	3,17	3,20	3,37	3,76	4,03	4,00	4,25	4,36	4,21	4,58	145,43
Diesel [PLN/l]	2,56	2,60	2,83	3,21	3,78	3,94	3,76	3,92	3,72	4,27	166,80

\* between 2001-2002 – 1 kg of liquified gas

Source: own elaboration based on [Ceny w gospodarce narodowej 2009, 2010],  
[www.bankier.pl/inwestowanie/notowania/macro.html]

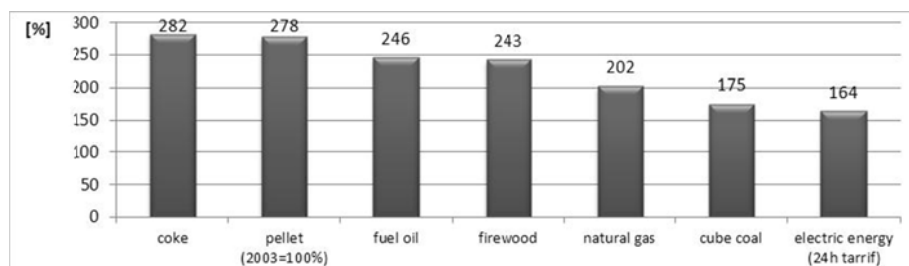


Fig. 2. Increase in prices of selected energy carriers between 2001-2010 (where 2001=100%)

Source: own elaboration on the basis of data from Central Statistical Office and the price lists of energy producers

In the analyzed period, all sources of energy in Poland underwent drastic increase in prices what is illustrated by Figure 2. The highest increase was recorded by coke. Its prices in the period under analysis grew almost 3 times. Similar increase was observed in the price of pellet yet its price from 2010 was juxtaposed with the price from 2003 the year when this fuel was launched on Polish market. At the time prices of oil and firewood grew at slightly lower pace. Electric energy prices changed the least and their growth amounted to 64%. While prices of natural gas doubled. In the

upcoming years one may predict that the tendency will continue and the prices of natural gas, electric energy and fuel oil will be growing.

### THE COMPARISON OF COSTS GAINED FROM ONE HEAT UNIT FROM VARIOUS ENERGY SOURCES

To evaluate the efficiency of one energy source it is not sufficient to analyze its price tendencies. Determining the full cost of obtained heat unit requires specifying its exploitation cost also called useful heat unit [Bal, Piechocki 2006]. Its value is determined using the following formula:

$$K_u = \frac{c_{jp}}{Q_w \times \eta_k} \quad (1)$$

where:

$K_u$  – cost of obtaining useful heat unit [PLN/GJ],

$c_{jp}$  – price of fuel unit [PLN/t] or [PLN/m<sup>3</sup>],

$Q_w$  – fuel calorific value [GJ/t] or [GJ/m<sup>3</sup>],

$\eta_k$  – heating system efficiency [%]

In table 2 the costs of exploiting heat unit obtained from various sources have been compared. The data shows that the cheapest biofuels and simultaneously the cheapest energy source is cube coal. Heating with pea coal or firewood is slightly more expensive yet it requires constant supervision of furnace. 20% more expensive than timber wooden briquettes due to ecological reasons may be an alternative for 18% to 26% cheaper coal, and due to economic reasons for 23% more expensive natural gas. In heating season 2010/2011 for the first time pellet – the most stable and homogenous fuel become competitive for wooden briquettes. Similar price of briquettes and pellet taking into account higher efficiency of pellet-fed heating systems made pellet a more modern and slightly less expensive fuel than briquettes.

The comparison of exploitation costs of heat unit obtained from various fuels shows gradual improvement in pellet utilization. During heating season 2010/2011 only cumbersome coal and firewood heating systems proved to be cheaper than pellet systems.

Table 2. Cost of heat unit generated from various types of fuels during heating season 2010/2011 compared with 2005/06, 2007/08, 2008/09, 2009/10

Type of fuel	Cost of generating useful heat unit [PLN/GJ]					Price equivalent obtained from pellet heat unit		Efficiency of heating installation [%]
	2005/06	2007/08	2008/09	2009/10	2010/11	2009/10	2010/2011	
firewood	17,68	22,70	30,61	36,47	45,29	0,81	0,84	70
wooden briquettes	29,60	32,49	35,31	45,75	54,17	1,01	1,01	80
(pellety) pellet	35,19	38,76	41,34	45,22	53,62	1,00	1,00	86
cube coal second class	19,29	24,68	30,86	35,71	42,86	0,79	0,80	70
coal	30,38	27,53	34,29	38,46	45,71	0,85	0,85	70
natural gas GZ 35/GZ 50*	45,86	49,51	61,04	64,70	66,84	1,43	1,25	88
fuel oil	78,83	88,50	82,12	94,84	96,90	2,10	1,81	86
liquid gas	90,35	104,64	123,58	104,52	108,90	2,31	2,03	88
electric energy night tariff G12	60,00	83,33	105,56	111,11	119,44	2,46	2,23	100
electric energy 24h tariff G11	106,00	122,00	130,56	133,33	138,89	2,95	2,59	100

Source: own elaboration on the basis of producers average prices

### CONCLUSIONS

1. Pellet prices in Poland, between 2007 and 2010, reached the level which was satisfactory for its producers justifying investment in this field.



2. Within the period under analysis between 2001 and 2010 all energy sources in Poland recorded a significant price increase.
3. The most visible price increase embraced cube coal and pellet. In the period under analysis those prices grew almost 3-times. The least changeable were prices of transport fuels. Price of petrol increased by 45% and fuel oil by almost 67%.
4. Evaluation of profitability of using an individual source of energy required determining a full cost of heat unit obtained. The lowest cost during heating season 2010/2011, was characteristic for energy obtained from coal, depending on its kind amounted to 42,86 up to 45,71 PLN/GJ. Similar expenditure had to be taken into account by fireplaces utilizing firewood (45,29 PLN/GJ). Approximately 10 PLN more expensive was implementing pellet (53,62 PLN/GJ) and wooden briquettes (54,17 PLN/GJ). Significantly more expensive almost 3 times dearer was the production of thermal energy.
5. Profitability of pellet utilization as the source of thermal energy gradually increases. In heating season 2010/2011 only more cumbersome heating using coal and firewood was cheaper than heating utilizing pellet.
6. Forecast further increase in prices of conventional energy sources will lead to the increase in prices of their substitutes among them firewood and ecological fuels such as pellet and wooden briquettes. It is not to be expected however that the pace of that price increase was so high as to lower the profitability of pellet utilization in relation to conventional energy sources.

#### LITERATURE

1. Bal R., Piechocki J. (2006): *Odnawialne źródła energii i możliwości ich praktycznego wykorzystania*. Podlaska fundacja rozwoju regionalnego. Białystok.
2. *Ceny w gospodarce narodowej w 2008 r.* GUS. Warszawa 2009.
3. *Ceny w gospodarce narodowej w 2009 r.* GUS. Warszawa 2010.
4. *Pellet Market Data*. (2011): [www.pelletsatlas.info](http://www.pelletsatlas.info), 25.05.2011.
5. Wach E. (2006): *Polski i europejski rynek pelet*. *Czysta energia* 6 (55).

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### LAND USE SYSTEMS APPROACH TO SOIL AND ENVIRONMENT CONSERVATION

**Abstract:** Land use is characterized by the crop sequences, crop production technologies, including soil management. From the beginning of the soil disturbance, close correlation can be found between land use pattern and environment state. The land use systems were classified and grouped on the basis of the farming features and their impacts on soil and environment quality condition. Terms of the systems in Hungarian relation and in chronological order are as follows: early extensive (from the beginning till 1860), conventional (1860-1960), early intensive (1960-1980), integrated (1980-), modern intensive (1990-), modern extensive (1990-) and ecological (1989-). The land use systems can also be grouped by their environment capability. In environmental respect three of them are considered to harmful, two are medium and other two (integrated and ecological) are ranked to conservation. There are 11 important factors which help to identify the term of any land use system and to separate them consecutively, that are the crop, crop yield, productivity, fertilization, crop protection, chemical load, energy demand, equipment level,

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soil tillage, impacts on soil and environment and training demand. In this paper our current and past research is summarised to approach an environmental sound land use and to create and maintain harmony between soil conservation and crop production to meet Hungarian needs throughout the future.

## INTRODUCTION

The role of land use form and soil tillage is important because it may increase or decrease the physical deficiencies that make the production risky (Várallyay 1996; Ruzsányi and Pepó 1999). Authors outlined that in a modern land use system both tillage and crop sequence are well-adopted to the soil and environment conservation, and tillage methods give conserving, improving and maintaining effects, however, they save energy (Veldkamp et al. 2001). The physical and chemical loading of soils is undesirable. It also helps to minimise the environment pollution disregarding the harmful chemicals. The endeavours in the land use system are to conserve the natural condition of the landscape through natural materials and specified cropping methods (Tóth and Kismányoy 2001; Kessel and Wendroth 2001). Soil tillage, as a land use factor is given alternatives to maintain the cultural condition.

## MATERIAL AND METHODS

This study is based on data of the monitoring and the literature however, the new data for land use evaluation, are originated from long-term experiments. Research of the land use forms and consequences started at the Department of Soil Management at Szent István University. The monitoring concerned to the last decades from 1976 following the periods of the developing and declining of land use and covered 31,000 ha in 41 different districts of Hungary. Long-term trials were set up in 1991 in Gödöllő on a Chromic Luvisol, and in 2002 in Hatvan region on a Calcic Chernozem studying the land use impacts on soil quality. The variants of the land use were intensive (as multitraffic), regular (alternate ploughing and disking and use less traffic) and conservation (using soil structure conservation tillage with less traffic). Some of the results were published both in Hungarian and international relation (Birkás et al. 2000, 2001, 2002; Birkás and Gyuricza et al. 2003; Jolánkai et al. 1997). Purposes of the research are as follows: 1. Classifying and grouping of land use forms in Hungary. 2. Evaluation of land use impacts on soil quality. 3. Summarising the factors affecting soil quality in a modern land use system.

## RESULTS AND DISCUSSION

### *Land use forms in Hungary*

Close correlation can be found between land use pattern, production technology – including tillage – and soil damage BIRKÁS et al., 2000; KISMÁNYOKY et al., 1997). Details below refer to the Hungarian conditions.

**Extensive land use, early form** (1000-1860) characterised by a low technical level and the shallow tillage. Soil degradation occurred due to natural circumstances or lack of knowledge. There was no chemical load on soils. Crop rotations were run with a limited number of plants.

The deterioration in soil condition was begun. In the given level of production the physical soil problems could not be managed.

**Conventional land use** (1860 as the first year of deeper tillage - 1960): Ploughing is used generally (in the 1800s 3-5 times in a year). Crop rotation is planned for more crops. By the end of the period the chemical load appeared on the arable fields. The soil physical degradation (compaction, dust formation) have been induced earlier was strengthened. At the same time new damage occurs.

**Intensive land use, early form** (1960-1980): Varying depth for primary tillage simultaneously used with out-of-date and up-to-date tools. More tillage traffics caused soil compaction, but alleviation is also dealt with. There are rotations with limited number of crops or monoculture. Chemical load of soils is occurred because applying chemical materials is commonly used. A great



problem is the deterioration in soil structure. Taking account to the soil biological condition is surpassed.

**Intensive land use, modern form (1990s-):** There are some important differences between the earlier and the modern forms. Few, up-to-date, high level equipment is used. Intensive tillage with variable depth and less traffic is in use. Simple crop sequences (monoculture, biculture, rotation) with the cash plants are applied. Expansion of soil degradation can slightly be decreased however, the chemical load of soils, can become risky. This form spreads in medium-size, well-managed farms in Hungary.

