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SPIS TREŚCI

From the Editorial Committee

We are giving you the next 23rd (4/2016) issue of the Quarterly of the Faculty of Management of the Rzeszow University of Technology entitled “Modern Management Review”.

The primary objective of the Quarterly is to promote publishing of the results of scientific research within economic and social issues in economics, law, finance, management, marketing, logistics, as well as politics, corporate history and social sciences.

Our aim is also to raise the merits and the international position of the Quarterly published by our Faculty. That is why we provided foreign Scientific Council, as well as an international team of Reviewers to increase the value of the scientific publications.

The works placed in this issue include many assumptions and decisions, theoretical solutions as well as research results, analyses, comparisons and reflections of the Authors.

We would like to thank all those who contributed to the issue of the Quarterly and we hope that you will enjoy reading this issue.

With compliments
Editorial Committee

MODERN MANAGEMENT REVIEW **2016**
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Aleksandra BADORA[1]
Małgorzata CHACEWICZ[2]

MANAGEMENT OF INNOVATIVE MILLET PRODUCTS IN THE CONTEXT OF SELECTED CHEMICAL PROPERTIES

In the article it was examined the content of selected elements in certain millet products and the results were compared with the data presented on the labels and data from the literature. Flour and flakes are the most popular products derived from millet. Millet groats is also very often eaten. The flour is made of hulled grains and it often has a maximum ash content, therefore it is related to as whole-meal. It does not contain gluten, so it cannot be used for baking; instead, the best results are achieved by adding it to the flour of other cereal species. Products made from millet soothe the symptoms and effects of many diseases. Standard methods were involved to investigate selected elements in flakes of millet of Batom and Bio Planet company and in flour of millet of Symbio and Bio Futuro company. Despite of some slight differences in the contents of elements determined in the laboratory and those reported in the literature by other authors as well as on the labels, the millet products from all surveyed manufacturers were characterized by abundant contents of macro and micronutrients valuable for human's health. The aim of this study was to examine the contents of selected elements in certain millet products and to compare with the data presented on the labels and data from the literature

Keywords: flour and flakes of millet, selected elements, dry matter and ash, properties

1. INTRODUCTION

At the present time, more and more people suffer from civilization diseases, suffer from food intolerance, and live in the fast lane and stress neglecting a balanced diet, thus do not provide all the necessary nutrients to their organisms. Plants, and more particularly cereals, are the main source of food throughout the world. They occupy the largest cultivation area[3].

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[3] Świetlikowska K., (ed.), 2006. *Surowce spożywcze pochodzenia roślinnego*. Wyd. SGGW, Warszawa, pp. 1-364.
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Badora A. (ed.), 2012. *Kształtowanie jakości i standaryzacja surowców roślinnych*. Wyd. UP Lublin, spp. 1-272.
Rakiel-Czarnecka W. (ed.), 2012**.** *Tydzień Chleba Na Zakwasie w Szkole 2012*. Wyd. Fundacja Dobre Zdrowie, Warszawa, 1-149.

Millet (*Panicum miliaceum* L) is a valuable crop, yet less popular in our country[4]. Millet plants can be distinguished by the fact that they do not contain gluten, are easy to digest, and have large amounts of valuable and readily digestible elements in their composition[5]. Products made from millet soothe the symptoms and effects of many diseases; they are also worth consuming in the prevention of civilization diseases and cancers of different organs that occur more often nowadays[6].

Flour and flakes are the most popular products derived from millet. Millet groat is also very often eaten. The flour is made from hulled grains and it often has a maximum ash content, therefore it is related to as whole-meal. It does not contain gluten, so it cannot be used for baking; instead, the best results are achieved by adding it to the flour of other cereal species. In addition, it is used as a thickener for soups, pastes, savory dishes, and desserts. Bread made of millet flour shows greater volume, as well as its other characteristics desired by consumers such as, for example, better color, odor, flavor, and texture, are improved[7].

The aim of this study was to examine the contents of selected elements in certain millet products and to compare with the data presented on the labels and data from the literature.

2. MATERIALS AND METHODS

The tested millet products (flour and flakes) were subject to determinations of water and dry matter content (absolute dry matter) in the air-dry samples, which consisted in drying the aliquot of particular material at 100-105 °C to a constant weight and subsequent calculating the amount of water from the mass difference. Clean ash in tested products was determined in a muffle furnace, where the temperature was graded from 250-300 °C, through 450 °C and 550 °C. Also wet mineralization of tested products was conducted: in concentrated H_2SO_4 with H_2O_2 addition to determine the total N – by means of Kjeldahl method, P – applying vanadium-molybdate colorimetric method at a wavelength of 470 nm, K, Ca, Mg, Na, Mn, and Zn by atomic absorption spectrometry (AAS), as well as Fe using colorimetric method with ammonium thiocyanate. The intensity of the resulting color was measured on a colorimeter in 1 cm^3 capacity cuvettes at a wavelength of

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Tynka A., 2012. *Bardziej świadome zakupy w marketach*. TUV Rheinland Polska Sp. z o.o., spp. 1-3.

466 nm. Prior to determination, the total amount of iron was oxidized to trivalent using 3% H_2O_2.

All laboratory analyses of tested samples were performed in triplicates. Products were purchased from different producers: millet flakes from Batom and Bio Planet, while millet flour from Symbio and Bio Futuro.

3. RESULTS AND DISCUSSION

3.1. Ash and water contents in dry matter of millet products

Tables 1 and 2 present results of laboratory determinations related to dry matter, water, and ash contents in tested millet products. Achieved values were compared with literature data.

Table 1. Dry matter, water, and ash contents in millet flakes from two producers

Product	Component	Results	Mean	Literature
Millet flakes from Batom	Dry matter [g/kg]	0.89	0.90	0.87 1)
		0.90		
		0.90		
	Water [g/kg]	0.11	0.10	0.13 2)
		0.10		
		0.10		
	Ash [g/kg]	0.01	0.01	0.03 3)
		0.01		
		0.01		
Millet flakes from Bio Planet	Dry matter [g/kg]	0.91	0.91	0.87 4)
		0.91		
		0.92		
	Water [g/kg]	0.09	0.09	0.13 5)
		0.09		
		0.08		
	Ash [g/kg]	0.02	0.02	0.03 6)
		0.02		
		0.02		

1) through 6) Rudziński[8].

Analysis of the dry matter in organic millet flakes traded by two producers (Batom and Bio Planet) revealed that results differed only by 0.01 g/kg (Table 1). In another product – organic flour by Symbio – dry matter content was lower and amounted to 0.85 g/kg, while in the other flour, which is a natural product, it was 0.86 g/kg (Table 2). Rudziński[8] reported that the content of dry matter in millet grain oscillated around the average of 0.87 g/kg. Water complements dry matter in products. According to Rudziński[9], flakes should contain 0.13 g/kg of water. Results obtained in this study are similar and are at a level of 0.10 g/kg of the product from Batom and 0.09 g/kg of the product from Bio Planet (Ta-

[8] Rudziński R., 2011. *Zasady przechowywania i magazynowania towarów pochodzenia rolniczego*. W: Zesz. Nauk. Uni. Przyrod.-Human. w Siedlcach, nr 88, 113-115.

[9] Ibid.

ble 1). And also according to Rudziński[10], water in millet grain, like in flakes, should be at the level of about 0.13 g/kg. The results achieved by authors of the present paper were 0.15 g/kg for organic flour and 0.14 g/kg for natural product (Table 2).

Table 2. Dry matter, water, and ash contents in millet flour from two producers

Product	Component	Results	Mean	Literature
Millet flour from Symbio	Dry matter [g/kg]	0.87	0.85	0.87 1)
		0.79		
		0.89		
	Water [g/kg]	0.13	0.15	0.13 2)
		0.21		
		0.11		
	Ash [g/kg]	0.02	0.01	0.03 3)
		0.01		
		0.01		
Millet flour from Bio Futuro	Dry matter [g/kg]	0.90	0.86	0.87 4)
		0.78		
		0.90		
	Water [g/kg]	0.10	0.14	0.13 5)
		0.22		
		0.10		
	Ash [g/kg]	0.01	0.01	0.03 6)
		0.01		
		0.01		

1) through 6) Rudziński[11].

Ash was present in tested products at the level of 0.01 g/kg (Batom) and 0.02 g/kg (Bio Planet), while data reported by Rudziński[11] reveal mean ash content at about 0.03 g/kg (Table 1); the millet flour from both producers contained 3-fold less ash (Table 2).

3.2. Macroelements in millet products

Tables 3-4 show the nitrogen, phosphorus, and potassium contents in the millet products. The nitrogen quantity recalculated from the protein amount indicated on the label of millet flakes was 16 g/kg, while results obtained in the laboratory was 16.38 g/kg in the product from Batom and 19.09 g/kg from another producer (Table 3). Similarly in the case of flour: the label indicated 14.56 g/kg, whereas results achieved in the laboratory were significantly higher (Table 4). The Symbio flour contained nitrogen at the amount of 17.27 g/kg, while for the other manufacturer (Bio Futuro), it was up to 19.04 g/kg (Table 4).

[10] Ibid.

[11] Ibid.

Table 3. Nitrogen, phosphorus, and potassium in millet flakes from two producers

Product	Element	Results	Mean	Literature
Millet flakes from Batom	N [g/kg]	16.38	16.38	16.00 [1)]
		16.24		
		16.52		
	P [g/kg]	1.80	1.75	2.40 [2)]
		1.65		
		1.80		
	K [g/kg]	1.76	1.75	1.95 [3)]
		1.68		
		1.81		
Millet flakes from Bio Planet	N [g/kg]	19.18	19.09	16.00 [4)]
		19.04		
		19.04		
	P [g/kg]	3.30	3.13	2.40 [5)]
		3.00		
		3.10		
	K [g/kg]	2.51	2.36	1.95 [6)]
		1.98		
		2.59		

1) and 4) Information on the label, 2) and 5) Czerwińska[12], 3) and 6) Czerwińska[12].

Table 4. Nitrogen, phosphorus, and potassium in millet flour from two producers

Product	Element	Results	Mean	Literature
Millet flour from Symbio	N [g/kg]	17.36	17.27	14.56 [1)]
		17.36		
		17.08		
	P [g/kg]	2.9	2.83	2.40 [2)]
		2.8		
		2.8		
	K [g/kg]	1.88	1.85	1.95 [3)]
		1.82		
		1.85		
Millet flour from Bio Futuro	N [g/kg]	18.76	19.04	14.56 [4)]
		19.04		
		19.32		
	P [g/kg]	2.35	2.30	2.40 [5)]
		2.35		
		2.2		
	K [g/kg]	1.52	1.56	1.95 [6)]
		1.56		
		1.61		

1) and 4) Information on the label, 2) and 5) Czerwińska[12], 3) and 6) Czerwińska[12].

Like in the case of nitrogen, phosphorus proportions were also diverse in millet flakes. The test material from Batom contained phosphorus in an amount of 1.75 g/kg, while

from Bio Planet the value was almost twice as high (3.13 g/kg). Czerwińska[12] in the study upon the value of millet groats reported 2.4 g/kg of phosphorus. When comparing the phosphorus content in millet flour, some differences are prominent. Czerwińska[13] determined the phosphorus content in millet groats for 2.40 g/kg, while 2.83 g/kg in millet flour. The product purchased in Futuro Bio contained phosphorus at the level of 2.30 g/kg. This value was similar to results reported by other authors (Tables 3 and 4)[14].

Potassium content in the product from Batom was 1.75 g/kg and it was slightly lower than the result obtained by Czerwińska[15] in the grain. However, flakes purchased from the other producer contained 2.36 g/kg K, which was even higher than results found by Czerwińska[16] (Table 3). Results related to potassium content in flour and obtained in the laboratory were similar to those reported by cited author Czerwińska[17]. Millet flour manufactured by Symbio contained 1.85 g/kg of potassium, while according to Czerwińska[18], the millet grains contained 1.95 g/kg of potassium in dry matter. A significant difference was observed when comparing percentage of potassium present in the flour from Futuro Bio and results achieved by Czerwińska[19] – as much of 0.39 g/kg (Table 4).

Tables 5 and 6 show the contents of calcium, magnesium, and sodium present in the millet products. The amount of calcium in millet flakes from Batom was 2.5 times lower than the information on the labels of products (Table 5). Even greater difference was observed between the calcium content indicated on the packaging and in tested flakes from the other manufacturer. On the other hand, no such differences were observed in the flour (Table 6). The calcium contents in the flour from Symbio and grain examined by another author were similar (Table 6). In laboratory, this element quantity was determined for 0.05 g/kg, while Czerwińska[20] found that the amount of calcium was 0.08 g/kg. A smaller difference was recorded when comparing this value to the calcium content in the millet flour from Bio Futuro (0.10 g/kg).

Table 5. Contents of Ca, Mg, and Na in millet flakes from two producers

Product	Element	Results	Mean	Literature
Millet flakes from Batom	Ca [g/kg]	0.15	0.10	0.25 1)
		0.1		
		0.06		
	Mg [g/kg]	0.84	0.84	1.14 2)
		0.76		
		0.91		
	Na [g/kg]	0.04	0.03	- 3)
		0.02		
		0.03		

[12] Czerwińska D., 2009. *Charakterystyka żywieniowa*... Op. Cit.

[13] Ibid.

[14] Czerwińska D., 2009. *Charakterystyka żywieniowa*... Op. Cit.
Czerwińska D., 2010. *Wartość odżywcza*... Op. Cit.

[15] Czerwińska D., 2010. *Wartość odżywcza*... Op. Cit.

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] Ibid.

[20] Ibid.

Product	Element	Results	Mean	Literature
Millet flakes from Bio Planet	Ca [g/kg]	0.06	0.09	0.25 [4)]
		0.15		
		0.06		
	Mg [g/kg]	1.32	1.43	1.14 [5)]
		1.42		
		1.56		
	Na [g/kg]	0.03	0.03	- [6)]
		0.04		
		0.02		

1) and 4) Information on the label, 2) and 5) Czerwińska[14], 3) and 6) Czerwińska[14].

Table 6. Contents of Ca, Mg, and Na in millet flour from two producers

Product	Element	Results	Mean	Literature
Millet flour from Symbio	Ca [g/kg]	0.05	0.05	0.08 [1)]
		0.05		
		0.05		
	Mg [g/kg]	1.38	1.37	0.95 [2)]
		1.45		
		1.27		
	Na [g/kg]	0.05	0.04	- [3)]
		0.03		
		0.03		
Millet flour from Bio Futuro	Ca [g/kg]	0.07	0.10	0.08 [4)]
		0.14		
		0.08		
	Mg [g/kg]	1.15	1.13	0.95 [5)]
		1.06		
		1.18		
	Na [g/kg]	0.03	0.05	- [6)]
		0.06		
		0.05		

1), 2), 4), 5) Czerwińska[14], 3) and 6) Unavailable data

Results related to magnesium appeared to be different. Depending on a manufacturer, various results were achieved (Table 5). This element determined in flakes from Batom occurred in an amount significantly less than in the study performed by Czerwińska[21] (1.14 mg/kg of magnesium in millet grains), whereas flakes from Bio Planet contained 1.43 g/kg of magnesium. This was the highest magnesium content achieved in all tested products. Millet flour contained less magnesium than flakes (Table 6). According to Czerwińska[22], there is about 0.95 g/kg of the element. However, in this study it was found that magnesium appeared in an amount of 1.37 g/kg in product from Symbio and 1.13 g/kg from Bio Futuro (Table 6). Comparison of the sodium content in tested products

[21] Ibid.