**Integrated land use (from the 1980s):** Conservation type, variable depth and operation in tillage harmonize with crop sequence. Physical and chemical load on soils are low. Soil and environmental damage are prevented and decreased. Soil state in deeper layers is considered and modern soil conservation systems are stated (Table 1). Some farms in the 1980s had positive experiences with this system. After 5-6 years break efforts for integrated land use can be seen again. Although this system is not widely practiced it gives perspective for the future.

**Extensive land use, modern form (1990-):** The use of few, up-to-date equipment and technology that requires high level of knowledge is usual. Less crop rotation rather 2 or 3 plants or bi/monoculture are used. Shallow, ploughless, and reduced soil tillage are used. The system can alleviate the deterioration in soil quality (ECAAF, 1999). The improvement of deeper soil layers should be done. In some cases chemical load may occur. This form of land use can be practiced in large fields for mass production. In the future the extensive farming may be extended in Hungary.

Table1. Features of the integrated land use system

Factors	Advantages	Considerations
Crop	adaptable to arable site, climatic and economic conditions	to grow cash and soil condition improving crops
Crop yield	harmony between quality and quantity	optimal is not highest
Productivity	harmony between arable site, land use and production technology	soil fertility and soil condition control required
Fertilization	soil fertility maintenance, site specification	organic material recycling; soil fertility control
Crop protection	maintaining an adequate level	both prevention and protection are required
Chemical load	decreasing	continuous control
Energy	adequate level of consumption	higher energy demand periodically
Equipment	medium and up-to-date (mid-tech)	soil and site adaptability required
Tillage	well-adopted to soil and climatic conditions	to improve and maintain the root zone condition; surface mulching (attention to advantages and risks)
Impacts on soil and environment	soil quality improving and maintaining	attention to effective soil conservation methods
Training demand	innovative	continuous activity required

**Ecological land use (1989-):** The main goal is to produce foods without artificial matters. Crop production is adapted to site and ecological requirements (Lacko-Bartosová et al 1995; Demo 2001). Recycling of organic materials and using of natural manures to maintain the soil fertility are also demand. Chemical load may not occur. The energy consumption is low however, the level of the technique, is adequate. Ploughing and ploughless tillage are used completing the subsoil loosening. This system may maintain the soil quality with low risk. The ecological farming is to pay more attention in the future in Hungary.

#### *Evaluation of land use impacts on soil quality*

Changing in the humus content, agronomical structure and soil moisture management may give useful information of the land use impacts on soil quality condition.

The results reconfirmed that less soil disturbance can be applied to conserve organic materials effectively, however to disturb a soil frequently promotes the loss of humus content during the longer period. The humus content was lowest in soil disturbed intensively in a long-term and it remained higher, when soil disturbance were reduced (Figure 1). The ploughing and loosening

systems can be considered as a slightly conservation way if stubble residues decomposed into the soil for many years. The soil condition improving and maintaining systems give a real chance to limit the organic material loss from arable soils. Moreover, the organic matter conservation may decrease the soil sensitivity to the drought, considering the climatic extremity. It is clear, because the soil water-holding capacity depends on soil structure state which is closely related to cycle of soil organic material.

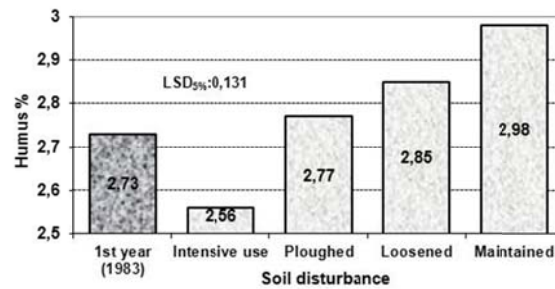


Figure 1. Land use impacts on humus content of soil (Hatvan, 1983, 2003)

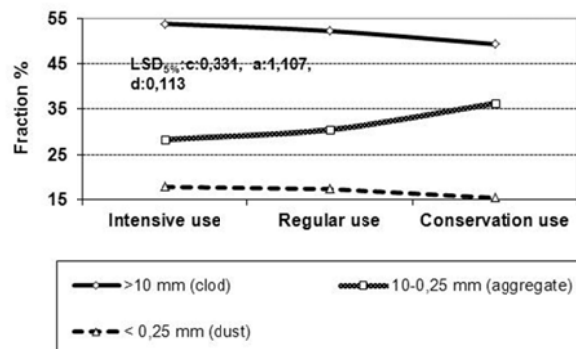


Figure 2. Land use impacts on soil agronomical structure (Hatvan, 1983-2003)

The soil agronomical structure is closely related to land use systems. In the soil utilized intensively the ratio of the clod:aggregate:dust were percentage of 54:28:18, while a long-term regular use resulted of 52:31:17 % (Figure 2). The conservation land use impact on soil agronomical structure was more favourable and resulted less clods and dust fractions with higher percentage of aggregates (49:36:15). It is stated, that structure degradation is one of the negative consequence of the intensive soil disturbing systems using in a long-term. It is concluded, that prevention of the clod and dust formation by the use of soil conservation land use may promote structure conservation on arable fields.

The third standpoint is to evaluate the land use impacts on soil moisture content during the droughty summer of the year 2003. The concerning results reconfirmed that both structure conservation land use and less soil disturbance may reduce the loss of water, however to disturb a soil frequently promotes the moisture loss in droughty seasons. The drought effect succeeds with a greater probability on soils has been cultivated and compacted intensively for decades. Otherwise, the deterioration of agronomical structure promotes the limitation of natural water management in the soils. Moreover, a soil conservation land use may prevent most of tillage faults and maintain a favourable water management through the infiltration and decreasing the moisture loss during the seasons (Fig. 3).

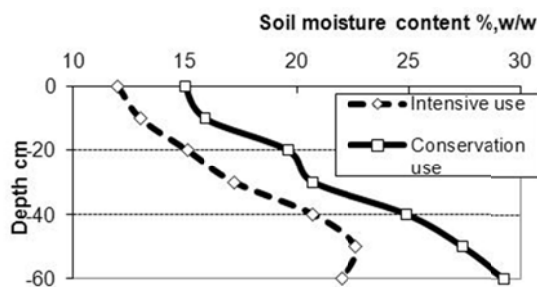


Figure 3. Land use impact on soil moisture content in a droughty summer (2003)

*Summarising the factors affecting soil quality in a modern land use system*

Factors improving soil quality condition are summarised in Table 2. Seven factors refer to maintain the soil quality and other seven factors present the possible soil tillage technique.

Table 2. Factors improving soil quality condition in a land use system

Biological factors	Environment	Tillage factors
(1) Mulching with natural materials	Conserving, maintaining and/or improving of soil	(1) Form the surface for soil and moisture conservation
(2) Stubble residues incorporation and recycling		(2) Reduce the physical load of soils
(3) Organic material management	↓	(3) Reduce the disturbance for soil structure conservation
(4) Crop rotation with high biological effect		(4) Prevent and alleviate soil compaction harms
(5) To promote soil mellowing		(5) To prevent the dust formation
(6) Optimal water-, air and heat management		(6) To maintain water absorbing and holding capacity of soils
(7) To reduce chemical load of soils		(7) To control weed, pest and disease infestation

Agronomic ways for prevention or alleviation of tillage-induced harms include crop rotations which require a minimum of traffic, crops that produce organic materials for maintenance of soil organic matter, crops with penetrating and fibrous root systems, liming and manure management. In both environmental approach and farming aspects is important to manage the biological activity in soils consciously thus decompose of the stubble residues through the humification and mineralization processes consequently maintain a mellowed soil condition. In a land use system, it is important to manage the biological activity in soils through the biological processes, and to maintain a good workability.

For harmony between land use and soil quality, the most important goals are: to prevent the soil harms, including compaction, to reduce the frequency of soil disturbance while still improving the soil mellowing processes and to form a soil and water conservation surface. Balancing the biological and tillage factors will provide the basis for soil conservation strategies and can help to harmonize the environment conservation with the demands of crop production. Land use, including tillage is well-adopted to the environment conservation, and the systems give improving and maintaining effects. It can be stressed that to adopt the soil quality improving or maintaining land use, the demand of the crops may be fulfilled with less energy and mechanical damage. The new aim of the land management is to create and to maintain a harmony between environment conservation and crop production to meet Hungarian needs throughout the future.

The monitoring survey of Hungarian land use patterns proves that different forms of land use can be found at present agriculture. The modern intensive and conventional forms are more than reasonable and integrated and modern extensive ones are less than predicted.



Both natural and land use induced water deficit is affected by soil quality condition and all of these may increase the harmful climatic impacts. The lack of water in soils connected with climatic extremities is needed to improve the land use systems.

Fourteen biological and tillage factors were selected to start the prevention steps and to summarise the fundamental requirements of the soil condition improvement and maintenance in an adequate land use system. The most important tasks for the future: 1. Avoiding the tillage-induced soil harms and alleviation of the existing faults. 2. Improving the soil structure and loading capacity by the organic material conservation. 3. Soil moisture management related to stubble residues mulching and decomposing. 4. Using soil and water conservation tillage. 5. Improve the soil biological state by crop rotation. 6. Harmonizing the possible machinery and site factors to reduce energy consumption thus to decrease the environmental load. 7. Maintain soil cultural condition approaching to the cultivated agricultural landscape.

#### LITERATURE

1. Birkás M., Percze A. et al. 2000: Evaluation of soil conservation depending on land use and soil tillage in Hungary. SPU Nitra, Zborn. z ved. konf. s medzinárodnou účasťou, 78-79.
2. Birkás M., Percze A. et al. 2001: Soil condition development and soil conservation. 37<sup>th</sup> Croatian Sympos. on Agr. with Internat. Participation. Opatija, Summaries, 13-15.
3. Birkás M., Szalai T., Gyuricza C. et al. 2002: Effects of the disk tillage on soil condition, crop yield and weed infestation. Rostlinná Vyroba, 48. 1. 20-26.
4. Birkás M. Gyuricza, C., Percze A., Ujj A. 2003: Soil condition impact on fertilization efficiency. II. Alps-Adria Scientific Workshop. Trogir, Croatia, Conf. Proc. (ed. C. Gyuricza), pp. 15-19.
5. Demo M. 2001: Soil tillage and crop production peculiarities in sustainable agricultural systems. In: Soil tillage in sustainable farming. Akaprint, Budapest, pp. 47-70.
6. ECAF 1999: Conservation Agriculture in Europe: Environmental, economic and EU policy perspectives. European Conservation Agricultural Federation, Brussels.
7. Jolánkai M., Birkás M. and Szalai T. 1997: Soil tillage influenced by the physical state of soil. Acta Agr. Hung., 45 (2) 155-161.
8. Kessel C. van, Wendroth O. 2001: Landscape research – exploring ecosystem processes and their relationships at different scales in space and time. Soil Till. Res, 58, 97-98.
9. Kismányoky T., Hoffmann, S., Tóth, Z. 1997: Long term effect of different soil tillage systems on crop yield and nitrate content of soil. Bibliotheca Fragmenta Agronomica, 2B, Proc. Puławy, Poland, 359-362.
10. Lacko-Bartošová M. et al. 1995: Ekologické poľnohospodárstvo. VES VŠP, Nitra.
11. Ruzsányi L., Pepó P. 1999. Interactions between crop production and environment quality. In: Crop Production and Environment. MTA Stratégiai kutatások az ezredfordulón.
12. Tóth Z., Kismányoky T. 2001: Impacts of fertilization on organic matter content of soil and on agronomical structure in crop rotation and monoculture. Agrokémia és Talajtan, 50, 207-223.
13. Várallyay G. 1996: Hungarian soils sensitivity to degradation and compaction. Környezet és Tájjgazdálkodási Füzetek, 96/1. Pszicholingva, Szada, 15-30.
14. Veldkamp K., Kok K. et al. 2001: Multi-scale system approaches in agronomic research at the landscape level. Soil Till. Res, 58, 129-140.