[22] Ibid.

revealed that more of the element was present in the millet flour rather than in flakes (Tables 5 and 6).

3.3. Microelements in millet products

Tables 7 and 8 show the contents of selected trace elements in tested millet products. Manganese in flakes from Batom occurred at the level of 7.00 mg/kg (Table 7), while the flour from Symbio and Bio Futuro was present at lower amounts (6.67 mg/kg and 5.33 mg/kg) (Table 8). Czerwińska[23] reported that millet grain can contain up to 16.00 mg/kg of manganese. A similar manganese content as on the label was found in flakes purchased from Bio Planet. Those differences may resulted from technological processing.

Table 7. Microelement contents in millet flakes from two producers

Product	Element	Results	Mean	Literature
Millet flakes from Batom	Mn [mg/kg]	7.00	7.00	16.00 1)
		7.00		
		7.00		
	Zn [mg/kg]	21.20	19.57	17.00 2)
		18.20		
		19.30		
	Fe [mg/kg]	0.01	0.02	0.90 3)
		0.02		
		0.02		
Millet flakes from Bio Planet	Mn [mg/kg]	11.00	11.00	16.00 4)
		11.00		
		11.00		
	Zn [mg/kg]	28.50	27.73	17.00 5)
		26.40		
		28.30		
	Fe [mg/kg]	0.04	0.04	0.90 6)
		0.03		
		0.05		

1), 2), 5), 6) Czerwińska[23], 3), 4), 7), 8) Information on the label

Just like in the case of flakes (Table 7), zinc proportion in millet flour (Table 8) was higher than that determined by Czerwińska[24] in the grain. The iron content in flour was at a similar level as in the study carried out by Czerwińska[24] in this product (Table 8). Greater differences were observed for flakes (Table 7). The zinc content in all tested millet products was higher than that reported by Czerwińska[25] for grains.

[23] Ibid.

[24] Ibid.

[25] Ibid.

Table 8. Microelement contents in millet flour from two producers

Product	Element	Results	Mean	Literature
Millet flour from Symbio	Mn [mg/kg]	7.00	6.67	16.00 [1)]
		7.00		
		6.00		
	Zn [mg/kg]	28.20	29.10	17.00 [2)]
		30.20		
		28.90		
	Fe [mg/kg]	0.05	0.06	0.07 [3)]
		0.06		
		0.08		
Millet flour from Bio Futuro	Mn [mg/kg]	5.00	5.33	16.00 [4)]
		6.00		
		5.00		
	Zn [mg/kg]	23.90	23.57	17.00 [5)]
		22.30		
		24.50		
	Fe [mg/kg]	0.05	0.10	0.07 [6)]
		0.18		
		0.06		

1) through 6) Czerwińska[25].

4. CONCLUSIONS

1. Dry matter, water, and ash contents in all tested products were close to the literature data. An exception was the millet flour, in which the ash content was three times lower than that indicated in literature.
2. The contents of macronutrients differed from data provided on the label or in literature. Flakes of two manufacturers (Batom and Bio Planet) contained less P and K than described in literature, while less nitrogen as compared to the content shown on the labels. The flour from Symbio contained more N and P, whereas less K than those found by other researchers and information on the packaging.
3. Contents of other macroelements (Mg, Ca, Na) and microelements (Mn, Zn, Fe) in flakes from Batom and Bio Planet also differed from the literature data and information on the labels.
4. It should be noted that despite of some slight differences in the contents of elements determined in the laboratory and those reported in the literature by other authors as well as on the labels, the millet products from all surveyed manufacturers were characterized by abundant contents of macro and micronutrients valuable for human's health.

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ZARZĄDZANIE INNOWACYJNYMI PRODUKTAMI Z PROSA W KONTEKŚCIE WYBRANYCH WŁAŚCIWOŚCI CHEMICZNYCH

Zbadano zawartości wybranych pierwiastków w niektórych produktach z prosa i porównano te zawartości z danymi na etykietach oraz danymi z literatury. Mąka i płatki to najpopularniejsze produkty pozyskiwane z prosa. Bardzo często spożywana jest również kasza, zwana jaglaną. Mąka powstaje z obłuszczonego ziarna, często ma ona najwyższą zawartość popiołu, od czego zwana jest razową. Produkty z prosa łagodzą objawy i skutki wielu schorzeń. Badania laboratoryjne prowadzono standardowymi metodami w płatkach jaglanych z firm: Batom i Bio Planet oraz w mące jaglanej firm: Symbio i Bio Futuro. Mimo pewnych, nieznacznych różnic w zawartościach badanych pierwiastków stwierdzonych w laboratorium i podanych w literaturze przez innych autorów oraz na etykietach, produkty z prosa wszystkich badanych firm odznaczały się bogatą zawartością cennych dla zdrowia makro- i mikroelementów. Celem niniejszych badań było określenie zawartości wybranych pierwiastków w niektórych produktach z prosa I porównanie tych zawartości z danymi z literatury I na etykietach badanych produktów. Chociaż zanotowano pewne różnice w stężeniach badanych pierwiastków oznaczonych na etykietach i laboratoryjne, to jednak produkty z prosa charakteryzowały się zbliżonymi zawartościami składników pokarmowych, ważnych z punktu widzenia zdrowia człowieka, prezentowanych w niniejszych badaniach i przez innych autorów. Uwzględnienie odżywczych produktów z prosa w diecie człowieka jest jednym z innowacyjnych zmian w trendach żywnościowych.

Słowa kluczowe: mąka i płatki z prosa, wybrane makro- i mikroelementy, sucha masa i popiół, właściwości.

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WHICH POWER TECHNOLOGIES ARE WORTH CONSIDERING AS AN INVESTMENT?

The analysis in this paper involves the issues of the specific cost of electric power generation in the particular technologies applied in its production. Therefore, the analysis involves all accessible technologies in power engineering (except hydroelectric power stations): coal-fired power plants applying conventional combustion and CCS (Carbon Capture and Storage) technology in oxy-combustion, nuclear power plants, combined cycle power plants – CCPP, dual-fuel combined cycle power plants – DFCC, wind farms, photovoltaics power plants. The article presents from the economic perspective, that the most beneficial technology is the one in which the cost of power generation is the lowest. It is relative to: specific cost of investment, internal electric load of the power plant, its annual operating time, fuel prices and their variability in time, ratio of the chemical energy of the fuel in its total annual use, for which the purchase of additional CO2 allowances and tariff rates on the use of the environment is not required. The calculations apply the methodology and mathematical modeling of the specific cost of electric power generation valuation in continuous time. The use of continuous time approach provides an options for the analysis of various scenarios regarding variability of energy carriers in time. Moreover, such approach can apply differential calculus for the calculation of the specific cost of electricity production. The analysis of sensitivity of the cost incurred in such production can aid in the assessment of the variability of energy carrier prices in the function of the parameters which influence the overall cost.
Keywords: power technologies, specific cost of electricity production, CCS, CCPP, DFCC

1. INTRODUCTION

A decision regarding an investment in power engineering needs to be based on information giving answers to a few questions. What are the suitable technologies to guarantee Poland's security of energy supply, including security and continuity of electricity supply? What is the influence of the prices of energy carriers and what relations between them need to be maintained to maintain a target value of an adopted criterion in the search for an optimum investment strategy? The above questions are relevant with regard to the economic efficiency of technologies applied in power engineering. It seems quite clear that profit on an investment should be as high as possible, the cost of electricity produc-

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tion should be low whereas the condition of stability and security of power supply is fulfilled.

The aim of this paper is to present analysis which involves the issues of the specific cost of electric power generation in the particular technologies applied in its production. Therefore, the analysis involves all accessible technologies in power engineering (except hydroelectric power stations):
- coal-fired power plants applying conventional combustion and *CCS* (*Carbon Capture and Storage*) technology in oxy-combustion[4] (Fig. 1),
- nuclear power plants (Fig. 1),
- combined cycle power plants – *CCPP* (Fig. 2),
- dual-fuel combined cycle power plants – *DFCC* (Figs. 3&4),
- wind farms,
- photovoltaics power plants.

The calculations apply the methodology and mathematical modeling of the specific cost of electric power generation valuation in continuous time (formula (1))[5]. The use of continuous time approach provides an options for the analysis of various scenarios regarding variability of energy carriers in time. Moreover, such approach can apply differential calculus for the calculation of the specific cost of electricity production. The analysis of sensitivity of the cost incurred in such production can aid in the assessment of the variability of energy carrier prices in the function of the parameters which influence the overall cost.

2. APPLICATION OF A MATHEMATICAL MODEL IN SEARCH FOR AN OPTIMUM INVESTMENT STRATEGY OF INVESTMENT IN ELECTRICITY SOURCES

The mean specific cost of electricity generation is expressed by the formula[5]:

$$k_{el,av}=\left\{(1+x_{sw,m,was})\frac{e_{fuel}^{t=0}}{a_{fuel}-r}[\mathrm{e}^{(a_{fuell}-r)T}-1]+\frac{\rho_{CO_2}p_{CO_2}^{t=0}}{a_{CO_2}-r}[\mathrm{e}^{(a_{CO_2}-r)T}-1]+\frac{\rho_{CO}p_{CO}^{t=0}}{a_{CO}-r}[\mathrm{e}^{(a_{CO}-r)T}-1]+\right.$$
$$+\frac{\rho_{NO_X}p_{NO_X}^{t=0}}{a_{NO_X}-r}[\mathrm{e}^{(a_{NO_X}-r)T}-1]+\frac{\rho_{SO_2}p_{SO_2}^{t=0}}{a_{SO_2}-r}[\mathrm{e}^{(a_{SO_2}-r)T}-1]+$$
$$+\frac{\rho_{dust}p_{dust}^{t=0}}{a_{dust}-r}[\mathrm{e}^{(a_{dust}-r)T}-1]+(1-u)\frac{\rho_{CO_2}e_{CO_2}^{t=0}}{b_{CO_2}-r}[\mathrm{e}^{(b_{CO_2}-r)T}-1]+$$
$$\left.+\frac{\eta_{el}}{rt_A}\left[(1+x_{sal,t,ins})i(1-\mathrm{e}^{-rT})\delta_{serv}+riz(\frac{1-\mathrm{e}^{-rT}}{T}+1)\right]\right\}\frac{r}{\eta_{el}(1-\varepsilon_{el})(1-\mathrm{e}^{-rT})}\rightarrow\min. \tag{1}$$

[4] Hnydiuk-Stefan A., *Analysis of the parameters of power plants operating in oxy-fuel combustion*, Ph.D. thesis, Opole University of Technology 2014 [in Polish]

[5] Bartnik R., Bartnik B., Hnydiuk-Stefan A., *Optimum Investment Strategy in the Power Industry*, Springer, New York 2016

where:

a_{el}, a_{fuel}, a_{CO_2}, a_{CO}, a_{SO_2}, a_{NO_X}, a_{dust}, b_{CO_2} – controls [6,7],

δ_{serv} – annual rate of constant cost regardless of the value of investment (cost of maintenance of overhaul of equipment),

ε_{el} – internal electric load of the power plant (its value is relative to the technology applied in electric power generation),

η_{el} – gross electric power efficiency (its value is relative to the technology applied in the electric power generation),

u − ratio of the chemical energy of the fuel in its total annual use for which the purchase of additional CO_2 allowances is not required,

p_{CO_2}, p_{CO}, p_{NO_x} p_{SO_2}, p_{dust} – specific rates per emissions of CO_2, CO, NO_x, SO_2, particulate matter, PLN/kg,

ρ_{CO_2}, ρ_{CO}, ρ_{NO_x}, ρ_{SO_2}, ρ_{dust} – emission of CO_2, CO, NO_x, SO_2, per unit of the chemical energy of fuel, kg/GJ (relative to the type of fuel).

r − discount rate,

t_A − annual operating time,

T – calculated exploitation period of a power plant expressed in years (depreciation rate),

$x_{sw,m,was}$ − coefficient used to account for the cost of supplementing water, use of auxiliary materials and waste disposal,

$x_{sal,t,ins}$ − coefficient used to account for the cost of remuneration, taxes, insurance, etc.

z – coefficient expressing immobilization of capital [6,7].

From the economic perspective, the most beneficial technology is the one in which the cost of power generation $k_{el,av}$ is the lowest. It is relative to: specific cost of investment i, internal electric load of the power plant ε_{el}, its annual operating time t_A, fuel prices and their variability in time, ratio u of the chemical energy of the fuel in its total annual use, for which the purchase of additional CO2 allowances and tariff rates on the use of the environment is not required.

3. DISCUSSION AND ANALYSIS OF EXEMPLARY RESULTS

Figs. 5−14 present the results of calculations regarding specific cost of electric power production k_{el} in the specific technologies. Figs. 1–4 contain the energy balances corresponding to them. Table 1 contains the input data used in these calculations. Figs. 5−14 also show how the value of k_{el} is affected by the variability in the fuel prices e_{fuel}, investment J and internal electric load of the power plant ε_{el}. The variability of these values was assumed to vary in the range of 20% from the base values (Tables 1 and 2) The presented results deal with both the payback period of the investment as well as the period which follows it. The reduced prices which correspond to the base ones assume the value of 1 on the X axis in Figs. 5−14.

[6] Bartnik R., Bartnik B., Hnydiuk-Stefan A., *Optimum Investment Strategy in the Power Industry*, Springer, New York 2016.

[7] Bartnik R., Bartnik B., *Economic calculations in power engineering*, WNT, Warszawa 2014 [in Polish].

3.1. Power units in the conventional and *CCS* technologies and nuclear installation

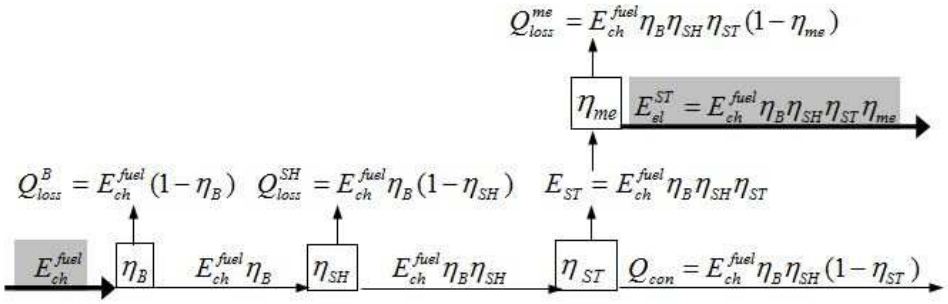

Fig. 1. Energy balance in a conventional technology, CCS technology and a nuclear installation (for the case of nuclear power plant, a nuclear reactor and steam generator is used in the place of a boiler).