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## **END USERS' PREFERENCES FOR JOINERY PRODUCTS AND FURNITURE**

**Abstract:** This paper deals with the determination of end user attitudes towards different ways of wood utilisation. The preferences of consumers for the selected wood properties in comparison with substitute materials were assessed for the area of joinery products and furniture used in households. The survey was carried out using a questionnaire survey of the selected sample in the Slovak Republic and in Poland. The research identified competitive properties of wood and compared preferences of consumers for wood in both countries.

### **INTRODUCTION**

Besides the non-production forest functions and a wide scale of services for society, the significance of forests is also in the raw wood material production. The way of roundwood from the forest to final consumer is quite long and many times it has to pass different levels of processing and different types of markets while it is used for the desired purposes. Wood and wood products can be wide applied at the different types of market, from large commodity markets (construction industry) to niche markets (musical instrument production). Wood passes through different levels, which are represented by the forest, primary forest industry, secondary forest industry, relating sectors using wood for their production and finally reaches the final consumers.

Wood and wood products demand is derived demand in terms of the way how it is created and it depends on the final wood products demand (e.g. beech round timber demand is derived from the beech furniture demand). If the final products demand is increasing the demand for the production inputs (intermediate products) is increasing too. At the same time with the wood products demand there is a demand for the competitive products. In relation to wood the competitive products take a position of substitutes. The main feature of the substitutive materials is that they can satisfy the same needs and the buyers (purchaser) and consumers have the possibility to choose among them according to their individual preferences. One of the main conditions of substitution is the technical compatibility of the materials and price level of substitutes.

Competitive advantages of wood can be found in its properties. However, these properties are specific to any particular use of wood or wood products. One may prefer wooden furniture to plastic one because of nature of the material as well as ecological and aesthetic properties. On the other hand, wood as building material will be used because of its durability and other mechanical and physical properties. Taking into account the different properties of wood (stability, durability, aesthetic properties, ecologic properties, renewable resource, etc.) there are different possibilities for wood utilisation and a different number of competitive (substitutive) products and materials existing on each of the markets. A real technical compatibility and possibility to meet the same needs and expectations of consumers are the basic precondition for products substitution. Optimally, substitution process in each market sector should to be evaluated individually. Such an approach would allow to identify the factors and trends within each market sector and to recognise whether the wood products are the "winners" or "losers" in the competitive fight.

The objective of this paper is to determine attitudes of end users towards different ways of wood utilisation in Slovakia and Poland. This determination is based on the evaluation of

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consumers' preferences for the selected wood properties in comparison with substitute materials for the selected area of wood use.

## METHODOLOGY

A prior to the questionnaire survey it was necessary to determine main end uses of wood and characteristic properties of wood products within each of these groups. The following products groups were identified:

- windows, doors, flooring, wall facing,
- furniture,
- buildings and building material,
- paper a paperboard as packaging material,
- energetic use of wood and wooden biomass.

For this particular research the results of two first groups only i.e. windows, doors, flooring, wall facing and furniture are presented.

Based on an extensive literature review covering a broad scope of scientific, expert and popular literature it was able to determine a number of properties for each area of wood use. Such properties represented physical, hygienic, utility, aesthetic, ecological, environmental, quality and other properties of wood and its substitutes specifically for each product category. The identified properties are important from the point of end users decision making when choosing between the wood products and their competitive products from non-wood materials. In addition, the basic demographic data of respondents were proposed to be collected: gender, age, completed education and net income per month.

The questionnaire was distributed in Slovakia and Poland, covering 625 and 114 respondents, respectively. Non-probability sampling was used. The introductory part of the questionnaire contained instructions for respondents. The questionnaire body included 5 tables, each for the respective area of wood use (product category). Each table contained selected properties of wood and non-wood products. The last part consisted of demographic data. We used closed, semi-closed and open questions. Semi-closed questioned were used to allow respondents to identify their own product properties.

Data collected in the survey were coded and table arranged. A frequency analysis was used to evaluate the data.

## RESULTS

In Slovakia, men represented 41.8% of respondents. As for the age structure, over 48% of respondents was between 26-60 years of age. Over 72% concluded secondary and 22% university education. More than 44% earns 350-700 EUR per month and over 38% up to 350 EUR per month.

The Polish sample of respondents was represented by 60% of men. Over 56% of respondents were at the age of 26-60 years. More than 57% concluded secondary and more than 37% university education. More than 27% earns up to 350 EUR, 42% between 350-700 EUR and 30% over 700 EUR per month.

The relative frequencies are shown in table 1. Answers not relevant to the particular product group are marked by n/a. The missing percentage indicates that the question was not answered by respondents.

In general, respondents in both countries prefer wooden windows, doors, flooring and wall facing to the competitive non-wood products. The most preferred properties of wood in comparison to other non-wood materials are the ecological use of wood, its environmental appropriateness, renewability and naturalness of wood. Ecological use is connected to the ability of wood to be recycled, repeatedly used, etc. Environmental appropriateness of wood relates to low environmental loads and disposals, lower emission of pollutants etc. Renewability of wood material is linked to its ability to be renewed without significant endeavour of people. Wooden joinery products gain other



significant preferences also for their traditions, naturalness of the material and the fact that wood contributes to the creation of enjoyable atmosphere and comfort. Health and safety properties of wood as a material are also important features considered by the end users. On the other hand, non-wood windows, floors, doors are preferred because of their resistance to fire and pets as well as their durability, endurance, and firmness of the material. Similarly, over 73% of Slovak respondent would prefer wooden products because of their fire resistance, while in Poland it is only 50%.

Taking into consideration differences between the Slovak and Polish respondents, it can be said that the prevailing number of properties is similarly preferred for wooden windows, doors, flooring and wall facing in both countries. However, properties such as sound insulation properties relating to noise elimination and acoustic properties, fire resistance and durability of material are perceived differently in Slovakia and Poland. Only 36.8% of the Slovak respondents would prefer wooden windows because of its insulation properties, while in Poland more than 80% of the observed sample would prefer wooden windows and doors to other non-wood products in order to eliminate noise. The last significant differences can be found in considering durability, endurance and firmness of wood used for windows and doors manufacturing as 27.5% of the Slovak respondents and 53.5% of the Polish respondents would prefer wood because of their mechanical and physical properties.

Table 1. The results

Material properties	Windows, doors, flooring, wall facing				Furniture			
	SK		PL		SK		PL	
	Wooden	Other non-wood materials	Wooden	Other non-wood materials	Wooden	Other non-wood materials	Wooden	Other non-wood materials
	in %							
Versatility of product use	n/a	n/a	n/a	n/a	65,9	32,2	80,7	19,3
Material contributes to the creation of enjoyable atmosphere in a room	88,2	8,6	98,2	1,7	94,9	4,2	99,1	0,9
Heat insulation properties	65,4	34,4	68,4	31,6	n/a	n/a	n/a	n/a
Natural defects of material	53,4	43,0	63,2	36,8	61,9	33,9	71,0	29,0
Aesthetic properties	79,0	20,5	77,2	22,8	80,5	18,2	98,2	1,8
Sound insulation properties	36,8	59,4	80,7	19,3	n/a	n/a	n/a	n/a
Ecological use of material	95,0	3,5	87,7	12,3	88,2	9,0	88,6	11,4
Fire resistance	17,1	73,6	48,2	50,0	17,0	74,4	31,6	68,4
Durability, endurance, resistance (firmness) of material	27,5	69,0	53,5	45,6	36,6	60,5	57,9	42,1
Easy renovation	62,4	34,4	71,0	29,0	72,0	26,0	75,4	23,7
Health and safety properties of material	89,4	7,8	94,7	1,8	89,4	8,3	100,0	0
Environmental appropriateness of material	96,2	2,2	100,0	0	95,8	2,7	100,0	0
Renewability of material	93,0	5,3	98,2	1,7	93,8	4,5	100,0	0
Naturalness of material	95,2	2,7	99,1	0,9	91,7	6,4	100,0	0
Material is unique	79,8	14,4	85,1	14,9	81,4	13,6	97,4	2,6
Tradition in material use	87,0	6,2	92,1	7,9	93,1	2,7	100,0	0
Resistance against pets	3,4	95,0	0,9	99,1	3,8	94,9	0	100,0

Similarly, most of the properties of wood are preferred in furniture products to other materials used for furniture manufacturing. End users prefer wooden furniture mainly for its health and safety properties, environmental appropriateness, renewability and naturalness of wood. Wooden furniture contributes to the creation of enjoyable atmosphere and comfort in homes. Traditional use of wood in furniture making is also considered to be a significant feature. According to the respondents, fire resistance and resistance against pets are properties in favour of substitution materials.

Taking into account differences in both countries, preferences for wooden furniture are similar to those in joinery products. The main differences can be also found in considering fire resistance and durability of wood material. Generally, higher percentage of Polish respondents would prefer wooden furniture to other materials when these two properties are considered.

Without testing the relations in results between the two product groups (joinery products and furniture) and two countries (Slovakia and Poland) it is not possible to define significant differences.

## CONCLUSION

The properties of wood and wood products are important for end users to make decision when purchasing such products. The objective of this paper was to determine attitudes of end users towards different ways of wood utilisation in Slovakia and Poland based on the evaluation of consumers' preferences for the selected wood properties in comparison with substitute materials for joinery products and furniture. For both product groups and in both countries wood is preferred to non-wood materials principally because of its ecological properties, environmental appropriateness, renewability and naturalness as well as traditions and health and safety properties. The presented results are part of a more extensive research. Additional results can be gained by using multi-criteria statistical analyses to identified significant wood properties and relations.

## REFERENCES

1. Paluš H., Maťová H., Blažková H., Kaputa V., Parobek J. 2011: Metodický postup prieskumu spotrebiteľských preferencií k výrobkom z dreva. In Marketing a obchod 2011. CD ROM. Bratia Sabovci 2011.s. 221-226 ,ISBN 978-80-89241-41-5.
2. Paluš H. 2002: Modelovanie dopytu po výrobkoch z dreva na trhu v SR. Vedecká štúdia 3/2002/A. Zvolen. TU, 2002. 49 s. ISBN 80-228-1153-X.
3. Paluš H. 2010: Obchod s drevom a výrobkami z dreva. Vyd. II-2010. Zvolen. TU 2010. 112 s. ISBN 978-80-228-2092-9.
4. Šupín M. 2006: International market selection for the small and medium-sized wood processing enterprises. In Intercathedra 2006, ISSN 1640-3622, No 22, p. 169-172.
5. Šupín M. 2009: Megatrendy vo vývoji svetového hospodárstva a možnosti Slovenskej republiky zmäkčiť dôsledky hospodárskej krízy. Mikuláš Šupín. In: Marketing a obchod: vplyv hospodárskej krízy na marketing a obchod. Zvolen. Bratia Sabovci 2009. ISBN 978-80-89241-33-0. s. 5-8.

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## CREATION STANDARDS FOR W3C WEB SITES USED IN WOOD SECTOR PORTALS AND VORTALS IN POLAND

**Abstract:** In this study were introduced standardisation organisations working on the needs of Internet. and presented the basic script technologies used to building of web pages for which exist standards defined by the organization W3C. It shows a short profile of portals and the vortals from the wood industry, which were chosen and analysed. The main part of this paper is the analysis of compliance of technologies used to the building of these services with standards, which were defined by W3C organization. This article contains the synthetic discussion of got results and recapitulation and short recapitulation too.

**Key words:** W3C standards, website development technologies, wood industry, internet portal and vortal

### 1. INTRODUCTION

Over several years, the Internet has transformed from ‘the information society phenomenon’, as it was called a dozen years ago, into a permanent element of everyday life. Using the Internet is just necessary, and not only suggested. Internet is a global network used by people from different countries and different cultures and speaking different languages. This fact is the reason for the permanently increasing importance of standardisation for communication tools, www sites being a perfect example thereof. This paper concentrates on compliance of script technologies applied for designing wood sector web sites, with standards.

### 2. STANDARDISATION ORGANISATIONS IN THE INTERNET

In the internet, not a single standard is valid, which would be imposed by any body<sup>13</sup>. Yet, in practice, several organisations are active determining Internet operation specifications and standards. Besides W3C, such best known bodies are:

- ISO (International Organization for Standardisation) - A non-governmental organisation for local standardisation bodies. ISO members are not delegated by governments despite some ISO member organisation being incorporated in government structures. Strategic decisions are made by the General Assembly during its annual meetings.
- IETF (Internet Engineering Task Force) - An informal international society of individuals interested in determination of technical and organisational standards for the Internet. The IETF does not dispose of any formal power, still, it is just the IETF work outcomes that have decisive effects on the future Internet shape. The IETF generates a special set of documents, so-called RFC (Request For Comments) containing the entire Internet wisdom in questions and answers, which means: - technical and organisational standards creating this network. The IETF is open for new participants, any interested individual may access. Document standardisation in the Internet is an issue of a high importance. As in the entire information technology, documents in the Internet must be interpreted unambiguously. No room for any conjecture as to the document content. Standards for script technologies as applied for construction of web sites are worked out by the W3C organisation shown below.

### 3. WORLD WIDE WEB CONSORTIUM – W3C

This organisation is active in the area of determination of standards for construction of WWW sites, transmission, and interpretation thereof by browsers. The organisation was founded 1994 by

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<sup>13</sup> The only standard adopted as required and commonly used on the Internet is the set of TCP/IP protocols. Without this protocol support installed, computers can not connect with Internet.

Tim Berners-Lee, the originator of WWW services who also created the very first Internet browser. At present, the W3C member list contains more than 400 organisations, companies, governmental agencies, and universities from all over the world. The W3C is divided into numerous discussion teams for defined tasks. Teams are composed of experts from W3C members, whereas members are companies and all types of organisations interested in the establishment of the standard involved. Standards (called „recommendations”) published by the W3C have no legal power, which could impose the use thereof but the very influence of the organisation can not be omitted. The organisation makes available tools for verifying the code (HTML, XML, CSS) compliance with the defined standard. Such tools were applied for carrying out the analysis used in this paper.

#### 4. CHARACTERISTICS OF TECHNOLOGIES UNDER ANALYSIS

##### 4.1. HTML

This language is listed among the oldest technologies designed for website construction. As such, HTML is the basic and commonly applied technology. HTML consists of markup tags: commands in angle brackets such as <A>, with parameters added. HTML is an interpreted language: the browser displays (builds) the web site based on markup tags, by their sequence in the file describing the involved site. HTML has a specific feature: errors are not generated - that statement is false for all the other programming languages. Any error in the HTML code is ignored<sup>14</sup>. That feature makes influence on the content of the displayed page, but does not give reason to stop displaying. HTML (Hypertext Markup Language) is a document description language - a set of markup tags describing the document structure as well as object location and formatting within the site. Besides, HTML is independent of the equipment and software platform. A site-describing file is an ordinary text file - that is the reason that the file can be edited in any text editor. At present, the HTML standard<sup>15</sup> is not under development because the work concentrates on XHTML, with the new HTML version complying with the XML specification<sup>16</sup>. A conclusion can be drawn that a majority of individuals creating their own web sites started their Internet adventure a similar way - from learning the HTML programming software.

##### 4.2. XHTML

The XHTML (Extensible Hypertext Markup Language) specification does not contain any markup tag. The specification only defines the amendments necessary for a HTML document in order to convert it into a XHTML document. In practice, a number of differences exist: formal requirements, including the necessity to write markup tag names with small letters only, and quotation marks for names. Documents written in XHTML must be univocally and with no problem interpretable by other users, that is why they require so-called „validation” - a verification whether they really comply with the specification. Such validation is in every user’s interest because this standard is widely used for e-commerce (e.g. web stores). The specification defines three language dialects: strict, transitional, frameset (as for HTML). The transitional<sup>17</sup> dialect accepts element names written with small letters or capital letters; quotation marks for attribute values are optional as closing some elements is. The strict dialect is more restrictive than the transitional dialect. The requirement list for strict dialect includes: closing of all the elements listed as „closing optional”, double quotation marks for attribute values, correct element embedding, and avoiding elements applied for visual text formatting (colours, fonts types, bold characters, italics, etc. - those effects should be obtained with application of CSS). Frameset - the third dialect - is only used for building the warp for documents created with frames. At present, two standards have been defined: XHTML

<sup>14</sup> Niederst J.: *Tworzenie stron WWW*. Wydawnictwo Helion, Gliwice 2002.

<sup>15</sup> <http://www.knowmore.pl/internet/html5-nowy-standard> 24.04.2010.

<sup>16</sup> XML (eXtensible Markup Language) – another standard developed by W3C. Instead of applying defined markup tags, designers may create own markup tags with any name. That is the place of origin for XML power and universality as the format for easy storage of any data.

<sup>17</sup> In Table 1, this dialect is marked as ‘Trans.’



1.0, XHTML 1.1, with the first one applied nearly nearly in all cases. Work is under way from 2006 on the specification version 2.0<sup>18</sup> - so far, no official standard has been published<sup>19</sup>.

#### 4.3. CSS

CSS, or Cascade Style Sheets allow site designers to use typographic styles and instructions for site elements. The sheets allow to determine traditional attributes such as font size, line spacing, character spacing. Besides, style sheets provide with determination methods for margin indents and element positions. A single style sheet can be connected with numerous HTML sites - this solution guarantees that one modification is effective for each copy of the involved element on just one site but also can be effective for hundreds or thousands of sites<sup>20</sup>. The cascade style sheet designers had an objective of connecting a flexible www site style control method and single elements within sites on one side with a correct style hierarchy on the other side<sup>21</sup>. At present, CSS version 2 is valid und used.

### 5. CHARACTERISTICS WEB SERVICES FROM THE WOOD SECTOR

Polish web services dedicated to the wood sector issues have a specific feature: a majority of those services belong to wood manufacturers or commercial companies (wood trading companies). Lately, the Internet has increased its importance because it has become a valuable potential information source for both customers for wood services and products, and for wood technology students. This paper concentrates on a part of those services: portals and vortals. The following portals and vortals were selected for analysis: [www.edrewno.pl](http://www.edrewno.pl); [www.drewno.pl](http://www.drewno.pl); [www.drzewny.pl](http://www.drzewny.pl); [www.drzewnictwo.pl](http://www.drzewnictwo.pl); [www.drzewnictwo.com.pl](http://www.drzewnictwo.com.pl); [www.gieldadrzewna.pl](http://www.gieldadrzewna.pl); [www.kurierdrzewny.pl](http://www.kurierdrzewny.pl); [www.przemysldrzewny.pl](http://www.przemysldrzewny.pl); [www.stolarstwo.pl](http://www.stolarstwo.pl); [www.tartaki.com.pl](http://www.tartaki.com.pl).

Those portals and vortals were analysed for compliance of the applied technologies with W3C standards.

### 6. ANALYSIS OF SCRIPT TECHNOLOGY COMPLIANCE WITH W3C STANDARDS

The table below contains the analysis of code used in wood sector portals and vortals: compliance of script technologies with W3C-defined standards. The analysis was made based on validators available from: <http://validator.w3.org> for HTML/XHTML compliance, and <http://jigsaw.w3.org/css-validator> - for CSS compliance.

The compliance criterion was the number of errors and suggestions<sup>22</sup> reported by validators for the sites under analysis. The analysis concentrated on source codes for web sites belonging to bathroom furniture manufacturers. In case of HTML and XHTML, codes were compared to the standard listed in the table; in case of CSS, the CSS2 standard was the reference point. The table 1 shows the status of July 2010, when the analysis was made.

The wood sector portals and vortals under analysis were specific for, on one hand: a high differentiation of their compliance level, and on the other hand: a low differentiation of standard versions that their codes were compliant with. It was only for one site and for CSS that the source code was entirely compliant with the respective standard. This status should be ranked unsatisfactory. Not a single site was built with HTML applied. Nevertheless, all sites stated 'XHTML compliance' but the actual compliance level was not high. None of the sites met all requirements of the involved standard. Among 10 (ten) sites under analysis, 2 (two) were prepared applying a different standard than XHTML 1.0 Transitional (one site applied XHTML 1.0 Strict, and one site applied XHTML 1.1). The highest compliance level was that of the [www.edrewno.pl](http://www.edrewno.pl)

<sup>18</sup> Description can be found at [www.w3.org/xhtml2](http://www.w3.org/xhtml2) - (status of July 2010).

<sup>19</sup> The 2.0 standard introduces numerous solutions resulting in incompatibility thereof with earlier versions.

<sup>20</sup> Niederst J.: *Tworzenie stron WWW*. Wydawnictwo Helion, Gliwice, 2002.

<sup>21</sup> Crowder D., Crowder R.: *Tworzenie stron WWW*. Wydawnictwo Helion, Gliwice 2003.

<sup>22</sup> Both in their English version and Polish version, validators (in particular CCS validators) reported 'errors' and 'warnings' indicating departures from the standard. In this paper, 'warnings' are called 'suggestions' because in the presented sites, validators suggested ways to remove the incorrect structures.



site. Undisputably, [www.przemysldrzewny.pl](http://www.przemysldrzewny.pl) ranked lowest. For this site, the 'XHTML compliance' category reported 1300 errors and 1100 suggestions. This situation should be understood as designers' negligence.

Table 1: Compliance of script technologies with W3C standards for selected web sites.

Site address	Compliance with standard				
	HTML, XHTML			CSS	
	Stated compliance	Errors	Suggestions	Errors	Suggestions
<a href="http://www.edrewno.pl">www.edrewno.pl</a>	XHTML 1.0 Trans.	8	0	11	124
<a href="http://www.drewno.pl">www.drewno.pl</a>	XHTML 1.0 Strict	38	14	33	2169
<a href="http://www.drzewny.pl">www.drzewny.pl</a>	XHTML 1.1	776	154	42	86
<a href="http://www.drzewnictwo.pl">www.drzewnictwo.pl</a>	XHTML 1.0 Trans	84	22	6	180
<a href="http://www.drzewnictwo.com.pl">www.drzewnictwo.com.pl</a>	XHTML 1.0 Trans	2	2	35	525
<a href="http://www.gieldarzewna.pl">www.gieldarzewna.pl</a>	XHTML 1.0 Trans	10	0	19	187
<a href="http://www.kurierdrzewny.pl">www.kurierdrzewny.pl</a>	XHTML 1.0 Trans	36	3	full compliance	
<a href="http://www.przemysldrzewny.pl">www.przemysldrzewny.pl</a>	XHTML 1.0 Trans	1316	1100	62	1627
<a href="http://www.stolarstwo.pl">www.stolarstwo.pl</a>	XHTML 1.0 Trans	77	4	25	845
<a href="http://www.tartaki.com.pl">www.tartaki.com.pl</a>	XHTML 1.0 Trans	17	8	185	362

Source: own research

## 7. CONCLUSION

The portals and vortals were designed with application of up-to-date XHTML and CSS script technologies. Unfortunately, those sites rank low for compliance with the script standards applied. Not a single site could prove a full XHTML compatibility. Just one site was CSS compliant. Wood sector web site designers still have a lot of work to do before the sites are compliant with the standards.