Source: own calculations

The gross efficiency of electric power generation in units with sub- and supercritical steam parameters is expressed by the formula (for the case of the nuclear power plant, the efficiency of the boiler η_B is expressed by the efficiency of the reactor and steam generator):

$$\eta_{el} = \frac{E_{el}^{ST}}{E_{ch}^{fuel}} = \eta_B\eta_{SH}\eta_{ST}\eta_{me} \tag{2}$$

At present, this efficiency can be as high as above 50% (whereas for nuclear power plants around 40%).

The net efficiency of electric power generation is expressed by the formula:

$$\eta_{el,net} = \eta_{el}(1-\varepsilon_{el}) \tag{3}$$

The net efficiency of the units operating in the particular technologies are functions of their internal electric load ε_{el}. By substitution of formulae (2), (4)−(6) instead of (1), we can analyze the effect of the efficiency of the equipment applied in the analyzed technologies on the value of $k_{el,av}$. For the case of gas and steam units, it is then necessary to account for the annual use of the chemical energy of gas in the gas turbogenerator with the capacity of N_{el}^{ST} an efficiency of η_{ST} equal to $E_{ch,A}^{g} = (N_{el}^{GT}\tau_A)/\eta_{GT}$, as well as account for the production electric power in them. In the search for the minimum of the cost $k_{el,av}$, optimization should involve the ratio of the chemical energy of the gas in the chemical

energy of the coal combustion in the power plant in equations (5) and (6), i.e. $q_{par} = E_{ch,A}^{gas} / E_{ch,A}^{coal}$ and $q_{ser} = E_{ch,A}^{gas} / E_{ch,A}^{coal}$.

3.2. Combined cycle units

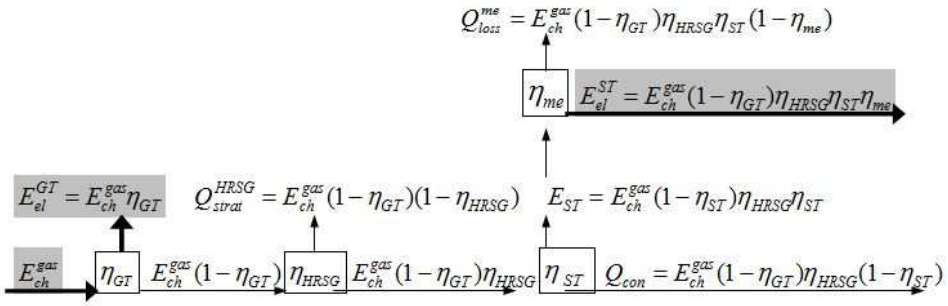

Fig. 2. Energy balance of a combined cycle power unit.

Source: own calculations

The gross efficiency of electric power generation in a combined cycle unit is expressed with a formula:

$$\eta_{el} = \frac{E_{el}^{GT} + E_{el}^{ST}}{E_{ch}^{gas}} = \eta_{GT} + (1-\eta_{GT})\eta_{HRSG}\eta_{ST}\eta_{me} \tag{4}$$

At present this efficiency can be as high as above 60% (with a note that the steam pressure in combined cycle power unit which secures its highest efficiency is two times lower from the value of the critical pressure in it [8]).

[8] Bartnik R., *Combined Cycle Power Plants. Thermal and economic effectiveness*, (Wydawnictwa Naukowo-Techniczne WNT), Warszawa 2009 (reprint 2012).

3.3. Dual-fuel combined cycle unit in a parallel system

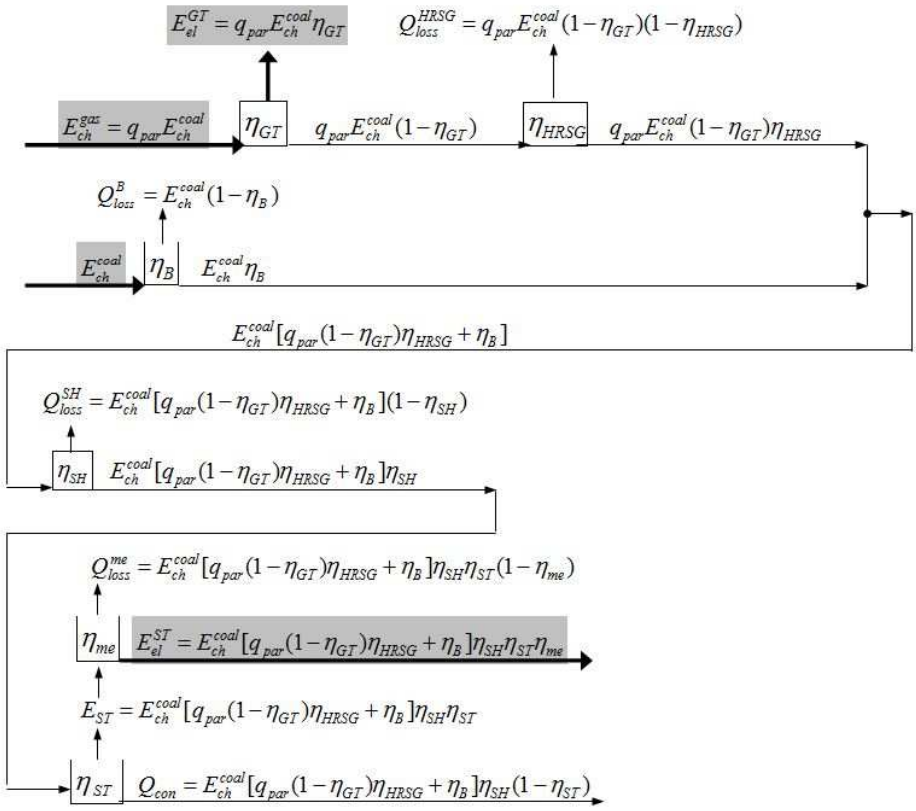

Fig. 3. Energy balance of dual-fuel combined cycle unit in a parallel system
Source: own calculations.

The gross efficiency of electric power generation in a dual-fuel combined cycle unit in a parallel system is expressed by the formula (this efficiency can be as high as 50%[9]):

$$\eta_{el} = \frac{E_{el}^{GT} + E_{el}^{ST}}{E_{ch}^{gas} + E_{ch}^{coal}} = \frac{q_{par}\eta_{GT} + [q_{par}(1-\eta_{GT})\eta_{SH} + \eta_B]\eta_{SH}\eta_{ST}\eta_{me}}{1 + q_{par}} \quad (5)$$

[9] Bartnik R., *Combined Cycle Power Plants. Thermal and economic effectiveness*, (Wydawnictwa Naukowo-Techniczne WNT), Warszawa 2009 (reprint 2012).

3.4. Dual-fuel combined cycle unit with in-series configuration

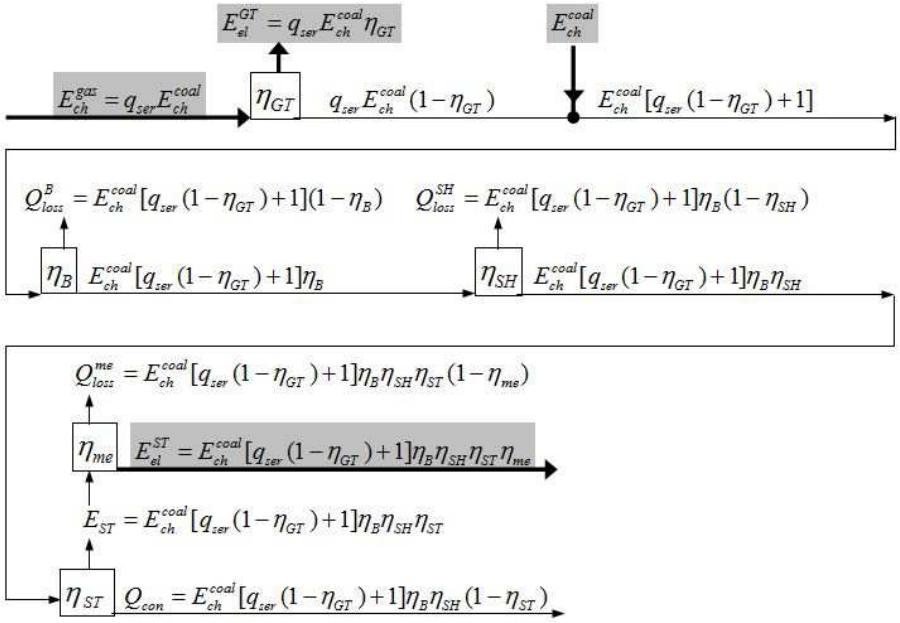

Fig. 4. Energy balance of dual-fuel combined cycle unit with in-series configuration

Source: own calculations

The gross efficiency of electric power generation of a dual-fuel combined cycle unit with in-series configuration is expressed by the formula (this efficiency can be as high as 45%):

$$\eta_{el} = \frac{E_{el}^{GT} + E_{el}^{ST}}{E_{ch}^{gas} + E_{ch}^{coal}} = \frac{q_{ser}\eta_{GT} + [q_{ser}(1-\eta_{GT})+1]\eta_B\eta_{SH}\eta_{ST}\eta_{me}}{1+q_{ser}} \tag{6}$$

where:

E_{ch}^{gas} – chemical energy of gas combustion in the gas turbine,

E_{ch}^{coal} – chemical energy of coal combustion in the boiler,

E_{el}^{GT} – gross electric output of the gas turbogenerator,

E_{el}^{ST} – gross electric output of the steam turbogenerator,

Q_{con} – condensation heat of the steam of the condenser in the steam turbine,

g_{par} – ratio of the chemical energy of gas in the energy of the coal in a parallel system,

q_{ser} – ratio of the chemical energy of gas in the energy of the coal in a series system,
η_B – gross boiler efficiency (for the case of the nuclear power plant- efficiency of the reactor and steam generator),
η_{HRSG} – gross efficiency of the heat recovery steam generator,
η_{SH} – energy efficiency of the crossoverpipe used to feed steam into the turbine,
η_{GT} – gross efficiency of the gas turbine,
$\eta_{ST} = \eta_{CR}\eta_i$ – energy efficiency of the steam turbine (product of the efficiency of Clausius-Rankine cycle and internal efficiency of the steam turbine),
$\eta_{me} = \eta_m\eta_G$ – electromechanical efficiency of the steam turbogenerator (product of the mechanical efficiency of the steam turbine and total efficiency of the generator).

Table 1. Summary of basic input data for calculations of specific cost of power generation in the analyzed technologies

Power plant type	coal-fired with air combustion	coal-fired with oxy-combustion	nuclear	photovoltaic	prosumer photovoltaic	wind	prosumer wind	combined cycle (CCPP)	dual-fuel combined cycle (DFCC)
Estimated investment i, mln PLN/MW	6,5	9.1	18	6.3 (1.5 euro/W)	12.6 (3 euro/W)	6.3 (1.5 euro/W)	12.6 (3 euro/W)	2.7	4.6
Annual operating time t_R, h/year	7500	7500	8000	750	750	1750	1750	7500	7500
Internal electrical load: ε_{eL} %	7.6	33	7.6	1	1	1	1	4	6.2
Construction period b, years	5	5	5	1	1	1	1	2	5
Specific fuel price, PLN/GJ	11.4	11.4	6.6	0	0	0	0	32	coal = 11.4 gas = 32
Exploitation period: T = 20 years									
Annual rate of maintenance and overhaul δ_{serv} = 3%.									
Coefficients: $x_{sal,t,ins}$ = 0.25; $x_{sw,m,was}$ = 0.02.									
Discount rate r = 8%									
CO_2 emission charges: e_{CO2}= 29.4 PLN/Mg_{CO2}, (e_{CO2}=7 euro; exchange rate EURO/PLN=4.2).									
Tariff charges on emissions: p_{CO2}=0,29 PLN/Mg_{CO2}, p_{CO}=110 PLN/Mg_{CO}, p_{NOx}=530 PLN/Mg_{NOx}, p_{SO2}=530 PLN/Mg_{SO2}, p_{dust}=350 PLN/Mg_{dust}									
Emission from coal combustion: ρ_{CO2}=95 kg/GJ, ρ_{CO}=0,01 kg/GJ, ρ_{NOx}=0.164 kg/GJ, ρ_{SO2}=0.056 kg/GJ, ρ_{dust}= 0.007 kg/GJ									
Emission on gas combustion: ρ_{CO2}=55 kg/GJ, ρ_{CO}=0 kg/GJ, ρ_{NOx}=0.02 kg/GJ, ρ_{SO2}=0 kg/GJ, ρ_{dust}= 0 kg/GJ									
Ratio of chemical energy of the fuel in its total annual use for which the purchase of additional allowances is not required: CO_2: u = 0.									

Source: calculations based on data from Bartnik Ryszard, Bartnik Berenika, Hnydiuk-Stefan Anna. 2016. *Optimum Investment Strategy in the Power Industry.* New York: Springer and Hnydiuk-Stefan Anna. 2014. *Analysis of the parameters of power plants operating in oxy-fuel combustion*, Ph.D. thesis. Opole University of Technology.