## 8. LITERATURE

1. Niederst J.: Tworzenie stron WWW. Helion, Gliwice 2002.
2. Crowder D., Crowder R.: Tworzenie stron WWW, Helion Gliwice 2003.

*Miriám Pekarčíková, Peter Trebuňa<sup>23</sup>*

## TRENDS IN DESIGN OF DISMANTLING WORKPLACE

**Abstract:** The process of dismantling the design process is a complex set of overlapping activities which require knowledge and individual approach designer. article discusses trends in the design of the dismantling process, based on the knowledge base for designing of the assembly processes.

**Key words:** process, design, dismantling, workplace, trend.

Dismantling operations are carried out on dismantling workplace that is created as a separate unit or part of dismantling the line.

Dismantling workplace is a set of dismantling equipment, handling and transport equipment, dismantling tools, plant. It also includes inputs and outputs of the process of dismantling and workers who provide for the dismantling of the whole process at the level of execution (by hand, operation of equipment or a combination) and control. The elements of the dismantling work (as

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well as offices in the dismantling lines) are linked material, information and functional ties, which form a unified and closed system.

Depending on the nature of the workplace is properly secured and logistically equipped with the necessary means of dismantling (disassembly machines, equipment, tools, fixtures, containers, etc.) That allows the execution of individual actions in dismantling operations.

Dismantling process begins with preparation for dismantling (placing on the dismantling table, cleaning of oil and dust), continues with its own dismantling and ends with the control (visual inspection, measurement, decision on use of parts, storage, recycling, disposal). The dismantling process is not only technological and service activities, as well as ancillary activities. The logical structure of each activity may be a variant and depends on the specific application dismantling the product. Basic disassembly functions are shown in Fig. 1<sup>st</sup>.

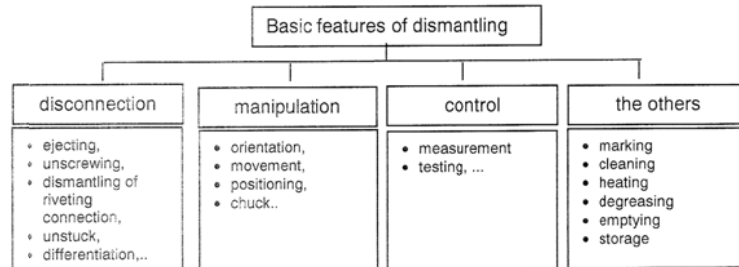


Figure 1. Basic features of dismantling

Organization of the dismantling process depends primarily on the objective of disassembly, whether it is a material (complete destruction), or product recycling (of components).

Secondly, it depends on the nature of the (relatively homogeneous or heterogeneous range of input), the amount of processed WEEE.

From these assumptions, then shows how the organization (automation) and the layout of workplaces. department, staffing (staff qualifications, their number) equipment of workplace (tools, equipment, fixtures, energy supply, conveyors, tanks etc.)

Significant impact on the implementation of the dismantling process has automation. Depending on the degree of automation can be distinguished:

- manual dismantling
- partially automated (mechanized, hybrid), disassembly,
- automated disassembly,
- automatic removal.

#### **Manual dismantling**

It is traditional, in some cases, technically and economically necessary way of dismantling products. It is used mainly energy and force the hand of the worker. As a manual removal are also considered such activities by making use of mechanized tools (in less than a third of the dismantling activities). Characteristic for manual disassembly is [2]:

- use simple preparations
- use the universal dismantling tools
- identification of connectors,
- simple handling products, dismantled nodes, components and materials,
- ergonomically optimal job worker (armrests, foot support, etc.).

A dismantling worker should be aware of the nature and hazardous properties of the dismantled components and should be trained for the safely and effectively removed of a given product. For

manual removal it is necessary to adapt the dismantling workplace and equip them the necessary tools, labor and means of protection (Fig. 2).

### Partially automated

By the hybrid removing are used a non-motor and motor tools, fixtures and assembly units. Individual dismantling workplaces are usually linked with the transport system (conveyor). Other characteristics are similar as by the manual process of dismantling

### Automated disassembly

The hallmark of automated disassembly is that each primary and auxiliary dismantling activities are carried out by automated dismantling equipment (use of automated machinery, lines, offices are linked conveyor systems). Dismantling equipment are operated and managed. The role of humans is limited to supervision of dismantling facilities and the decision-making functions. [1]

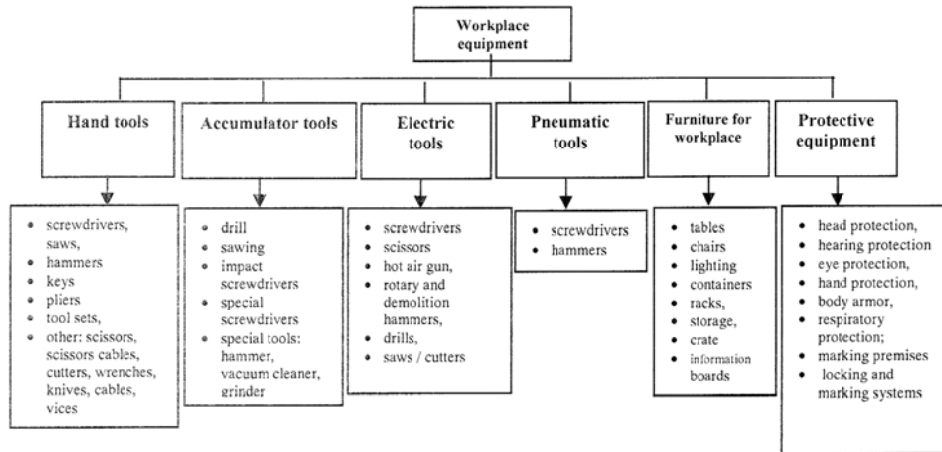


Figure 2 Securing of the workplace with tools, materials and plant

Automated (or semi-automated) disassembly process will be necessity in the near future due to rapidly increasing amount of world WEEE.

Problematic, however, in connection with the implementation of automation seems transport and concentration of sufficient quantities of one type of products in one place. Thus, it is necessary to dismantle a number of structurally diverse products in one place.

In the designing of the dismantling workplace should be taken into account ergonomic aspects as well. Set of conditions for design optimization in terms of ergonomic workstations represent the following basic requirements (imposed on this type of work):

- transparency - the optimal visual conditions,
- convenience - of appropriate size workspace physiologically appropriate working movements, adequate mental and physical burden
- orderliness - in relation to human well placed equipment, handling equipment, containers,
- hygiene - best lighting and visibility, optimal acoustic, climatic conditions, providing protection against hazardous and harmful substances, radiation and vibration.
- security - protection against accidents, safe access and escape from the workplace,
- aesthetic requirements.

In the designing of the dismantling facility is considered an effective dismantling of the creation of a modular system. This is a very flexible and efficient way of creating a new department as well as expansion of existing departments, in terms of simplicity, variability and quality design. It is a way to integrate new parts into existing system. Modules to be arranged so, that outputs of one

module are inputs to the next module. In each module, then runs a specific operation of dismantling process.

The modular approach is used mostly in the implementation of small and partly automated disassembly. Benefits from the application of a modular approach are as follows [11]:

- possibility of creating purpose-oriented departments and systems with optimal parameters, given the particular application conditions,
- multiple use of already developed and validated elements and units;
- reducing the cost of construction and design work,
- the possibility of rapidly obtaining derived modifications
- simpler and more flexible transition to other dismantling tasks
- reducing the cost of production and maintenance
- increase the serial and repeatability
- possible extension of new features and units,
- a high variation in solutions.

## CONCLUSION

Development of removal is an important way to deal WEEE, especially since in the case of recycling of materials allowing their recovery. Create an optimal model of the process of dismantling and adequate logistic support is fundamental determinants of dismantling performance. Projection the dismantling procedures includes the creation of optimal and economic solution and its implementation in dismantling the system. Demands placed on project activities related to the dismantling process modeling are based on a wide range of applicable disciplines, methods and tools.

## LITERATURE

- [1] Goosey M., Kellner R.: A Scoping Study End-of-Life Printed Circuit Boards, Supported by Department of Trade and Industry Intellect and Shipley Europe Limited, UK 2002. [www.cfsd.org.uk/seeba/TD/reports/PCB\\_Study.pdf](http://www.cfsd.org.uk/seeba/TD/reports/PCB_Study.pdf).
- [2] Kováč J., Svoboda M., Líška O.: Automatizovaná a pružná montáž. Vienaľa, Košice, 2000.
- [3] Lambert A.J.D., Gupta S.M.: Disassembly Modeling for Assembly, Maintenance, Reuse and Recycling. CRC Press, 2005. Florida, USA. ISBN 1-57444-334-8.
- [4] Willmann, CH.: Recycling Leitfaden für Produktentwickler, Diplomarbeit, Technische universität Darmstadt, 2002. [www.recyclingleitfaden.c-willmann.de/Anhang/DA\\_Willmann.pdf](http://www.recyclingleitfaden.c-willmann.de/Anhang/DA_Willmann.pdf).
- [5] Lorincová D., Brezinová J.: Analýza návarov v procese erozívneho opotrebenia. In: Transfer inovácií. č. 15 (2009), ISSN 1337-7094. [www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/15-2009/pdf/188-191.pdf](http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/15-2009/pdf/188-191.pdf).
- [6] Trebuňa P.: Projektovanie výroby integrované optimálnym systémom hmotných tokov. In: Transfer inovácií. č. 11 (2008), s. 184-186. [www.sjf.tuke.sk/transferinova\\_cii/pages/archiv/transfer/11-2008/pdf/184-186.pdf](http://www.sjf.tuke.sk/transferinova_cii/pages/archiv/transfer/11-2008/pdf/184-186.pdf). ISBN 978-80-8073-832-7.
- [7] Ručinská S., Ručinský R.: Inovácie a investície ako vybrané predpoklady konkurencieschopnosti regiónu. In: Regionalistické perspektívy. Lučenec2008.
- [8] Pekarčíková M.: Implementácia inovačných nástrojov tvorby logistických modelov demontážnych procesov. Dizertačná práca SJF TU v Košiciach, 2008.
- [9] Trebuňa P.: Kategorizácia a definovanie podnikovej logistiky. In: Transfer inovácií. č. 11 (2008), s. 187-190. [www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/11-2008/pdf/187-190.pdf](http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/11-2008/pdf/187-190.pdf). ISSN 1337-7094.
- [10] Malák M.: Uplatnenie sieťovej analýzy pri TPV, In.: Transfer inovácií. Č. 19 (2011), ISSN 1337-7094.

- [11] Malega P.: Effectiveness of production as a key indicator. In: Elektronický časopis Transfer inovácií č. 10, Košice, 2007, s. 48-50, ISBN 80-8073-461-5
- [12] Varga V.: Typové riešenia modulových montážnych pracovísk. In: Transfer inovácií. č. 2 (2000). s. 78-80. Internet: [www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/2-2000/pdf/78-80.pdf](http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/2-2000/pdf/78-80.pdf).
- [13] [www.greenpeace.org/raw/content/slovakia/press/reports/vyhlasaka\\_elektroodpad.pdf](http://www.greenpeace.org/raw/content/slovakia/press/reports/vyhlasaka_elektroodpad.pdf).
- [14] [www.ietc.unep.or.jp/ietc/Publications/spc/EWasteManual\\_Vol1.pdf](http://www.ietc.unep.or.jp/ietc/Publications/spc/EWasteManual_Vol1.pdf)
- [15] [www.ietc.unep.or.jp/ietc/Publications/spc/EWasteManual\\_Vol2.pdf](http://www.ietc.unep.or.jp/ietc/Publications/spc/EWasteManual_Vol2.pdf)
- [16] [www.industryweek.com/ReadArticle.aspx?ArticleID=9223](http://www.industryweek.com/ReadArticle.aspx?ArticleID=9223)
- [17] [www.ipaslovakia.sk/slovník.aspx](http://www.ipaslovakia.sk/slovník.aspx)

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**Rastislav Rajnoha<sup>24</sup>**

## **BUSINESS PERFORMANCE MANAGEMENT – VALUE STREAM MAPPING AND COSTING METHODOLOGY IN WOOD INDUSTRY COMPANY**

**Abstract:** Paper describes one innovate access to the right calculation of the production performance and production costs. It offers a transparent way, how to calculate the lean indicators in the real industrial production. Traditional companies use standard costing as the primary method of production costs control process. Today's production environment enables a vitally mechanism in the area of monitoring of real production costs, because all types of wastes are undesirable and the motivation to cost decreasing is in according to the productivity improvement, higher efficiency and respectable cost level very important. This paper presents one of the most effective tools for enterprise processes cost reduction – value stream mapping and costing. This tool enables by lean metrics to improve not only the cost structure, but the system of cost calculation as a system for higher process profitability too.

**Keywords:** costing, lean production, performance management, value, value stream mapping

### **INTRODUCTION**

The standard costing allocates all overheads to the product and these overheads relate to the amount of labor required to make the product. Some products appear to cost more than they really do and other products appear to cost less. These costs mislead people and cause them to make wrong decisions relating to pricing, profitability, make/buy and others. By this fact it doesn't motivate to lean behavior in production operations. Traditional companies use standard costing as the primary method of production costs control process.

Today's production environment enables a vitally mechanism in the area of monitoring of real production costs, because all types of wastes are undesirable and the motivation to cost decreasing is in according to the productivity improvement, higher efficiency and respectable cost level very important. The cost of the product varies according to the product volume and production mix,

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overhead costs are related to the value stream as a whole and the maximum profitability comes from the maximum production flow through the value stream.

In a competitive environment a firm must be able complexly to eliminate the non-value-added activities and to increase the number of value-added activities, especially from the customer profitability site. When we speak about sources of the non-added value activities, we mean on: producing to build up inventory, waiting for processing, spending time and effort to move products from place to place, transporting workers to work sites, producing defective products, realized administrative processes with small efficiency, etc.

Value Stream Costing is the continual effort that allows firm to achieve a lean status.

## 1. VALUE STREAM MAPPING AND COSTING METHODOLOGY

Value Stream Costing is than a suitable method, how to detect all necessary characteristics of the value stream in the company and consequently to use these data scans for monitoring and optimization of the production flows and costs.

Value Stream Costing is based on two key processes:

- monitoring of the real (actual) value stream process,
- monitoring of the future state of the value stream.

Through value stream mapping can identify continued opportunities to enhance value, eliminate waste, and improve flow.

Production process is a stream of activities, which must be full realised, in according to the goal achievement – a final product. Right processing of the product is a basic assumption of the possibility to make some improvements from the cost reduction point of view.

Construction framework of the Value Stream Costing:

- definition of the goal of cost reduction system and obtaining of the final estimation that is lower than standard cost, allocated to the value stream,
- continuously looking for a waste points, their comparison with existing production conditions in order to reduce costs in the whole value stream and (monitoring of the real state),
- definition of the costing target by each production step that produced on non satisfied added value level volume,
- implementation of the proposed targets to the value stream steps and evaluating of the future cost reduction contributions (monitoring of the future state).

As a final result we should obtain the two key monitoring indexes, that inform us about the Value Stream Profit (in Euro) and ROS (Return of Sales in %). If value stream reduces some inventory (material, machine hours, labor etc.) by selling more than it makes, the value stream will show a higher profit and a lower average unit cost.

The principal question there is the identification of the key drivers in the processes of firm value creation, especially the definition of productive and non-productive part of each realized process from the value-added point of view. In a competitive environment a firm must be able complexly to eliminate the non-value-added activities and to increase the number of value-added activities, especially from the customer profitability site.

When we speak about sources of the non-added value activities, we mean on:

- producing to build up inventory,
- spending time and effort to move products from place to place,
- transporting workers to work sites,
- waiting for processing,
- producing defective products,
- realized administrative processes with small efficiency, etc.

Value Stream oriented firms operate by the cost reduction principle (internal elimination of waste), produce the highest quality, meets quality – cost – delivery requirements. Value Stream Costing is the continual effort that allows firm to achieve a lean status.

The standard costing motivates non-lean behavior in processes and operations. The key measurements by standard costing system include the personal efficiency of production workers, the utilization of machines/equipment, and the amount of overhead absorbed by production units – or cost drivers. The production managers, supervisors and operators recognize these results, but they cannot to say, which level of profitability they just have by the “actual cost level”. They can use standard cost metrics. Standard costing allocates the overhead to the product, which evokes it, not to the process – this is the conflict and the impulse to change the standard costing for value stream costing.

The lean production and value stream costing means that the overhead and other costs are allocated direct to the value stream as a whole and not to the labors or other direct costs. The maximum of profitability comes from the productive production operations through the value stream at the pull of customer. The profit is primary dependent from the rapidity of process flow at the bottleneck operations within the value stream.

Value stream costing – is the mutual comparison of two basically parameters: productive (added value) and non-productive activities/cost drivers (non-added value). Principal question is the elimination of following activities - wastes:

- overproduction (a lot of purchase, inventory at the end of flow, bad production flow,...)
- inventory (bottlenecks, bad sale forecast, production planning, documentation - that nobody need etc.)
- waiting (acceptance of the purchase from the process/customer)
- unnecessary processes (transportation, jobs, service)
- corrections (“quality at the place and job”)
- workers (non ergonomically process, job standard)
- transport (information transfer, logistic)
- unusable worker (not physically by job, but his knowledge or skills).

### **1.1 CLASSIFICATION OF KEY PERFORMANCE METRICS BY VALUE STREAM COSTING**

Two key evaluation metrics will be used by the value stream costing in according to the monitoring of real production costs:

- LPI – Lean Performance Indicator – enables a measurement as a consistent way to determine the effectiveness of our firm lean efforts; this index can replace direct/indirect hour measurements,
- LMI – Lean Money Index – describes the effectiveness of the production performance in real time period.

In according with the LPI and LMI must be arrange, that the reporting must be not by departments, but direct by value stream, than the people in the company must be assigned to the value stream with little or no overlap, the production processes must be reasonably under control and have a low variability in time period and the inventories of all factors must be under control, relatively low, consistent.

The more important parameters of value stream costing are:

- cycle time, changeover time → output: gross throughput time,
- required time of equipment running → output: gross throughput time of product delivery to the customer,
- size of production entity → output: stocks size and processing size entities,
- number of workers → output: production entities amount,
- product variants number → output: value added index,
- amount of delivery losses → output: number of process steps, at which will be created the value for customer,
- working time /without interruptions/ → output: added and non added value of operation on worker, worker productivity,

- added and non added value of process step or activity,
- cost calculation of value stream improvement,
- number of non reduced wastes and the financial effects,
- equipment reliability quantification,
- continuous flow and pull production value.

## 1.2 VALUE STREAM COSTING AND BUSINESS PROCESSES VALUE ADDED METRICS

Calculation based on value added index (VAI) of processes is focused on surveying the value of total process cost flow (PCF) through production system for the total continuous production time and thus brings a real view of the total amount of process-generated costs by considering the actual tangible and intangible factors, participating on the production process.

Business process value added analysis is concentrated on surveying the costs of the entire value chain, i.e. since receiving production orders to sending the output to customers, and it strictly differentiates between costs incurred to generate added value and costs of non-productive, i.e. value-not-added activities and processes.

Economic Value Added (EVA) as the key performance indicator in business is not automatically generated only by a strategy appropriately designed and chosen. This just defines the way to achieve it provided that there is an interaction between the underlying factors of success; a positive change of EVA can only be optimized intentionally provided that it becomes aligned with the knowledge of real added value of business processes (Fig. 1). Combination of EVA and VAI brings a brand new viewpoint the process of economic efficiency management of business process by means of actually showing the price and profitability of business assets based on the knowledge of actual inclusion of a certain volume of assets into the production process, and on the other hand it assesses effectiveness of the use of these assets through their actual workload within a clearly defined total continuous production period. It points out the fact that economic profit in realization of a production plan can be significantly different depending on actual production profit achieved, primarily affected by total production system flow (Fig.1).

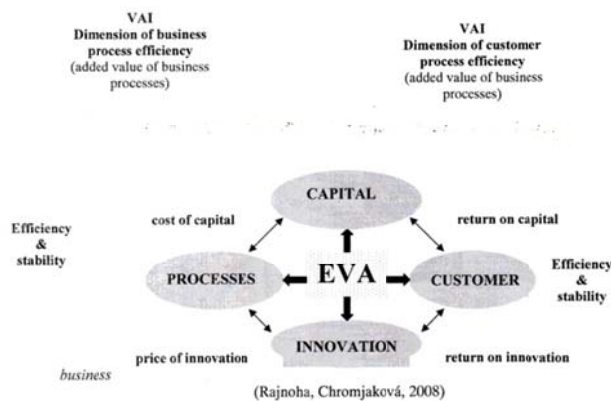


Figure 1. Two related dimensions of quantifying the value added in business

In connection with the quantification of business process added value based on VAI as a value added in the production process of the company the key problem is being solved - how to set up a production process flow to generate an optimum return of value stream.

Process cost flow (PCF) is defined as a total amount of process units which flow through the production system per time unit, but always in relation to a selected product representative – holder and not a complex portfolio included in the production programme. It reflects the flow of process costs which are represented e.g. by purchase costs, costs of technical preparation of production,



production organization and management, logistic processes, and on the other hand by cost flow associated with the product realized, such as material, labour and overhead costs in relation to the product representative - holder. Basic principle of process cost flow calculation is the fact that the production system input amount must be equal to the output amount, then the optimal profit of value flow at the level of 0 occurs. Theoretically, this means that the production value stream makes no inefficiency (e.g. excess inventory in store, excess time capacity of staff, poor operation layout, etc.). In real-world business experience, the figure is mostly in negative terms. The basic scheme for the calculation of the flow (PCF) is as follows:

$$PCF = \text{Process costs} + \text{Product costs} + \text{Value Stream Profit} \quad (1)$$

The need to increase the added value makes technologists, planners and managers in production, auxiliary, service as well as administrative processes, reflect on two crucial facts:

- what internal constraints occur in business processes, or is it possible to eliminate these constraints for the purpose of increasing the share of value added in the production process and increasing the efficiency of value stream?
- which of these constraints have a major impact on increasing the flow and consequently on improving the value stream profit?