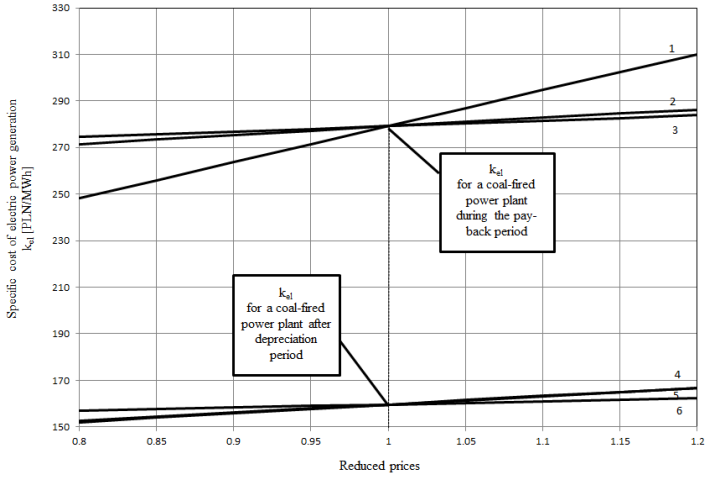

Fig. 5. Impact of fuel prices, internal load of the power plant, and value of investment on the specific cost of electric power generation k_{el} for a coal-fired power plant during the pay-back period and after this period: 3, 6 – internal electical load of the coal-fired power plant ε_{el} during the pay-back period and after depreciation of the unit, respectively; 2, 5 – fuel prices; 1, 4 – investment J in the coal-fired power plant

Source: own calculations

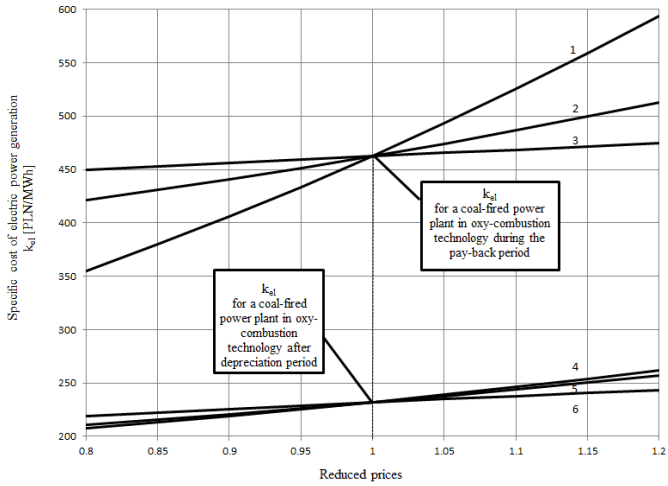

Fig. 6. Impact of fuel prices, internal electric load of a power plant, and value of investment on the specific cost of electric power generation k_{el} for a coal-fired power plant in oxy-combustion technology and for condition that x_{ccs}=0.2 during the pay-back period and after depreciation period, where: 2, 5 – internal electric load of the power plant ε_{el} in oxyfuel technology during the pay-back period and after depreciation period; 3, 6 – fuel prices; 1, 4 – investment J in the power plant in oxyfuel technology

Source: own calculations

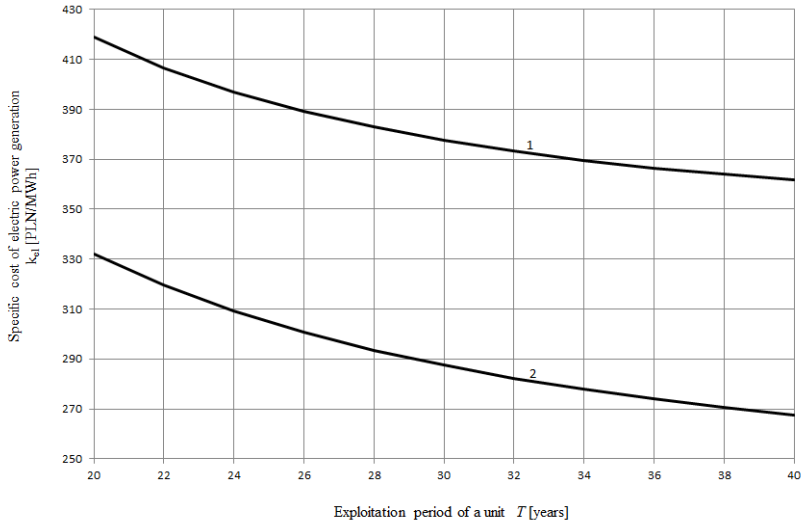

Fig. 7. Specific cost of power generation in a nuclear plant in the function of the exploitation period of a unit T (identical with depreciation period) for the discount rate: 1 – r = 8%, 2 – r = 5%

Source: own calculations

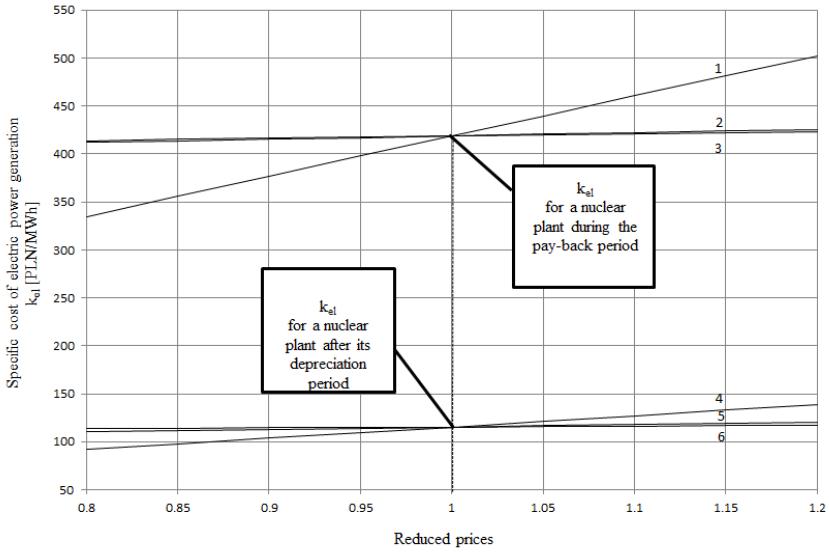

Fig. 8. Impact of fuel prices, internal electrical load of the power plant, and value of investment on the specific cost of power generation k_{el} for a nuclear plant during the pay-back period and after its depreciation period, where: 3, 6 – internal electric load ε_{el} of a power nuclear plant during and after its depreciation; 2, 5 – fuel prices; 1, 4 – investment J in a nuclear power plant

Source: own calculations

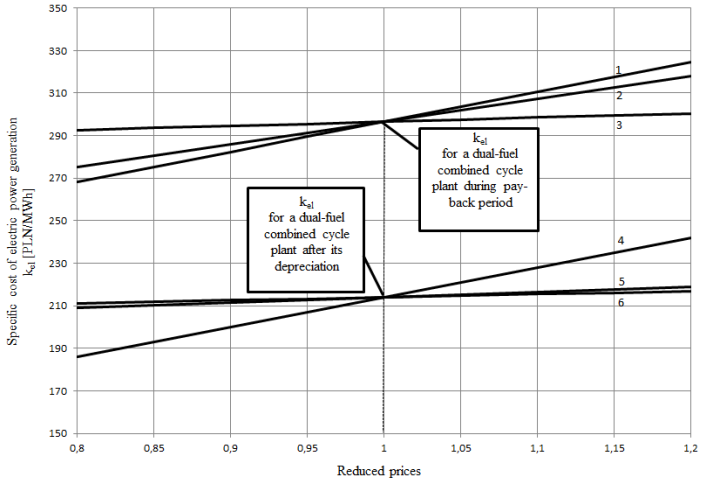

Fig. 9. Impact of fuel prices, internal electric load of a power plant, and value of investment on the specific cost of power generation k_{el} for a dual-fuel combined cycle plant during pay-back period and after its depreciation, where: 3, 6 – internal load ε_{el} of a dual-fuel combined cycle plant during its depreciation period and after its depreciation, respectively; 4– fuel prices; 2, 5 – investment J in a dual-fuel combined cycle plant

Source: own calculations

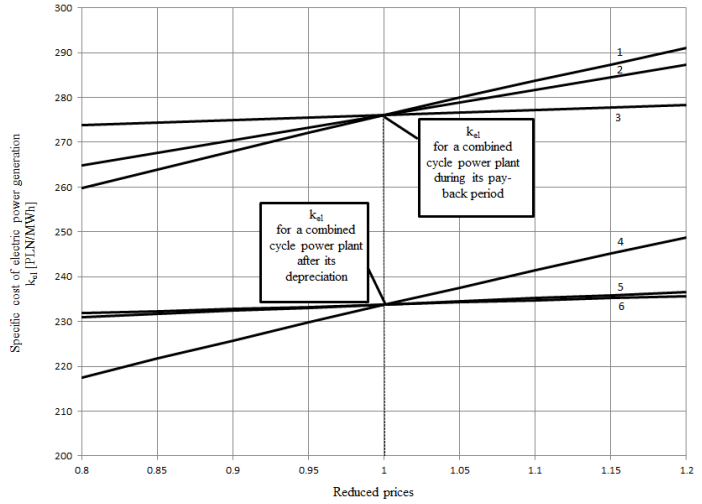

Fig. 10. Impact of fuel prices, internal electric load of the power plant, and the value of investment on the specific cost of electric power generation k_{el} for a combined cycle power plant during its pay-back period and after its depreciation, where: 3, 6 – internal electric load ε_{el} of the combined cycle power plant during its pay-back period and after its depreciation, respectively; 1, 4– fuel prices; 2, 5 – investment J in a combined cycle power plant.

Source: own calculations

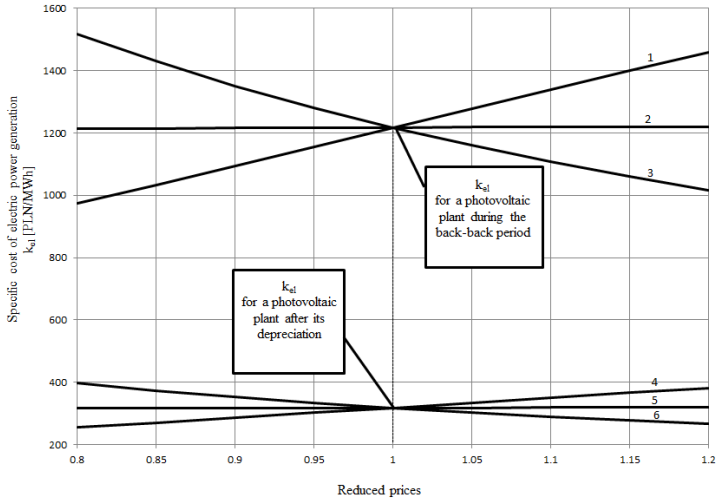

Fig. 11. Impact of fuel prices, internal electric load of the power plant, and the value of investment on the specific cost of electric power generation k_{el} for a photovoltaic plant during the back-back period and after its depreciation, where: 2, 5 – internal electric load ε_{el} of the photovoltaic plant during the back-back period and after its depreciation, respectively; 1, 4 – investment J in a photovoltaic plant; 3, 6 – annual operating time of a photovoltaic plant.

Source: own calculations

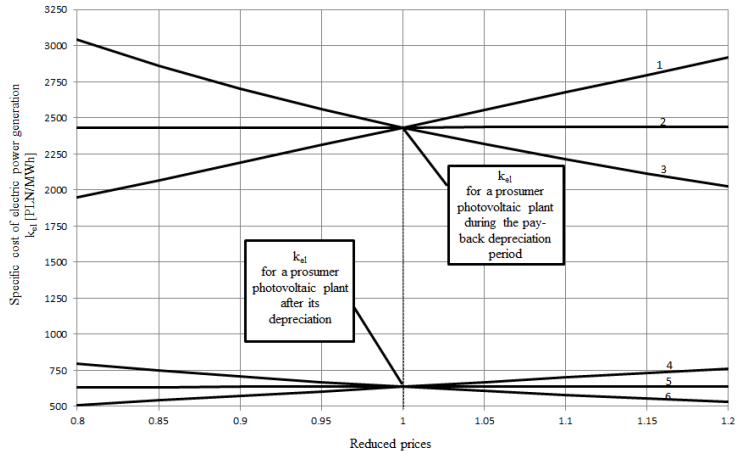

Fig. 12. Impact of fuel prices, internal electric load, and the value of investment on the specific cost of power generation k_{el} for a prosumer photovoltaic plant during the pay-back depreciation period and after its depreciation, where: 2, 5 – internal electric load ε_{el} of a prosumer photovoltaic plant during the pay-back period and after its depreciation, respectively; 1, 4 – investment J in a prosumer photovoltaic plant; 3, 6 – annual operating time of a photovoltaic plant.

Source: own calculations

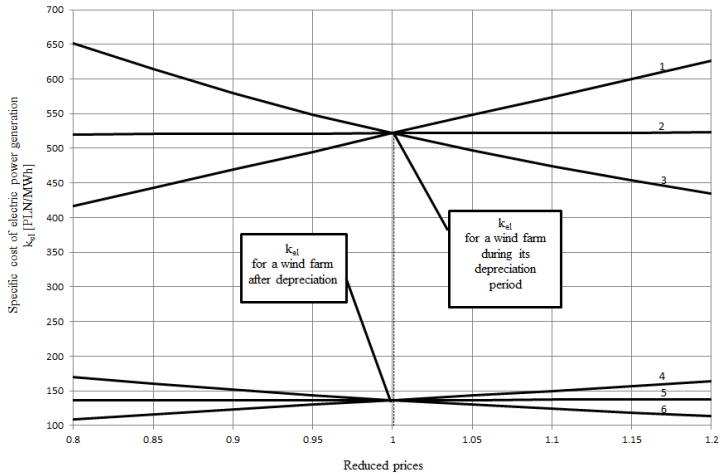

Fig. 13. Impact of fuel prices, internal electric load, and the value of investment on the specific cost of electric power generation k_{el} for a wind farm during its depreciation period and after depreciation, where: 2, 5 – internal electical load ε_{el} of a wind farm during its pay-back period and after its depreciation, respectively; 1, 4 – investment J in a wind farm; 3, 6 – annual operating time of a wind farm.
Source: own calculations

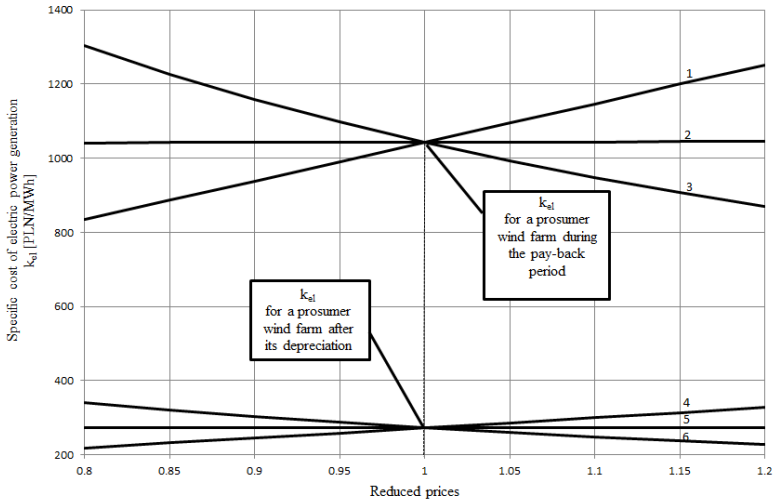

Fig. 14. Impact of fuel prices, internal load, and the value of investment on the specific cost of power generation k_{el} for a prosumer wind farm during the pay-back period and after its depreciation, where: 2, 5 – internal electric load ε_{el} of a prosumer wind farm during the pay-back period and after its depreciation, respectively; 1, 4 – investment J in a wind farm; 3, 6 – annual operating time of a prosumer wind farm.
Source: own calculations

Table 2. Summary of mean specific cost of power generation in the particular technologies of its production for the data in Table 1.

Power plant type	nuclear	photovoltaic	prosumer photovoltaic	wind	prosumer wind	dual-fuel combined cycle (DFCC)	combined cycle (CCPP)	coal-fired with air combustion	coal-fired with oxy-combustion x_{ccs}= 0.2
Specific cost of electric power generation k_{el} [PLN/MWh]	419	1217	2434	522	1043	296	276	279	463
Specific cost of electric power generation after depreciation period $k_{el,amort}$ [PLN/MWh]	115	318	636	136	273	214	234	160	232

Source: calculations based on a formula Bartnik Ryszard, Bartnik Berenika, Hnydiuk-Stefan Anna. 2016. *Optimum Investment Strategy in the Power Industry*. New York: Springe and data from Table 1.