Primary concentration on increasing the share of value added to the total continuous production time results in quantifying Value added index - VAI. Just the value added index indicates the level which we achieve current efficiency and effectiveness of flow:

$$\text{Value added index (VAI)} = \frac{\text{Time when the product is added value}}{\text{Total continuous time during which the product is created}} \quad (2)$$

VAI knowledge is particularly important because of the flexibility of value stream cost control within which the production system should generate the highest added value possible without unnecessary wasting – i.e. it is primarily used to eliminate non-productive activities and to support the productive or value-adding activities and processes.

## **2. PROPOSAL FOR A METHODOLOGY OF BUSINESS PROCESSES VALUE ADDED MANAGEMENT**

The text below points out the fact that the base for a comprehensive perception of the whole methodology is a proper understanding of the value stream throughout the process chain, i.e. the core of added value creation is not only presented by activities related to the processes themselves, but also resources supporting the implementation of these processes (capacity resources ready for use, delivery cycle of input, inventory of work in progress between processes, etc.). For the purpose of correct identification of the current value stream we will use the so-called Value Stream Mapping which clearly points to the specific context of value creation. Value stream is always oriented to one product – so-called product representative.

Value Stream Costing is primarily focused on monitoring the value created. The hallmark is division of costs into two basic categories:

- costs of the productive tree (i.e. value added),
- costs of the non-productive tree (i.e. value not added).

To assess the costs of value stream we define a variable indicator of so-called value stream profitability:

$$\text{Value Stream Profitability} = \text{Value Stream Income} - \text{Value Stream Costs} \quad (3)$$

Thus to calculate the value stream profitability it is crucial to know how much cost enters the stream, how much cost is consumed by the stream and what earnings emerge from the stream. In practice, to calculate the profitability we will use the two value stream maps – current value stream map and future value stream map, where the value stream profitability achieved will be compared on the basis of the value stream profitability improvements realized.

Value stream costing will be carried out in the following five steps (Chromjaková, Rajnoha 2007):



- product costing – calculation of costs, directly entering the product created by the stream; calculation of costs of work in progress ("stacks"),
- process costing – calculation of the amount of process costs caused by the active involvement of the process and its parts in product creation (material and labour costs of process of order acceptance, order preparation for production, organization of production, logistic processes and processes of communication with suppliers and customers, also process overhead costs are included which are counted as one unit for the entire value stream). The following process indicators are particularly relevant for the value stream costing:
  - total real disposable capacity of equipment for the value stream,
  - real daily capacity of equipment for the process,
  - time capacity for necessary technological breaks (casting, maintenance, other),
  - degree of equipment utilization,
  - cyclical time, claimed by the value stream for individual processes and activities with connection to the overall production volume which is assigned to the value stream,
  - cost of 1 process minute,
  - total costs of the process.

Value stream costing other costs – the calculation of costs which are necessary for realization of the value stream as a whole but until now have never been counted (e.g. quality control, maintenance, license fees, software, etc.). This includes all costs that are directly related with the value stream, they can not be directly determined on one piece of product / or one process within the value stream but are necessary for manufacture of the product – i.e. all inputs which have to be, in addition to direct material and wages, available before the process starts, so that the product could be produced (production overheads, tools, contents, externally supplied parts for the product and other costs directly necessary for making the product).

Customer demand costing – calculation of input costs for implementation of annual and daily customer orders:

- input costs: daily customer demand x total costs per unit,
- annual customer demand x total costs per unit.

Final Value Stream Costing – will result in a complex cost calculation based on knowledge of value added created in the value stream – flow size, flow gain, coverage contribution to the process, WIP, and so on.

The whole methodology is based on a comparison of VAI - value added index which was acquired through the value stream mapping and costing in two forms – current and future state of value stream. As a result of optimizing the value stream there is a radical reduction of supplies in stocks, buffer stocks, and a further improvement of the value added index by better management of inventories and production flow.

## SUMMARY

Value Stream Costing is modern tool to precise quantification of production costs, with respect of added and non-added value by separate production steps. It schedules the information about direct cost in the whole process and provides excellent performance measurement. As the presented contribution implies, for the purposes of business process efficiency management it is not sufficient to monitor and manage only the economic value added (EVA), it is necessary to simultaneously confront it with efficiency and value added to processes, calculated on the basis of the value added index (VAI) which maps the real value stream in complex business processes.

## LITERATURE

1. Horváth P. & Partner (2000): *Balanced Scorecard v praxi*. Stuttgart. Schäffer-Poeschel Verlag. ISBN 80-7259-018-9.

2. Chromjaková F., Rajnoha R. (2007): Value stream costing monitoring of real production costs. In: Improvement of quality regarding processes and materials. Wydawnictwo PTM, Warszawa. ISBN 978-83-924215-3-5.
3. Chromjaková F. (2008): Flexibilné riadenie nákladov vo výrobe. BPM Portál, Plzeň. ISSN 1802-5676.
4. Kaplan R.S., Norton, D.P. (1992): The balanced scorecard: measures that drive performance. In: Harvard Business Review. Boston. Harvard Business Publishing, Jan–Feb, pp. 71-79. ISSN 0017-8012.
5. Rajnoha R., Chromjaková F. (2008): Zvyšovanie konkurencieschopnosti firmy riadením ukazovateľa EVA. In: Nová teorie ekonomiky a managementu organizací. Zborník z medzinárodnej vedeckej konferencie. Vysoká škola ekonomická, Fakulta podnikovo hospodárska. Praha, s.90. ISBN 978-80-245-1408-6.
6. Rašner J., Rajnoha R. (2007): Nástroje riadenia efektívnosti podnikových procesov. Zvolen TU, 286 s. ISBN 978-80-228-1748-6.
7. Tuček D., Zámečník R. (2007): Řízení a hodnocení výkonnosti podnikových procesů v praxi. Zlín. Technická univerzita vo Zvolene, 206 s. ISBN 978-80-228-1796-7.
8. Vidová J. (2004): Konštrukcia ukazovateľa EVA v slovenskom podniku. In: Medzinárodná vedecká konferencia „Ekonomika a manažment podnikov“. Zvolen TU. ISBN 80-228-1386-9, s.117-122.

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**Władysław Strykowski<sup>25</sup>**

## **ELECTRONIC MEDIA AND PAPER CONSUMPTION**

**Abstract:** The article discusses the latest global trends in the use of paper in the newspaper sector offered by continent for the years 1999 and 2009. These are supplemented with an account of the decisions made by major world and domestic titles with respect to venturing into the market of electronic media.

**Keywords:** newspaper paper, paper consumption, electronic media, printed media.

The motto of this year's fifth conference, held in Finland, which brought together manufacturers, users and experts of various kinds on the use of paper, mainly in the mass media was "Paper, the King of Media". The scope of the conference was supplemented with questions on the role to be played by the printed media in coming years, which ties directly to the status and significance of the main carrier of information, that is paper, mainly in the form of newspapers. The conference focused on the environmental impact of printed media, the effects of periodical design on readership, trends in press advertising, the mistakes made by the printed media industry, the degree of sustainability achieved by paper producers, and a range of other specific topics. In addressing the questions, a number of views were voiced on the future of paper and the related media. Notably, as in the past, the dominance of paper and the related media was confirmed by predominant opinions. However, many participants pointed out that this carrier has become outdated while its use in the media sector is a symptom of backwardness.

One might conclude that these new social and cultural behaviors have been fostered by the growing influence of computers and the Internet, affecting in particular younger generations, all of which bears on the perception of the paper industry.

It should also be noted that a number of new products emerge which replace paper in its specific applications, fueled by a selective drive for environmental friendliness which appears to be

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the main or at least one of many critical choice criteria. One could even find experts who claim that plastics are more friendly to the environment than paper. This is because a great deal of myths and misleading information have accumulated in recent years with respect to the pulp and paper industry which less knowledgeable paper user take to be true (rain forest destruction, environmental contamination by pulp and paper plants, etc.). Note also that the industry is a leader in the share of energy derived from renewable sources. It pursues the principles of sustainable growth, as recognized by many experts<sup>26</sup>. In fact, the pulp and paper industry is Europe's only sector to have half of its energy consumption come from renewables, that is far ahead of the EU's 20% target envisioned for 2020.

Without a doubt, the biggest challenge faced by the pulp and paper industry is to secure supplies of wood, especially at a time when the area of forests used to produce raw materials dwindles increasingly while a growing number of traditional as well as new users, in particular in the energy sector and various subdivisions of the chemical industry, take growing interest in the material.

Further, it needs to be noted that the pulp and paper industry of the European Union consumes as little as 17% of the available timber and that its consumption has been diminishing consistently.

In Poland, wood for the pulp and paper industry is supplied by the country's state forests which provide approximately 70% of the timber used for production. The remaining proportion comes from foreign or domestic private forest owners.

In recent years, Poland's pulp and paper industry has consumed ca. 5 million tons of wood, most of which in the form of pulpwood with a small addition of sawmill waste. The availability of wood and the stability of its prices is key to the competitiveness of the pulp and paper sector. The industry is seen as a high investment risk as the investment cycles of large paper plants last as long as several years.

To return to the initial question regarding the role of paper in the media, it is best to begin by quoting certain facts. Table 1 summarizes the industry's global output and the consumption of paper and cardboard, with separate figures provided for the paper used in newspapers.

Table 1. Global output and consumption of paper and cardboard

Specification	Output				Consumption			
	total		newspaper paper		total		newspaper paper	
	1999	2009	1999	2009	1999	2009	1999	2009
	in millions tons							
Worldwide	314.6	376.8	38.1	32.7	318.63	374.18	38.29	33.15
Europe	96.0	106.9	12.7	11.4	90.31	98.58	12.06	10.97
EU	85.0	89.4	9.8	8.6	81.50	80.31	10.64	9.14
Africa	2.9	3.9	0.4	0.3	4.72	6.52	0.54	0.72
Asia	89.5	156.5	7.6	12.0	97.07	161.40	9.45	13.90
China	33.3	90.2	1.1	4.9	40.81	90.31	2.14	5.23
India	3.8	7.6	0.5	0.8	4.48	8.55	1.00	1.53
Indonesia	7.0	11.5	0.5	0.6	4.22	8.33	0.20	0.42
Central and North America	113.1	90.5	16.0	7.6	110.88	87.47	14.22	6.09
Canada	20.3	12.8	9.2	4.4	8.38	5.92	0.98	0.52
USA	88.7	72.1	6.5	3.0	95.79	71.27	12.60	4.86
Oceania	3.4	4.2	0.8	0.7	4.21	4.59	0.84	0.82
Australia	2.6	3.3	0.4	0.4	3.52	3.82	0.49	0.34
Sought America	9.7	14.8	0.6	0.6	11.45	15.62	1.17	1.14
Brasil	6.3	9.4	0.2	0.1	6.49	8.49	0.56	0.47

Source: Author's work based on Eurostat, *Forestry in the EU and the World. A Statistical Portrait. 2011 edition*, European Commission, p. 79

<sup>26</sup> Cf. M. Jarczyński: *Jak przetrwać i się rozwijać? (How to Survive and Grow)*, *Przegląd papierniczy* 2010 Nr VI pp. 301-302.

In 1999, the global production of paper and cardboard was 314.6 million. By 2009, the output rose to 376.8 million tons. The production of newspaper paper amounted to 38.1 million tons in 1999, or 12.1% of the total paper output in that year. By 2009, however, the output fell on 1999 (Table 1). Similar trends could be observed in Europe and the EU as the share of paper consumed in the total production output and in total paper consumption in 1999-2009 was seen to decline. A much sharper drop in newspaper paper was seen in Central and North America where the reduction exceeded 50%. Asia saw rapid growth in both the production of newspaper paper and its significance (Table 1).