4. CONCLUSIONS

As we can note from the calculations in Fig. 6, the specific cost of electric power generation in coal-fired units employing CCS technology is as much as two times higher from the cost in the power units lacking these technologies (Fig. 5). This cost is even considerably higher than the cost incurred in nuclear power plants (Figs. 7, 8) despite two times more costly specific investment in the nuclear units (computed per unit of capacity). If the policy aimed at limiting greenhouse gases is maintained worldwide, a current issue should concern finding a substitute to the current use of coal. However, if such a policy provides for stricter emissions control, this issue will also concern the use of natural gas. In such a case, there is no other option than the use of fissile fuel. For the case of nuclear power plants, the cost of nuclear fuel accounts for a small proportion (around 5%) of the specific cost k_{el} of electricity generation in them, whereas in conventional units the proportion of the cost of coal and gas use are considerable (i.e. around 35% in conventional coal-fired plants with supercritical parameters, 30% in the ones employing oxy-fuel combustion and 75% in combined cycle power plants burning natural gas). In this case, the specific cost of electricity generation in a nuclear plant is equal to around k_{el} = 420 PLN/MWh (by increasing the depreciation period from T = 20 years to T = 40 years, k_{el} = 362 PLN/MWh; on condition that the interest rate on the investment decreases by 3 %, i.e. from r = 8% to r = 5%, k_{el} = 332 PLN/MWh for T = 20 years and k_{el} = 268 PLN/MWh for T = 40 years, Fig. 7). The commissioning of nuclear stations additionally lead to the increase in the energy security of the country. In addition, in the long term nuclear-generated power becomes a very cheap source after the depreciation of the units and considerably cheaper from the production in depreciated coal-fired unit with supercritical parameters. This price is decided primarily by the cost of the nuclear fuel, which forms only a few per cent of the specific cost of k_{el}, whereas in the coal-fired units coal accounts for several dozen per cent of the overall cost. Hence, the only sensible and justified way of finding a substitute for coal and gas in the existing power plants is associated with their substitution with fissile fuel. By the way, we can note that the Poland's energy policy needs to combine coal and nuclear sources of power. In this, we need not build new coal-fired plants but retrofit the existing ones so that their operation is possible over the next dozens of years.

The option of ceasing their operation imposed by the European climate and energy package is counter to the Polish raison d'être. The investment in the retrofitting the existing power plants is inconsiderable in comparison to the investment required to build new ones burning coal. In addition, investment needs to be made in nuclear power plants, as it is justified from the economic perspective. This policy should be accompanied by the development of production of fuel elements for power reactors. The resources of uranium ores in Poland are large. Thus, following this direction offers a rational way of economic and civilization development of the Polish state.

Renewable energy sources (RES) are characterized with particularly high specific costs of electric power generation, as concluded from Figs. 11–14. This is due to the high specific investment needed in them, which is equal to the ones made in the units with supercritical parameters. Another factor is the very short period of their potential yearly operation, which is equal to 1,500−2,000 h/a for the wind farms in the conditions of Polish climate (compared to the total number of 8,760 hours in a year). In addition, electricity generation of RES sources is random as a result of unreliable weather conditions. Furthermore, power generation in photovoltaic cells is another solution which cannot secure sufficient power supply in sufficient volumes and in a reliable manner. This is due to their high cost and low reliability, as well as the operating time estimated at 750 hours per year. Hence, despite the fact that solar power is the only endless and reliable source of energy, harnessing its power is matter of remote future, at least dozens if not hundreds of years. A solution which seems to offer a closer perspective is associated with gaining skills in applying fusion reaction. As a consequence of its development, humankind will have an inexhaustible source of clean energy. The existence of RES is only possible due to the subsidies from the state treasury (i.e. it relies on taxpayers). In the old 15 EU member states, power generation in photovoltaics obtains a subsidy in the amount of 430 €/MWh, while the power from wind turbines – 160 €/MWh). In addition, such sources can only prove as a supplement to the baseload power plants, which are the only ones capable of continuously supply the required volumes of electric power. Sociological analysis indicates that 80% of people will live in metropolitan areas in 2050; hence, the idea of the prosumer RES is a complete delusion. Apart from this, the specific cost of power generation in them are the highest, as visible in Figs.12, 14.

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W JAKIE TECHNOLOGIE ENERGETYCZNE NALEŻY INWESTOWAĆ?

W artykule przeanalizowano jednostkowe koszty wytwarzania elektryczności w różnych technologiach jej produkcji. Analizie poddano wszystkie dostępne technologie energetyczne (bez elektrowni wodnych): elektrownie węglowe ze spalaniem konwencjonalnym

i w technologii CCS (Carbon Capture and Storage) oxy-spalania, elektrownie jądrowe, elektrownie gazowo-parowe, elektrownie gazowo-parowe dwupaliwowe, elektrownie wiatrowe, elektrownie fotowoltaiczne. W artykule przyjęto, że najkorzystniejszą ekonomicznie technologią jest ta, dla której średni jednostkowy koszt produkcji energii elektrycznej jest najmniejszy. Zależy on między innymi od takich czynników jak: od jednostkowych nakładów inwestycyjnych, elektrycznych potrzeb własnych, rocznego czasu pracy, ceny paliwa i jej zmian w czasie, udziału energii chemicznej paliwa w całkowitym jego rocznym zużyciu, dla którego nie jest wymagany zakup pozwoleń na emisję CO2, taryfowych opłat za korzystanie ze środowiska naturalnego, co wykazano w artykule. W obliczeniach posłużono się ponadto metodyką i uzyskanym za jej pomocą modelem matematycznym jednostkowego kosztu produkcji, co istotne, z czasem ciągłym. Umożliwia on uwzględnianie w obliczeniach m.in. różnych scenariuszy zmian w czasie cen nośników energii. Co więcej, pozwala na wykorzystanie rachunku różniczkowego do analizy wartości jednostkowych kosztów wytwarzania elektryczności. Przeprowadzono ponadto dla rozważanych technologii analizę wrażliwości tych kosztów w celu oceny zmian ich wartości w funkcji zmian parametrów mających na nie wpływ.

Słowa kluczowe: technologie energetyczne, koszt wytwarzania energii, CCS, elektrownie gazowo-parowe, elektrownie gazowo-parowe dwupaliwowe

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SMEs DEVELOPMENT WITHIN INDUSTRIAL CLUSTERS – STRATEGIC CHALLENGE FOR CLUSTER MANAGEMENT

The purpose of this article is to characterise the role of industrial clusters in SMEs development. Trying to meet demands of the current environment, these companies are forced to constantly identify new ways of development, including new sources of sustainable competitive advantage. Nowadays, focusing only on the internal (endogenous) development for many entities is insufficient and external development of the SMEs through the clusters may be a complementary approach for their internal development. Despite the scarcity of clear cluster definitions it is widespread that clusters - as concentrations of R&D entities, business support institutions and interconnected firms operating in the same or related economic sectors that cooperate and compete at the same time - provide favorable conditions for entrepreneurship and innovativeness development. SMEs can improve their market offer, transfer knowledge, formulate and implement R&D activities, and develop relational capital by actively operating within clusters and collaborating with their partners, both in internal and external environments (eg. involvement in foreign networks). The activities of cluster coordinators play a strategic role in shaping the appropriate conditions for the development of cluster members. Based on the good practice in the field of Polish-Spanish international networking linked to the execution of the "Adelante" project by the coordinator of Sub-Carpathian Renewable Energy Cluster, the benefits for SMEs of that cluster were pointed out. This practice shows that the involvement of a cluster coordinator with key cluster stakeholders for development of cluster members contribute to development of the entire cluster and boost its competitiveness.

Keywords: cluster, management, SMEs, development, competitiveness.

1. INTRODUCTION

The activity of industrial clusters has strategic importance for the long-term process of transformation that take place in the economy, stimulating the growth of entrepreneurship, innovativeness and competitiveness at micro, meso and macro levels. The entrepreneurial ecosystem of clusters created by the accumulation of values such as knowledge, cooperation of actors forming regional innovation system, coopetition, socio-economic traditions of the region and social capital, provides favourable conditions for business development, in particular for micro, small and medium-sized enterprises (SMEs).

A significant number of SMEs are not able to individually meet the challenges of the current turbulent environment (the amount of change and complexity in the environment)

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and various development barriers (market-oriented, social, financial, technological, etc.). Globalisation, glocalisation, still growing industrial competition in the area of innovations and technological development, increased level of requirements and customer awareness or local barriers to development are only a few examples of factors that determine SMEs decisions to undertake greater co-operation within the framework of industrial clusters.

The aim of the article is to characterise industrial clusters as an external (exogenous) way of the SMEs development based on selected Polish clustering experiences. The choice of this research problem was related to the fact that SMEs are the most diverse elements of the economy in terms of structure, operation methods, economic potential and flexibility. Being a fundamental element of the structure of clusters, these entities expect synergies resulting from cluster cooperation, the continuous search for new technological, organisational and marketing solutions, the implementation of which will improve their current activities and will strengthen the competitiveness at national and international scale. These expectations provide many new challenges for the cluster management, for example in terms of networking, sustainable development, building trust capital, acquiring new partners for cluster projects, R&D infrastructure development cluster, and financing cluster activities. Therefore, this kind of cluster management challenges led to three related research questions:

- what distinguishes activity of industrial clusters?
- what is the current role of industrial clusters for SMEs development?
- how does cluster coordinator (cluster organisation) shape the favourable conditions for SMEs development?

The scientific considerations that were presented in the article were based on selected theoretical research results and desk research. In the research process, the most useful research method was the case study. The source of data in qualitative research was co-author[3] experience acquired in the implementation of an EU-funded project aimed at developing SMEs through international cooperation between Polish and Spanish clusters. This case study was partly determined by phenomenological paradigm because of the holistic view of the phenomenon and knowledge generation based on participant observation (the observation extends beyond naturalistic observation because the observer is a "player" in the action). The choice of this method resulted from the conviction of the authors that the case of successful project executed by the cluster may be a source of inspiration for various cluster stakeholders.

2. SMEs AS A KEY COMPONENT OF INDUSTRIAL CLUSTERS

Industrial clusters are widely discussed in the scientific literature, because cluster concept is still a popular topic and various types of industrial clusters exist. In particular, there are two types of industrial clusters that can be found among commercial activities today: industrial clusters that historically developed in many areas around the world, and more recently modern industrial clusters that were formed or initiated by entrepreneurial

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individuals[4]. Multiple different factors (endo- and exogenous) induce the formation of industrial clusters worldwide[5]. Therefore, still there is no universally accepted definition of industrial cluster. The economic literature provides many definitions of what an industrial cluster is, for example:

- one of new combined methods of various theories such as theory of economic geography, financial geography, regional economics, national innovation system, transmitting knowledge theories, social capital theories and social networks[6];
- structure which is generated and reinforced by a positive feedback process based on a set of advantages that arise from the agglomeration of industrial activities[7];
- intermediate organisations located in a specific geographical region that are officially or unofficially formed by different enterprises (micro, small, medium and large) with shared goals and unified rules[8];
- form of territorial "aggregation" between companies operating in the same sector or branch and characterised by specific technical and social relationships among private and public actors[9];
- selected sets of multiple autonomous organisations, which interact directly or indirectly, based on one or more agreements between them. The aim of clusters is to gain a competitive advantage for the individual organisations involved and occasionally for the entire cluster as well[10];
- flexible production platforms with some kind of activity specialisation. Cluster operation can be targeted directly to consumer markets but also to supplies of specific intermediate products. In some cases a cluster is organised as an alliance of equal parties (i.e. firms with similar size and importance), in other cases the organisation is more satellite - like and there is one or few large companies that determine cluster activities according to their input demands[11];
- a system composed of many industries. The structure of industrial clusters concerns the correlation and interdependent relationship among basic integral parts, namely, among industries. It is determined by the functional and spatial links among industries and in turn, deeply influence these links. Economic links among industries within clusters not only include input-output relationships, but also reflect external economic relationships[12];

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- a geographic concentrations of interrelated companies and institutions that co-locate around a variety of common interests or needs. It is geographically bounded groups of firms that depend on other nearby firms and institutions for their livelihood in a variety of ways[13];
- a group of geographically close and interacting leading companies and affiliated organisations which act in specific economy sphere of the region, which are closely connected with each other in the framework of industrial, technological, scientific of interactions[14];
- a business and living area that comprises a large variety of firms that are relatively homogenous in production activities and constituted by socioeconomic structures. A community of firms in the area is embedded socially as a community of people, in support of trust and reciprocal relationships, that gets involved in transactions. Market relations between cluster firms can be organised on the basis of mutual co-operation and competition (coopetition)[15].

According to P. Morosini an industrial cluster is a socioeconomic entity characterised by a social community of people and a population of economic agents localised in close proximity in a specific geographic region. The ultimate goal of this kind cluster is to generate superior products and services that are valuable to customers in the marketplace. Within an industrial cluster, a significant part of both the social community and the economic agents work together in economically linked activities, sharing and nurturing a common stock of product, technology and organisational culture. In a well-developed industrial cluster, these linkages can be numerous, unique and specialised[16].

There are various types of definitions of industrial clusters identified in the literature. Two main approaches to defining industrial clusters have developed over the last 20 years: clusters based on inter-industry linkages inferred from multi-region analysis and cluster definitions based on observed linkages among industries or firms in a single region[17].The most important definition of industrial cluster was given by Michael Porter, because he focused primarily on the dynamics of industry clustering. For this paper an industrial cluster was defined as a cross-industry system that arise in certain locations based on buyer-supplier relations (vertical relations) and the coopetition relations between competitors in the market (horizontal relations), interconnected firms (SMEs and large) and institutions connected with them (e.g. universities, standardisation institutions and industrial associations). Geographic, cultural, technological and institutional proximity provide companies with special access, closer relationships, better information, powerful incentives, and other advantages that are difficult to tap from a distance[18]. Porter's notion

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of ‘industrial clusters' is easily the most popular and well known. Moreover, has become the standard concept in the field of promoting national, regional or local competitiveness, innovation and growth.

Many researchers stress that the industrial cluster is the new phenomenon of the development of companies and regional economies[19]. It can play a significant role in stimulating the regional development and strengthening the local-global linkage. The creation of industrial clusters has been regarded as an important strategy to improve the competitive advantage of a national economy and to cope with the fierce global economic competition[20]. Furthermore, an industrial cluster has great influence on the optimisation of regional industrial layout and regional economic structure[21].

L.W. Munnich argues that firms within certain industries have a tendency to cluster geographically within urban areas. The nature of the process by which industrial clusters emerge within urban areas has, in recent years, become a major topic of study in fields such as urban economics and economic development policy. Industries with higher location quotients are assumed to be more competitive, representing “traded” clusters that sell a larger share of their output outside the immediate region[22]. The development of industrial clusters is considered as an effective alternative approach to building a competitive advantage for the industries in particular and the region in general. Moreover, it can be used to develop broad industries that focus on the types of products with high international competitiveness in both domestic and global markets[23].

In the formation of industrial clusters, special economic zones make a prominent contribution to national economic development, and are thus important indices of industry cluster development[24]. Tax reliefs are one of the instruments for the new projects promotion in special economic zones used widely as an element of industrial policy, both in developing and highly developed countries. The aim of the special economic zones is to attract new, high-tech enterprises that can contribute to export growth, sustained modernisation of the regional economic structure, effective use of local resources in a sustainable way, stimulating the local job market, and creating a cooperation network between the actors of the regional innovation system. The formation of industrial clusters cannot be achieved by the market mechanism alone because the harmonisation of suitable economic policies and cluster policies is also required[25].

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An industrial cluster is still perceived as the source of a lot of advantages for the cluster members functioning in their structures and the countries in which they are located (Table 1). The biggest advantage of the cluster approach is that the group of people share a common prospect or problem; hence they can unanimously decide and come to a solution. This is one of the advantages of partnership within cluster, especially where the partners have different skills and can work well together[26].

Table 1. Key benefits for industrial cluster members

Characteristics of selected benefits/advantages:
• industrial cluster development can impel economic growth and urge the formation of a regional innovation system • industrial cluster plays an important role in a group of competitive, interconnected industries and other entities; through specialisation and collaboration between enterprises within the group established a close relationship between competition and cooperation • through competition and cooperation (coopetition), members in the cluster complete the human resource distribution and establish economic and technological relationships based on input–output analyses • the appropriate support agencies, to provide various services such as local governments, industry associations, the financial services sector and education and training institutions • the concentration and collaborative ties of companies promote efficiency and productivity • clusters offer companies easy access to important resources, lower transport costs, access to customers and the workforce • cluster in many ways to establish an environment conducive to innovation, face to face communication between people in the cluster and the mobility of labour, to speed up the flow of business knowledge, financial knowledge and technical knowledge, to stimulate innovation • clusters in all sectors can be developed through the construction of internal industrial networks, reduce costs and promote innovation • the main function of a cluster is to promote innovation (and open innovation) • within the industrial clusters, improvement of innovation capability relies on the sustainable supply and input of technology development resources from both internal and external • the improvement of innovation capacity relies on the continuous supply of internal and external technical resources to the industrial cluster, namely talents and academic research, enterprise research and development, and other technological innovation information transfer networks • division of labour between firms in the cluster can reduce production and transaction costs • cluster members through joint use of public facilities to reduce the additional investment required to dispersed layout, and use of geographic proximity and save the costs of material and information flow in the inter-migration, thus reducing production costs • common culture and shared values within cluster is conducive to the establishment of a partnership between cluster members and trust-based social networks, making it both easy to deal and fulfil the contract, thereby reducing transaction costs, but also to make the transaction uncertainty lead to the risk of cost reduction • cluster formed by establishes a “brand” and leads to the formation of a good brand image among consumers, enhances consumer desire to buy, expand the market competitive advantage • industrial clusters tend to have the characteristics of cross-regional and cross-industry

[26] D. Bhattacharyya, *Cottage industry clusters in India in improving rural livelihood: an overview*, “International Journal of Humanities & Social Science Studies” 2014, vol. 1, no. 1, p. 63

Characteristics of selected benefits/advantages:
• cluster has an impact on effectiveness of cluster companies, where the effectiveness is understood here as the ability to create a competitive advantage for companies functioning within the cluster either directly considered in relation to these entities and countries (or regions) in which clusters exist

Source: prepared based on: Z. Qing, *The research on influence* …, op. cit., pp. 206-212; K. Cheba, *The influence of clusters on economic development. A comparative analysis of cluster policy in the European Union and Japan*, "Quarterly Journal Oeconomia Copernicana" 2015, vol. 6, no. 3, p. 78; J. Adams, J. Wang, *Industrial clusters and regional economic development in China: the case of "green food"*, "Journal of Chinese Entrepreneurship" 2009, vol. 1, no. 3, pp. 279-294; X. Jia, M. Jiang, T. Ma, *The dynamic impact* …, op. cit., pp. 807-813; Z. Garanti, A. Zvirbule-Berzina, *Regional cluster* …, op. cit., pp. 91-97.

Productivity, innovation capacity and an increase in efficiency of geographically concentrated enterprises can contribute to the enterprise competitiveness[27]. The benefits resulting from cluster activities may be divided into material benefits (easily measurable) and intangible assets (difficult to measure). Thus, can be analysed at various levels (cluster members, cluster as an organisation, region and country level) from different perspectives. The economic literature frequently shows that the cluster is used as a tool to create competitive advantages, particularly regarding micro, small and medium-sized enterprises (SMEs). Nowadays, clustering is indeed important for the development of SMEs as well as the region[28].

The European definition of SMEs including micro (up to 10 employees), small (up to 50 employees) and medium-sized enterprises (up to 250 employees). SMEs represent 99% of all businesses in the EU. The definition of an SMEs is important for access to finance and EU support programmes targeted specifically at these enterprises[29]. Within a cluster there can exist three different types of SMEs[30]:

- first type are SMEs that simply respond to some challenge or local need that is clearly apparent and does not require a great deal of technical knowledge, large investment capital, or significant labour force;
- second type are SMEs that have moved up the technology curve. Over time, these type of companies gain knowledge and experience in operating large-scale production equipment and start to offer design options to their clients;
- third type are SMEs that reflect strong entrepreneurial initiatives (new products, processes, solutions, etc.).

[27] Z. Garanti, A. Zvirbule-Berzina, *Regional cluster initiatives as a driving force for regional development*, "European Integration Studies" 2013, no. 7, p. 97.

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[30] G. Tesar, J. Bodin, *Marketing management* …, op. cit., pp. 35-36.

According to A.P. Muizer and G.J. Hospers, the motives for clustering may differ along with a companies size (cluster members). Moreover, the role and position in industry clusters as well as the characteristics of industry clusters may differ along with a companies size. They stress that the main motives for SMEs to participate in a modern industry cluster are technology-based. In order to reduce the power of uncertainty and maintain competitiveness particularly SMEs may be willing to develop new products, but do not have the economies of scale and scope in the R&D-function which large firms often do have[31]. Clustering can stimulate the development and growth of SME sector, as SMEs that participate in clusters can gain advantage from: an advanced and specialised infrastructure, a qualified workforce, increased possibilities to penetrate new markets, an increased ability to meet the needs of clients, and cost reduction in manufacturing operations[32]. Key factors that have a strong impact on development SMEs within an industrial cluster are e.g.: effect of transportation, effect of market size, effect of adjustment, effect of effectiveness, effect of control, effect of culture[33].

Polish clusters create an entrepreneurial ecosystem that contribute to boost the development of the Polish SMEs. This ecosystem has an insatiable demand for this kind of enterprise. In order to highlight the importance of SMEs in the development of Polish clusters, selected results of benchmarking surveys conducted among the Polish clusters were used. The Polish Agency for Enterprise Development (PAED) executed three editions (2010, 2012 and 2014) of benchmarking surveys. The purpose was to assess the state of Polish clusters, but also to identify trends in cluster development over the six years. Data for benchmarking analyses was primarily obtained through questionnaire interviews with cluster coordinators, which are defined as legal entities that perform coordinating functions in clusters. The experience of Polish clusters indicated that micro, small and medium-sized enterprises dominated numerically within cluster members. Table 2 shows the structure development of the surveyed clusters by size enterprises during the study period.

Tab. 2. SMEs within polish clusters (cluster benchmarking - edition 2010, 2012, 2014)

Edition of studies	**Size of firms**			
	Micro <10 employees	**Small <50 employees**	**Medium <250 employees**	**Large >250 employees**
2010 N = 47 clusters 1469 firms	44%	15%	29%	12%
2012 N = 35 clusters 1137 firms	45%	26%	21%	8%
2014 N = 35 clusters 1559 firms	44%	32%	18%	6%

Source: prepared by the authors based on: Deloitte, *Benchmarking klastrów w Polsce – 2010. Raport z badania*, PARP, Warszawa 2010, p. 31; J. Hołub, *Benchmarking klastrów w Polsce – edycja 2012. Raport z badania*, PARP, Warszawa 2012, p. 28; B. Plawgo, *Cluster benchmarking in Poland – edition 2014. General report*, PAED, Warszawa 2014, pp. 6-21.

[31] A.P. Muizer, G.J. Hospers, *Industry clusters and SMEs*, EIM, Zoetermeer 1998, pp. 5-6, 48-49.

[32] V. Navickas, A. Malakauskaite, *The impact of clusterization on the development of small and medium-sized enterprise (SME) sector*, "Journal of Business Economics and Management" 2009, vol. 10 (3), p. 257.

[33] A.P. Muizer, G.J. Hospers, *Industry clusters* …, op. cit., pp. 5-6, 48-49.

The information presented in Tab.2 indicates that micro firms constitute the largest group among cluster members surveyed in each of the three editions of the benchmarking. The second most important group consisted of small business. During the study it was confirmed that SMEs has shown a special interest in participating in this kind of initiative, considering cluster cooperation as a source of several benefits. SMEs were also deciding about the nature, scale and dynamic of development processes in studies clusters. The research has affirmed the natural feature of clusters as a pro-innovation environment. Enterprises belonging to clusters showed higher innovation activity than the average for the entire enterprise population. More than 7% employment growth has been noted in entities belonging to the group of clusters examined during the last two years (2014 July - 2012 July). Given that the number of people employed have virtually remained steady in Poland in that period, the rising employment in clusters is proof that they concentrate entities characterised by great competitiveness and expansiveness[34].

In 2015 Polish Agency for Enterprise Development (PAED) conducted further studies among Polish clusters. A research project implemented by PAED in 2015 included a cluster stock taking, aimed at establishing the real number of active clusters in Poland. In order to do this, basic data on cluster initiatives has been collected from various sources and validated with respect to correctness and completeness. Then a questionnaire based survey of cluster organisations (coordinators) has been performed in an attempt to collect comprehensive data on clusters and their members. Inventory of clusters operating on the territory of Poland has revealed the total number of 134 active clusters. In these clusters operated 4 578 companies and SMEs represented on average 78% of all cluster members. Chart 1 displays the structure of enterprises in the Polish clusters during the study period.

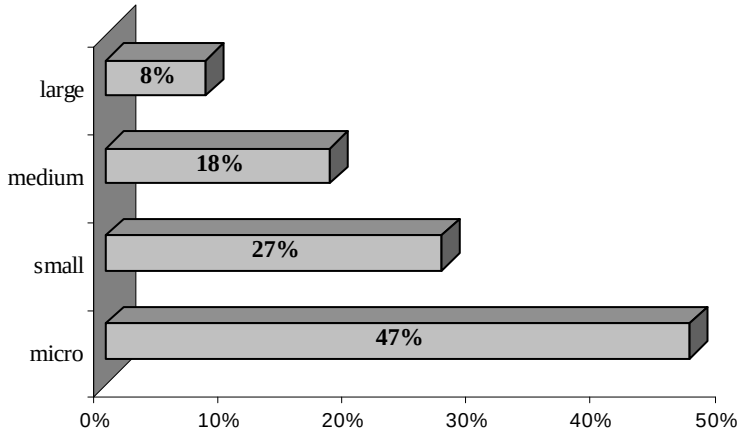

Chart 1. Business structure in clusters based on employment levels (2015, N=4578 enterprises)
Source: prepared by the authors based on: G. Buczyńska, D. Frączek, P. Kryjom, *Raport z inwentaryzacji klastrów w Polsce 2015*, PARP, Warszawa 2016, pp. 22-23.

Apart from the group of clusters actively operating (existing clusters) in Poland, the research also revealed 106 potential clusters (clusters that could operate but do not have sufficient key resources that allow its proper functioning and development). A big part of

[34] B. Plawgo, *Cluster benchmarking in Poland – edition 2014. General report*, PAED, Warszawa 2014, pp. 6-21.

group of potential clusters consisted of public support beneficiaries who either haven't managed to continue collaboration beyond their cluster projects or experienced a significant decline in their activity levels for different reasons. It seems that some of these potential clusters could change into real clusters in the near future[35].

In Poland, the best conditions for SMEs development offer clusters which acquired the status of Key National Cluster (KNC) and those whose cluster management system is consistent with the standards developed by PAED in 2014. Currently, 16 Polish clusters have active status of KNC[36], have strategic importance for the country's economy and are highly competitive. The KNC are identified at national level by the Ministry of Development that organises a competition procedure based on different criteria including, critical mass, development potential, innovativenes, level of internationalisation, existing and planned cooperation within the cluster and the experience and potential of the cluster coordinator. The analysis conducted by the PAED in 2015 aimed at verifying the degree of compliance of Polish cluster management within the formulated standards has shown that[37]:

- the cluster management standards should be understood as a code setting basic requirements for coordinators' practice and conduct in running a cluster;
- cluster entities, especially SMEs, have a real basis to verify competences of their coordinators;
- each cluster has been assessed against 36 cluster management standards covering five sections: cluster setup, resources, processes, services for cluster members and external collaboration;
- the overall level of compliance in five sections was as high as 92% on average;
- from 64 clusters involved in the study – 30 of them have met standards of cluster management;
- from 64 clusters – 5 were in the embryonic growth phase, 58 in the development phase and 1 cluster was in the mature phase;
- Polish clusters are young organisations and, in many cases, cluster coordinators are developing skills of profesional cluster management and effective actions for improving its competitiveness.

Curently, clusters are one of the most dynamic and flexible tools for cooperation of Polish SMEs[38]. Developed standards for cluster management are and will be an important factor in determining the quality of cooperation and management of Polish clusters. Striving for cluster management excellence can provide many new benefits for cluster members, including SMEs.

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[35] G. Buczyńska, D. Frączek, P. Kryjom, *Raport z inwentaryzacji …*, op. cit., p. 10.

[36] http://www.pi.gov.pl/klastry/chapter_95922.asp (access: 1.12.2016).

[37] D. Frączek, P. Kryjom, *Weryfikacja standardów zarządzania w wybranych klastrach – edycja 2015*, PARP, Warszawa 2016, pp. 6-23.

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3. GOOD PRACTICE FOR SMEs DEVELOPMENT WITHIN INDUSTRIAL CLUSTER - A CASE STUDY

The project "Adelante" was an EU funded initiative implemented during 2014-2015 in the Podkarpackie and Andalusia regions aimed at fostering international cooperation and knowledge transfer between Polish and Spanish SMEs representing eco-energy, smart cities and connected sectors. The aim of the project was to increase the competitiveness, adaptation potential and internationalisation level of micro, small and medium enterprises (SMEs) basing on the Spanish experiences related to renewable energies development, transition to a low carbon economy and creation of smart cities. The project was implemented by an interdisciplinary consortium, consisting of the following institutions: Subcarpathian Renewable Energy Cluster, Rzeszów Regional Development Agency, Andalusian Cluster of Renewable Energies and Energy Efficiency.

The Subcarpathian Renewable Energy Cluster - SREC (in Polish: Podkarpacki Klaster Energii Odnawialnej - PKEO) was a lead partner within project "Adelante". It is a network of inter-sectoral cooperation that brings together more than 80 institutions from private, public, academic and business support institutions representing renewable energy, energy efficiency and new technologies sectors. Established in 2011 and awarded with the prestigious Bronze Label Cluster Excellence[39], the cluster has experience in organising dozens of training, thematic events, information, education and advisory services, as well as in implementation of EU-funded projects. The cluster's actions aim to create a strong and uniform representation of the interests of entrepreneurs, investors, research and development (R&D) units as well as other entities working for the development of the environmentally friendly power industry based on renewable energy sources. The main SREC's activities focus on winning new partners, observing and analysing domestic and foreign experiences (good practices) as well as improving contact and communication mechanisms. One of the important assumptions of the strategy is the creation of joint products based on innovative solutions developed with the participation of R&D units of partner universities. Benefits for the cluster members are different: strong and influential group of partners; access to a R&D base, business contacts and sectoral news; participation in the creation and implementation of joint products and solutions; strengthening market position and positive image of the company; presentation of the company potential on cluster websites; consistent outside representation of cluster members' interests[40]. The cluster members want to develop international cooperation directed towards: exchange of knowledge and experiences; looking for access to the reliable /standard business cooperation solutions; looking for new markets for the cluster members and their products; looking for access to new technologies, organising cooperation with R&D units; organising study tours, internships and specialist training; and looking for sources of financing of joint activity[41].