Table 1 shows also that only Asia saw a substantial rise in the consumption of paper used for newspapers in 1999-2009.

Publishers of foreign magazines across the world have been searching for ways to boost their daily newspaper and periodical incomes. The largest newspapers of global reach such as The New York Times, The Wall Street Journal and The Financial Times now charge for online access to their newspapers. Some of the related statistics have been disclosed. The Financial Times, for instance, has had some 207,000 people purchase access to various online articles in 2011, up by an estimated ca. 70% on the preceding year. The average sales of the hard-copy newspaper now stands at around 390,000 copies. The publishers revenues from these sources in 2010 have been estimated at approximately £130 million, coming from roughly 120,000 readers.

As for the Polish media market, it has been reported that starting in mid-2011, "Media and Marketing Polska" whose circulation in Poland was 6,000, will be available on an up-to-date website. The annual online subscription sells for PLN 300, compared to PLN 360 charged for the paper copy. The publisher of "Media & Marketing Polska" moved its news to the Internet in line with the overall market trend<sup>27</sup>.

Another Polish example is the pop culture monthly "Machina" now available solely in its electronic pdf format since June 2011 but on a weekly basis. One issue sells for PLN 3. The hard copy commanded a higher price of PLN 5.

Calculations show that the Internet does not quite yet have the ability to provide the kinds of proceeds to the publishers that would compensate closures of paper publishing houses.

A decision to proceed with such a closure was made in 2009 by The Christian Science Monitor. Yet, despite increased interest in its online content, the revenues were halved. Another reported case concerns "Info World" which, having gone digital, increased its income from \$ 1.5 billion to \$ 1.6 billion. This, however, is a case of a specialized publisher with a well chosen target group. Such results are much harder to come by in general interest press. Hence, paper remains in use and continues to be a major source of advertising income as experiments continue with the Internet and such new media as smart phones. In Poland, the "Polityka", "Newsweek" and "Przekrój" weeklies as well as the "Gazeta Prawna" and "Rzeczpospolita" dailies are now available in their iPod versions. Yet, sales through this channel remain minute compared to those generated at newsstands.

## CONCLUSIONS

The evidence above points to a number of conclusions on the evolution in the media used in daily press publishing.

1. With the exception of Asia, a downward trend has been reported in both the production and consumption of paper used in newspapers<sup>28</sup>. (It is not clear whether the trend should be attributed to the coinciding crisis or a consistent advent of electronic media.)

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<sup>27</sup> M. Fura: *Za wcześnie na rozstanie z papierem. (Too early to part with paper). Dziennik Gazeta Prawna 2011, 139 p. A 11.*  
<sup>28</sup> Data on the production and consumption of the paper used in newspapers show that a substantial decline in the consumption of such paper has been observed in recent years throughout the world with the exception of Asia.



2. Increasingly, attempts are being made to replace daily press of general interest and specialized magazines with soft copy equivalents. The process, however, has been relatively slow and has so far failed to undermine the strong position of paper in the press publishing market.
3. The process may well be largely culture-driven. The next generation of daily press readers is likely to be much more approving of electronic media and reliant on the Internet, which is still to become universally available.
4. The above should be considered in the context of press publishing. An erosion in the significance of paper in the press sector will have serious consequences for the use of paper for other purposes, such as packaging materials.

*Edita Szombathyová<sup>29</sup>*

## UTILISATION OF ERGONOMIC PRINCIPLES AT SOLVING WORKPLACES

**Abstract:** While planning, and/or improving the existing workplace it is necessary to utilise the optimal dimensions and arrangement of the workplace, organisation of work-movements and the physical and mental needs of the man as well. The contribution introduces a simple process that is possible to use while planning or rationalizing the workplace. The process is plan is such way to respect the basic ergonomic principles.

**Keywords:** workplace, anthropometry, field of vision, reaching fields, work comfort.

### INTRODUCTION

The optimal arrangement and equipment of a workplace contributes to work comfort and utilisation of performance capacity of the worker. At the same time it decreases the negative effects of technical equipment and technologies on health, as well as harmful factors of the workplace.

### CRITERIA FOR SOLVING WORKPLACE

It is possible to divide the criteria for planning workplace or its rationalisation into several fields. The basic criteria and subject of solving are present in table 1.

Table 1: Criteria for solving workplace

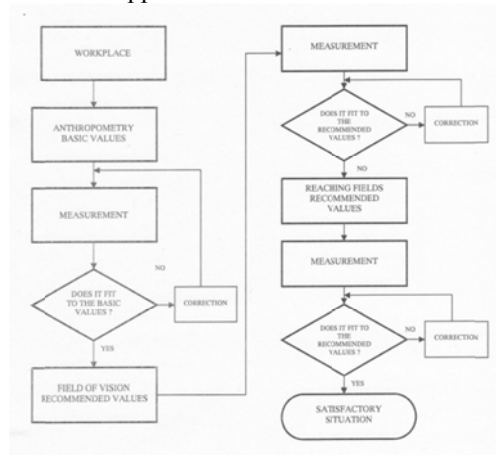
Criteria	Subject of solving
Dimensions of the Workplace	- min. surface for workplace
	- height of handling (work) platform
	- fields of reach of upper limbs
	- fields of reach of lower limbs
Working Position	- suitability from the point of view of executed work activity
	- position of control elements in the reach of limbs
	- positions of information elements in field of view
	- possibility of working position changes during short breaks at work
Work Movements	- prevention of physiologically unsuitable positions
	- allowing shift of activities of certain muscle groups
Work load	- respecting economy of movements
	- level of mechanization equipment of workplace
Factors of Working Environment	- following limits at handling burdens
	- respecting valid STN , regulations and other provisions
	- concurrent checking of allowed factor values

Workplace planning is to be made with the aim to enable to work execution of as extensive circle of workers as possible without increasing work load.

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Scheme 1 depicts the process of solving workplace by using the basic ergonomic principles. The planned process consists of several parts:

- creation of workplace by using anthropometric data,
- respecting the dimensions of field of view, including uneven colour perception,
- defining reaching field for work of upper and lower limbs.



Scheme 1 The process of solving workplace by using ergonomic principles

The single elements contain concrete data that can be use while planning a new or at rationalizing of existing workplace.

The process is arranged as a simple program for use in practice. After clicking on the selected element data are displayed, that are processed pursuant to valid STN, regulations of the Slovak Ministry of Health and Slovak Government Regulations, and/or recommended parameters according to professional literature.

#### **EXAMPLE OF USING PROCESS FOR CRITERION OF REACHING FIELD**

Reaching field is divided to field for work of hands – handling field and field for work of legs – pedipulation field.

##### **Reaching fields recommended values**

Recommended values for handling field:

Optimal height of working hand platform:

at standing work: 1030 mm - men

950 mm - women

at sitting work: 700 mm – men

650 mm – women

The free space between the upper surface of the chair seat and lower surface of the table must be at least 11 cm.

At work that is demanding for the eyes the height of the working platform is increased approx. by 100 - 200 mm, while it is necessary to ensure support of forearm, as well.

At standing work with subjects that are heavier than 2 kg the handling platform is decreased approx. by 100 - 200 mm.

The working surface of the table cannot be lower than 65 cm provided that its thickness does not reach 5 cm. The height of the table for sitting and standing work cannot be higher than 95 cm above the floor. [5]

Recommended values for pedipulation field:

Smallest width over floor

600 mm



Smallest total width	500 mm
Smallest depth from front edge of table	500 mm
Optimal depth from front edge of table	700 mm
Smallest distance of seat surface from lower surface of working table	200 mm.

### Measurement

Measurement is carried out in the concrete workplace, in horizontal and vertical direction, by distance meter. A suitable and simple device is the laser measuring device, type DLE 70 Professional by Bosch. The measuring range of this device is 0,05 – 70 m, measuring accuracy  $\pm 1,5$  mm. In respect of the measuring range of the device it is possible to use it for measuring:

- distance of element arrangement on the working board – arrangement of spare parts, tanks etc.,
- distance between single workplaces, that has its importance from the point of view of safety at work – distance of machine from the wall, distance between machines and equipment, etc.

### Does it fit to the recommended values

Decision-making on the further steps takes place on the basis of comparing of real and recommended values. In case of insufficient parameters of reaching field it is necessary to make corrections.

### Correction

Correction means accept the arrangement for improving reaching fields at the workplace. Arrangements are to have technical character – replacement of tanks, work board with the possibility to regulate its height, slope, etc.

### Satisfactory situation

This means ensuring optimal values for reach for both limbs, and therefore suitable conditions for executing work activity at the workplace.

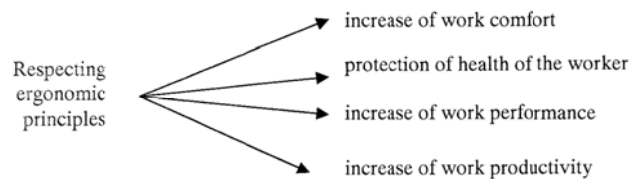
## CONTRIBUTIONS OF THE PLANNED PROCESS FOR SOLVING WORKPLACE

The process can be modified in order to solve the whole man – machine – environment system in a complex way. In this case it will be extended by the field of work load and by factors of the working environment. The result of this process's application should be reaching the optimal conditions, that means that the work system will respect the possibilities and abilities of the man, ensure work comfort and safety at work.

Contribution of the planned process of solving workplace is reflected on two levels:

- theoretical - provides approach on solving workplace with full respect of ergonomic principles. Consists of elements that suggest solution in the field of dimensional arrangement of the workplace – anthropometry, perimetry, reaching field,
- practical – since it contains concrete values, pursuant to regulations and norms, it can be used in practice.

Respecting the ergonomic principles at planning and rationalizing workplaces means not only contribution for the worker itself, but it also present in increasing work performance and productivity of work (scheme 2).



Scheme 2. Contributions resulting from respecting the ergonomic principles

## CONCLUSION

The role of ergonomic solution of human – machine – environment system relationships is to create such working conditions that contribute not only to the increase of work productivity, but



also to a comprehensive development of a man and to maintaining his health, i.e. physical, mental and social satisfaction. In order to reach this goal it is necessary to pay more attention to psycho – physiological possibilities of a man, as well as to his abilities and possibilities of applying ergonomic skills at the creation of technical side of the system, i.e. machines, equipment, working environment.

The man has the most important role at solving workplaces, to which it is necessary to adapt the technical side of the human – machine – environment system. While planning of rationalizing work place the possibility of its adaptation to individual requirements of a man has to be taken into consideration.

#### LITERATURE

1. Lorko M.: Ergonómia vo výrobe. Prešov FVT, 2001, s.105. ISBN 80-7099-692-7.
2. Smutná M., Dulina L. 2010. Nástroje modernej ergonómie. In Pokrokové priemyselné inžinierstvo, konferencia Invent 2010, ISBN 978-80-89401-12-3, 2010, s.344-347
3. Szombathyová E., Ondrejová L.: Utilization of perimetry during designing of workstation. Manufacturing engineering/Výrobné inžinierstvo č. 3/2010, str. 63–66. ISSN 1335-7972.
4. Szombathyová E., Kováč J.: Spôsoby merania vybraných ergonómických parametrov. Elektronický časopis Transfer inovácií č. 12/2008, SJF TU Košice, str. 159–162. [www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/12-2008.obsah.htm](http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/12-2008.obsah.htm). ISSN 1337–7094.
5. Vyhláška č. 542 Ministerstva zdravotníctva SR zo 16. augusta 2007 o podrobnostiach o ochrane zdravia pred fyzickou záťažou pri práci, psychickou pracovnou záťažou a senzorickou záťažou pri práci.