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[39] Bronze Label awarded to cluster organisations having taken part in a benchmarking exercise according to the „NGPExcellence-approach". Benchmarking exercise performed by the European Secretariat for Cluster Analysis (ESCA) relying on an international pool of specifically trained „Cluster Benchmarking Experts". Validity of the label: two years from month of benchmarking interview http://www.cluster-analysis.org (access: 1.12.2016).

[40] http://www.tci-network.org/initiatives/initiative/4704 (access: 1.12.2016).

[41] PARP, *Clusters in Poland*, PARP, Warszawa 2012, p. 39.

The Rzeszów Regional Development Agency (RRDA) was a Polish partner within the project. It was established in 1993 as a leading institution for comprehensive development of the Podkarpackie region and specialises in delivering training, consulting, EU projects and implementation of new technologies. The RRDA operates within national and European co-operation networks. It has obtained accreditation with the Polish Agency for the Development of Enterprise as far as training, information, consulting financial as well as pro-innovative services are concerned. It is a member of the National Service System for SME's in Poland and the network of the Innovation Relay Centres in Europe. The Agency employs a team of highly-qualified experts in the fields of law, economics, sociology, finance, architecture and civil engineering, who are dynamic, open-minded and ready to serve local enterprises, government, investors, as well as scientists and all those who contribute to the development of the region[42].

The Andalusian Cluster of Renewable Energies and Energy Efficiency (CLANER) was established in 2012, promoted by the Andalusian Association of Promoters and Producers of Renewable Energy (APREAN)[43]. The cluster brings together the leaders of development and the use of renewable energy resources and smart cities in Spain. Cluster activities are oriented on research, development and innovation, cooperation with companies and clusters, marketing and support for the internationalisation of its members. This cluster is born thanks to the collaboration of multiple entities in the field of R&D, to develop and carry out large projects taking advantage of the technological knowledge accumulated throughout years of leadership of the Andalusia's renewable sector companies. The cluster consists of nearly 100 members and aims to keep adding more key actors of the industry[44].

The target group of the project "Adelante" were SMEs representing eco-energy sector (renewable energy, environment, IT, construction, architectural and related), located in the Podkarpackie region and decided to increase their competitiveness through complex training and advisory support in the field of: strategic management, international financing, marketing, branding and packaging, internationalisation and export consortia. The programme was also focused on building a reliable, cross-sectoral international network of partners based on sharing experiences and transferring good practices from Spain to Poland in order to boost competitiveness, internationalisation and innovation of Polish SMEs. The project "Adelante" was implemented in participatory way focusing on strengthening regional and international linkages between the Podkarpackie and Andalucia regions, including engagement of the scientific and local/regional government institutions. The project includes a number of comprehensive activities, such as:

- transfer of Spanish experiences of renewable energies and smart cities development through a cycle of three thematic informs tailored to the Podkarpackie region economic and social reality;
- organisation of two participatory workshops aimed at identifying current needs and expectations of the SMEs;
- diagnosis of the situation of Polish SMEs carried out by Spanish experts and further elaboration of development plans;

[42] http://www.rarr.rzeszow.pl/en/ (access: 1.12.2016).

[43] http://claner.es/en/quienes-somos/ (access: 1.12.2016).

[44] http://www.investinandalucia.es/new/show/id/122/title/The-Andalusian-Renewable-Energies-Cluster-is-born (access: 1.12.2016).

- advisory services for Polish companies related to management, marketing, financing and internationalisation processes;
- elaboration of training programmes by Spanish partner;
- e-mentoring for Polish companies executed by Spanish experts;
- elaboration of final casebook and the organisation of a closing conference.

The project "Adelante" represented a useful tool for more than 20 SMEs and its 80 employees, generating several economic, social and technological synergies. The benefits of the project's implementation can be divided into benefits for SMEs, clusters, science and regional government, as well as material and intangible benefits for both entrepreneurial cluster ecosystems. The project was an interdisciplinary initiative with interrelated activities oriented to create technological, economic, social and marketing synergy effects on: business level (between Polish and Spanish SMEs representing eco-energy sectors), scientific and research level (between Polish and Spanish universities), public administration level (between Podkarpackie and Andalucia regional governments), cluster level (between Polish and Spanish clusters coordinating and facilitating project activities). Tangible benefits constituted during project implementation are the following:

- 3 thematic informs related to the development of renewable energy in Spain, transfer of case studies in field of smart cities and casebook - summary of the participatory process and knowledge transfer;
- 2 participatory workshops for Spanish and Polish partners aiming at identifying needs and expectations in terms of renewable energies and smart cities development;
- 21 diagnoses and 21 development plans for Subcarpathian SMEs development prepared by Spanish partner;
- elaboration of four training programs including Spanish experiences and corresponding to the identified needs of companies;
- 320 hours of specialised consulting for SMEs in field of strategic management, internationalisation, marketing and finance;
- organisation of two editions of specialised training (80 hours/edition) for 78 SMEs employees;
- 200 hours of Spanish e-mentoring for the Subcarpathian SMEs development;
- participatory elaboration of final casebook including Polish and Spanish partners;
- organisation of the closing conference, with pitching session that involved 27 SMEs, organisation of the technological exposition of SMEs products and services.

Intangible benefits for SMEs resulting from the implementation of the project are:

- increased level of mutual trust between Polish SMEs participating in a cluster;
- acquisition of specific knowledge about Spanish experiences and good practices about smart cities development;
- increased level of international linkages between Polish and Spanish partners;
- trust building between private, public, scientific and business support institutions.

In addition to the expected project results, several added-value activities took place during the project implementation:

- Smart Cities Innovation Bridge Rzeszów-Malaga cooperation agreement firmed by the Subcarpathian Cluster of Renewable Energies, University of Rzeszów and Andalusian Cluster Renewable Energies and Energy Efficiency;

- preparation of joint research project for Horizon 2020 call linked to international cluster cooperation;
- letter of intent on collaboration for socio-economic development between Podkarpackie region and Andalucia region;
- invitation to the INTERREG project aimed at improving energy efficiency and an increase the use of renewable energy for electricity production and thermal uses in buildings which is currently implemented by partners from Poland, Spain, Croatia, Lithuania and UK.

The project "Adelante" was an interdisciplinary initiative with several interrelated activities, oriented to create technological, economic, social and marketing synergy effects. Those synergies were possible to achieve, thanks to close cooperation of Polish and Spanish cluster managers and coordinators, engagement of public and scientific institutions and SMEs interest in acquiring new knowledge and developing partnerships with Spanish partners.

4. CONCLUSIONS

SMEs form a very important sector of the economy of many countries, including Poland. Their value could be seen, among others, in GDP co-creation, niche market services, developing an entrepreneurial mindset and building an entrepreneurial ecosystem of industrial clusters. This ecosystem shapes a dynamic and interlinked relationship system between various entities (business, R&D, business environment and local government). These entities - being concentrated spatially in a given territory and supplying regularly the system's own resources (tangible and intangible) - are more or less interdependent from each other. Functioning within an entrepreneurial ecosystem of industrial clusters creates direct opportunities for SMEs, building better conditions for their development, improving the efficiency of operations, the efficient use of complementary resources and the acquisition of knowledge from cluster members. It provides a solid counterbalance to the negative effects of globalisation that particularly affect SMEs.

Due to the importance of SMEs in the economy, it can be concluded that Polish clusters still need to improve their integrating and coordinating activities. The cluster coordinator performance varies, of course, according to the phase of the cluster cycle life, nature of the industry and cluster development directions. Given that SMEs are the foundation of most of the industrial clusters, it is necessary to undertake by cluster coordinators different activities, such as:

- permanently identifying their problems and barriers to development,
- inventory of its strategic potential,
- creation of adatabase including their current and potential capacities and needs,
- including their needs and expectations in the cluster development strategy,
- motivating to collaborate with R&D institutions,
- engagement in the cluster projects, co-creation of R&D and infrastructural cluster projects and to provide relatively stable sources of funding,
- facilitating access to new technologies, specific knowledge and other resources that could contribute to strengthening their competitiveness,
- support in the internationalisation process and integration with global value chains,
- strengthening human capital through different types of trainings for employees of cluster members that can contribute to getting to know each other,

- identification of sources for specialised and cheaper factors of production,
- updating the database about the possibilities of support under the EU funds, including various programmes,
- identifying sources of potential conflicts between cluster members, including relationships between SMEs and large companies,
- lobbying for the creation of better conditions for business development.

The authors own experience in the area of cooperation with the cluster coordinators indicate that SMEs are an example of exigent cluster members, expecting concrete benefits in a short period of time. Therefore support for current operation and SMEs development offered by cluster coordinators should be multilevel and adequate to current need of cluster members. It should take into account existing barriers for cooperation development at technological, organisational, legal, socio-cultural, economic and financial level. This requires the full engagement of cluster coordinator to overcome existing stereotypes, which may block the realisation of ambitious projects within clusters. It also requires constant cooperation with business environment institutions and local government in order to jointly allow for local SMEs development.

These considerations are the basis for further research on the prosperity of SMEs within a industrial cluster and propensity to implement an open innovation strategy. For a more comprehensive understanding of an SMEs activities in industrial cluster innovation process, this needs to be broadened to include key factors that constrain the adoption of innovation in SMEs and those clusters members who do not want extensive use of innovations. Further work is needed to explore in detail the complementary resources in cluster used by cluster members to achieve specific outcomes. Thus, the prospect research on the attractiveness of industrial clusters for SMEs development is a very broad field.

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ROZWÓJ MŚP W RAMACH KLASTRÓW PRZEMYSŁOWYCH - STRATEGICZNE WYZWANIE W ZARZĄDZANIU KLASTRAMI

Przedmiotem artykułu jest charakterystyka roli klastrów przemysłowych w procesie rozwoju mikro, małych i średnich przedsiębiorstw (MŚP). Przedsiębiorstwa te chcąc sprostać wymogom współczesnego otoczenia coraz częściej zmuszone są do identyfikacji wciąż nowych sposobów rozwoju, w tym źródeł względnie trwałej przewagi konkurencyjnej. Koncentracja jedynie na rozwoju wewnętrznym (endogenicznym) dla wielu podmiotów gospodarczych jest obecnie niewystarczająca. Komplementarnym dla rozwoju wewnętrznego jest rozwój zewnętrzny na przykład poprzez działalność w ramach klastrów przemysłowych. W artykule podkreślono, że w literaturze ekonomicznej wciąż brakuje jednolitego podejścia w definiowaniu tego typu klastrów. Pomimo braku jednoznacznej definicji w tym obszarze, upowszechniło się przekonanie, że klastry jako skupisko podmiotów sektora B+R, instytucji otoczenia biznesu, a w szczególności wzajemnie powiązanych firm, działających w tych samych i/lub pokrewnych sektorach gospodarki, współpracujących i konkurujących ze sobą (koopetycja), zapewniają dogodne warunki dla rozwoju przedsiębiorczości i innowacyjności. MŚP funkcjonując aktywnie w strukturze klastrów przemysłowych mogą podejmować wspólnie ze swymi partnerami działania z zakresu doskonalenia oferty rynkowej, transferu wiedzy, projektowania i realizacji prac B+R, rozwoju kapitału relacyjnego w środowisku wewnętrznym i zewnętrznym klastrów (m.in. poprzez udział klastra w międzynarodowych sieciach). W kształtowaniu właściwych warunków dla rozwoju członków klastrów strategiczne znaczenie ma aktywność koordynatorów klastrów. Bazując na dobrej praktyce koordynatora Podkarpackiego Klastra Energii Odnawialnej, w zakresie sieciowania polsko-hiszpańskiego, wskazano na korzyści, jakie dostarczyła realizacja projektu „Adelante" dla MŚP tego klastra. Praktyka ta pokazuje, że

zaangażowanie koordynatora klastra na rzecz rozwoju członków klastra, wspólnie z kluczowymi interesariuszami klastra, wpływa jednocześnie na rozwój całego klastra, wzmacniając jego konkurencyjność.

Słowa kluczowe: klaster, zarządzanie, MŚP, rozwój, konkurencyjność.

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HISTORY OF ETHICAL THOUGHT IN THE CONTEXT OF ETHICS MANAGEMENT

The issue of ethical behavior in management has a very long tradition, but it was not ever separated, it was usually a part of the problems of social ethics and an analysis of the issue of the right and justice. Ethics with its reliable and comprehensive opinions about the good and evil provides moral support to a man. According to Aristotle, it had a practical dimension, apart from politics and economics. The relationship between ethics and management was already present in the works of ancient thinkers and an analysis of issues of ethics in management started from them. Since the beginning of human history certain rules and laws influencing the behavior of people associated with the production and exchange of goods were introduced. Increasingly one wondered not only what and in what quantities should be produced, but also how to share any profits from this activity among all involved in the production and sales. Already in ancient times a correlation between economic activity and the development of civilization was noticed. At the same time, with the flourishing of trade, the need to establish and govern according to ethical principles emerged[3]. The aim of the article is to present the historical aspects of ethics management. The article, on the one hand evokes direct references to ethics management which was present in social thought over the centuries, and on the other one it shows a selection of the position of individual thinkers in the context of the above ideas. Due to limited space this review is not exhaustive, but it summarizes some background on the development of the concept of ethics in the management of social thought.

Keywords: ethics, axiology, morality, history, management.

1. THE ANCIENT AND MANAGEMENT ETHICS

Greek and Roman philosophers created the foundation for business ethics in a form as we know today[4]. New forms of commodity and monetary economy, whose genesis was associated with the start of work in industry, commerce and the development of maritime trade routes, were the subject of fierce debate of sages of Ancient Greece in spite of the fact that business ethics had not previously been the object of their interests. Human activity in the sphere of trade was regarded as an important part of human life, the purpose of which was to follow the arete and eudaimonia. The Pythagoreans were considered to be those who first began hearings over the theory of morality[5]. Their contribution to the de-

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[3] K. Kietliński, V.M. Reyes, T. Oleksyn, *Etyka w biznesie i zarządzaniu*, Oficyna Ekonomiczna, Kraków 2005, p. 69.

[4] Ibidem, p. 69.

[5] V.J. Bourke, *Historia Etyki*, Wydawnictwo Krupski i S-ka, p. 13

velopment of this field was appreciated by Aristotle, who developed the theory of virtue and he attributed a great contribution to it to the Pythagoreans. Although business ethics was not the center of interest of the Greek philosophers, but it was Socrates who is considered to be the father of ethics[6].

The theory of ethics by Socrates is a relation between knowledge and a virtue. This means that the previously mentioned two elements form a complementary whole and that the wise man is one who knows what is right and does so. According to Socrates a human being does not choose to do evil consciously and intentionally. It is quite a perverse statement as generally looking at human behavior in everyday life it can be concluded that the effect of doing evil is chosen consciously[7]. When using a saying that someone is responsible for evil deeds,, we automatically mean that the effects were fully aware. Therefore, if the action is not dictated by a desire to commit an evil act and it is done unconsciously, then it is not identified on the moral responsibility. There were initial attempts to create the foundations and the ground for the future business system. Paving the moral path was not easy. The next person who tried to follow the ideas of Socrates was his famous student, Plato[8]. He believed that humans as intelligent beings needed certain rules and laws that would assist them to make appropriate decisions. He opposed the possession of private estates which, according to him, should be returned to the state. According to Plato all economic activities should be conducted so as not to undermine the idea of good. *The Republic* is a work in which he presented his attitude to economic issues[9]. Plato did not conceal his negative attitude to people whose aim was to multiply their wealth. According to him, such an activity did not give a chance to spiritual development. He opposed any practices designed to collect additional fees for the loan granted and claimed that the role of state power was to supervise that such practices had no place. Plato believed that such behavior showed the greed of people. Later, the thought of Plato was continued by his student Aristotle, who was considered the first economist[10].

During his activities he pointed to two kinds of this science: *oeconomicus* understood as an ability to manage the household and *chrematisike*, or an ability to acquire material goods. *Eudemian ethics* and *Nicomachean ethics* are considered crucial for the development of ethical writings of Aristotle. Continuing education of Plato, he despised people aiming to gain money at any price, he regarded them as parasites who were not guided by any virtues in their life[11]. The process of buying goods at a low price and then reselling them at a higher price was described as usury. He approved citizenship property, which in his opinion was important to run a household. He divided the actions taken by people for economic reasons into those whose main goal was to meet the critical needs and these effects which were aimed at a profit[12].

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[6] *Ibidem*, p. 17

[7] F. Copleston, *Historia Filozofii*, Warszawa 2004, vol. 1, p. 94.

[8] A. MacIntyre, *Krótka historia etyki*, Wydawnictwo Naukowe PWN, Warszawa 2002, p. 60

[9] Platon, *Państwo*, Wydawnictwo Antyk, Kęty 2003

[10] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, s. 71

[11] R. T. George, A History of business ethics, see in:http://www.scu.edu/ethics/practicing/focusareas/business/conference/presentations/business-ethics-history.html, [access on: 14.08.2016]

[12] Arystoteles, *Polityka*, Warszawa, 2003

Ancient Rome was a period that was not enrolled in the history of the development of revolutionary economic concepts, and sages of that country focused their attention on full understanding and modifying those already known to them. Roman scholars pointed out that the mere fact of being rich did not have to be understood in the negative context provided that the rich did not emerge from the exploitation of others. According to them, the wealth was the foundation for development of the state. Mighty citizens should also help those in need. Residents of Ancient Rome drew from the knowledge of Ancient Greece and also had a negative attitude to usury and even considered persons who enriched themselves in this manner worse than thieves.

2. ETHICAL ASPECTS OF ECONOMIC BEHAVIOR IN THE MIDDLE AGES

Middle Ages were characterized by putting God at the center of interest of humanity and for this reason the religious aspects prevailed in ethics. During this period special attention of scholars was attracted by such issues as personal value, wealth, usury, exchange of goods and fair payment[13]. One of the major problems of this period was the creation of compatible rules for commercial activities with teachings of the gospel as in the importance hierarchy spiritual values were placed over every day ones. Scientists of the Middle Ages, together with the heads of the Catholic Church claimed that human behavior should be consistent with the will of God set in the legal code. This was considered as the code of Ten Commandments and teachings of the New Testament, which accounted for what was good and bad. Although the population was aware of the need to have personal goods, but the faith was the center of interest in a man, who was required to help those in need and to love God[14]. Christianity as the dominant religion in this period taught the necessity of renunciation of personal assets. According to this religion the eternal life was for those who lived in accordance with its rules. Otherwise, a man was waiting for eternal damnation. Some of the saints of the Catholic Church, among them, Clement of Alexandria even claimed that the rich could not attain the prize of eternal life[15]. Similar opinion was expressed by St. Ambrose who did not condemn prosperity, but he still identified a wealthy man as a person that life was guided by greed. The Catholic Church and its representatives believed that possession of the property was necessary, but only to the extent to provide adequate living conditions for themselves and their families.

Wealth should be obtained through work and not such a behavior which is contrary to the principles professed by the Church. Usury was branded by clerics who called for help those in need. The lender should be patient waiting for the return of the borrowed goods and should expect gratitude and not material values in return. An interesting concept by St. Augustine is worth quoting at this point. The greatest goal in life of every human being is to recognize the desire of God, because only this way the happiness is guaranteed. Evil is defined as the reason for the lack of good. And the presence of evil in the world is in the free will of the individual. The reason for the existence of evil is a man and his wine. The metaphor associated with St. Augustine is the idea that "less misfortune is not to be able to achieve what you want than to want what you should not"[16]. However, the millenniums

[13] *Ibidem*, p. 78

[14] *Pismo Święte Starego i Nowego Testamentu*, Wydanie piąte, Wydawnictwo Pallottinum, Poznań 2000, p. 1294

[15] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 78

[16] Św. Augustyn, *O życiu szczęśliwym*, tłum. A. Świderkówna, Dialogi filozoficzne, Kraków 1999, pp. 25-26.

have reviewed this thesis. The average person thinks exactly opposite, since the inability to get what you want starts our suffering. A human being is not accustomed to such prohibitions - "Do not", "not allowed". A desire to reach things in the world where anything goes smoothly is very difficult[17].

In the Middle Ages there was a further development of business ethics due to an increase in the role of the middle class. At that time the rules of conduct were formulated, the physical requirements necessary to perform specific work were shown and the rules of preparation for various professions were developed. In the Middle Ages St. Thomas Aquinas was very active. He based his teaching on the legacy left by Aristotle. He presented the Church's teachings related to accumulation of goods, rules of conducting commercial transactions, usury and loan[18]. The idea of the approach of St. Thomas was the conviction of the impartiality of good and ethical standards. When choosing a good one should be guided by kindness and not benefits and pleasures flowing from it. In his work *Theological sum*, he devoted much attention to the issue of usury, writing that it was not worthy to sell things more expensive than they were worth[19]. For example, according to Thomas a merchant who delivers grain to a country where there is lack of it should be aware of the upcoming supply and he should sell the goods there at the prevailing price. However, reliability of the merchant requires from him to preserve announcement or news of supply and lower prices for goods. This is not strictly related to the canons of justice[20].

Usury is a topic most often considered by scholars of the Middle Ages. Loans for credit from the very beginning were identified as negative dealings mainly driven by human greed and exploitation of other vulnerable people. The Bible clearly shows usury as a bad behavior which should be avoided. Books of the New Testament witness to the teachings of Jesus Christ who condemned usury[21]. According to the teachings of the Church temporal goods should not be the purpose of human life. The subordination of existence to wealth creation is an obstacle to achieve eternal life. On the other hand, the parable of the talents shows that enrichment in itself is not bad if it results from the work and not the actions that do harm to other people[22]. At that time, usury was defined not only as lending at interest, but also the purchase of goods at a low price to pedal to cash them for a higher amount and thus a revenue without doing honest work. When analyzing the parable of Jesus about throwing out the merchants from the temple, St. Thomas tries to prove that it is a sinful action, because only sinners do not deserve a place in the House of God. Trade was identified as an action contrary to the teachings drawn from the gospel. The attitude of ecclesiastical authority was unambiguously negative against usury and people who are accustomed to these practices. Such people were threatened by an exclusion from the communion of the Catholic Church. The activities of the clergy contributed to the fact that the Jews began to deal with usury, because only such actions were right according to their law. That period contributed to the creation of the stereotype of the Jew who was only involved in trade. These events became the genesis of the conflict between Jewish and

[17] http://wartowiedziec.org/index.php/start/aktualnosci/18012-etyka-na-co-dzie-jest-dokadnie-odwrotnie-nimawia-w-augustyn, access on (12.02.2016).

[18] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 83

[19] Św. Tomasz z Akwinu, tłum. P. Bełch, *Suma teologiczna*, part 1, London 1960, pp.4-6.

[20] Tomasz z Akwinu, *Summa theologiae*, pars II-II, q. 77, art 3, vol. II pp. 623-24.

[21] *Pismo Święte Starego i Nowego Testamentu*, op. cit., p. 1362

[22] *Ibidem*, p. 1319-1320

Christians communities, which led to taking over the Christian mansions by the members of the chosen people. In the follow-up period the attitude to usury and trade began to change slowly and it was not clearly negative. The state authorities started to encourage to sign the conclusion of international agreements, which were to bring financial benefits to the state treasury. They also started to call for the separation of the moral aspect and the economic activities in the economy. The image of the trade changed for better as one realized that countries and people had different commodities and a mutual exchange led to a mutual benefit. This contributed to drawing conclusions saying that trade was necessary and profit was the result of these actions. According to St. Thomas profit obtained as a result of commercial activity was not a cause for punishment if it was achieved through honest practices[23].

Further development of civilization and thus increased commercial activities meant that, in practice, usury activities could no longer be prevented. For this reason people changed their attitude to lending at interest[24]. They started to think about the amount of the maximum percentage of the loan. Some felt that it should not be predetermined while St. Thomas Aquinas believed that a fair amount was no more than 12 percent of the loan value. Based on Roman law he introduced a division into consumer goods which are destroyed in the course of time, therefore, one should not insist on their return along with additional benefits, and non-consumption goods which justified charging additional costs. Late Middle Ages was a period of lending on a massive scale, both non-interest bearing and interest-bearing. A faster economic growth achieved through borrowing became a cornerstone of the development of a new economic system - capitalism. Despite the liberalization of the views church and state authorities continued prohibiting excessively high percentages of the loan granted. The clergymen were fighting in that area and supported the establishment of so-called pious banks which specialized in providing low-interest loans. The image of money changed in the belief of the population and was no longer negative.

3. ETHICS IN THE MODERN TIMES

Modern times are considered to be a period of the birth of modern economic systems where ethical and moral behavior began to move away into the background. Political and social transformations, then the disintegration of the feudal system displaced by capitalism, brought new challenges in the method of business management.

The period between the sixteenth and the eighteenth century was a time of a rapid economic boom which took place in the background of significant political and social changes[25]. An important point of change was to isolate the new part of society - the bourgeoisie. Transformations in the world contributed to changes in the methods of management[26]. In addition, there was a sharp reversal of priorities in people's everyday lives. Faith was no longer the center and more attention was paid to temporal things[27]. There was a slow reversal of the role of the Church and its authority was undermined. People began to strive

[23] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 88

[24] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 88

[25] P. Więckowski, *op. cit*, p. 156

[26] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 89

[27] R. T. George, *op. cit*.

to satisfy their earthly needs. When analyzing business practices practicality was taken into account from the point of view of the economy than compliance with the teachings of the Catholic Church. However, no attempt was made to reject completely the ethical achievements but new philosophical concepts were created and they had to comply with new economic regulations. Calvin began a new chapter in the development of business ethics by giving economics the divine dimension[28]. He claimed that God appreciated the work of the man who brought him benefits, including the financial statements. Calvinism praised, among others, such human characteristics as efficiency, wisdom, dedication, diligence, thrift[29]. Credits were recognized as important elements of progress.

In the context of corporate social responsibility in times of Enlightenment, thinkers developed the concept of the social contract. One of them was a representative of empiricism John Locke. In his book *Two Treaties of Government* he presents his position on the property. In a large sense the property of an individual, which accounted for freedom, life and personal property. In the narrow meaning this term meant material possessions. Locke pointed out the existence of three natural properties, which were: charity, inheritance and work. It was a simultaneous denial of the theory that only the government gives privileges to the ownership[30], and a person with consciousness is able to understand that they are responsible for the actions,[31] and that it is inevitable.

A duty of every member of society was taking responsibility for compliance with the rules along with the violation of rights or the threat of punishment. Awareness of justice in the form of punishment eliminates the human fear of a possibility of personal harm. As a result, humanity is functioning on the principle of the common good.

The key to the modern ethical concepts is a postulate by Imanuel Kant who opposed the exploitation and objectification of people. He postulated to treat people fairly in every aspect of life also in this related to business activities. Other opinions were represented by utilitarians, whose views were spread primarily by Adam Smith. According to them, the right actions are only those that bring good for a large group of people. Thus, a commercial activity is good only when it benefits. Adam Smith proclaimed the economic liberalism, which was based on the assumption that people have to take care of their welfare which will translate into good of the whole society[32]. Smith believed that business ethics could play an important role because the main purpose of business was to generate profit. He believed that the objectives of running the company were incompatible with all ethical principles. Smith claimed that work is the source of people's livelihood and that is why remuneration for it had to be so high as to provide a dignified life to workers and their families. According to him a worker should receive twice the amount of remuneration so that he could offer a livelihood survival to their children and keep the continuity of the family[33].

[28] J. P. Wogoman, *Christian Ethics A Historical Introduction*, Westminster, Louisville 1993, pp. 124-125

[29] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 91

[30] J. Locke, tłum. Z. Rau, *Dwa traktaty o rządzie*, Warszawa 1992, p. XLVI, LIII.

[31] J. Locke, tłum B. Gawęcki, *Rozważania dotyczące rozumu ludzkiego*, Kraków 1955, vol. I, p. 490.

[32] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 94

[33] K. Kietliński, V.M. Reyes, T. Oleksyn, *op. cit*, p. 95

4. CONCLUSION

All these concepts have contributed to the modern concepts of ethical behavior, business ethics and corporate social responsibility. These concepts, although different, penetrate mutually and they have axionormative bases. A human factor is a common denominator that gives a form to the issues of business ethics in every century. A man is a person who initiates the action, who uses their intellect and available tools to be able to achieve anything. In this sense, we can say that a wise entrepreneur is the one that will apply ethical standards in their business in order to build a competitive advantage and a positive relationship with social environment.

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OPPORTUNITIES, THREATS AND VARIABILITY OF BUSINESS MODELS OF POLISH BUSINESSES ADAPTING OUTSOURCING – RESEARCH RESULTS[2]

The aim of this article is the presentation of result of an empirical research related to: perception of opportunities and threats among Polish businesses using outsourcing as well as dependency between perception of opportunities and threats and changes made in the business models of the investigated enterprises. The research paper consists of an introduction, a summary and four main sections. The first of the main sections contains the description of the methodology and characterization of the research sample in the cross-section of selected quality features. In the second section, the original concept of the variability of the business models based on the A. Osterwalder's concept of business models is described. The third part contains the results of the research about the perception of opportunities and threats related to the investigated enterprises. The article is concluded by the presentation of the results concerning the correlation between the changes made in the respective areas of business models of the investigated subjects, the probability of occurrence of the identified opportunities, and threats estimated by them. The results of the research indicate a significance of a business model as a strategic management tool, in particular in strategic change management. The indicated dependencies between the variables included in the research are a premise denoting the possibility to use business model in the context of adaptation of organization to its environment.
Keywords: business model, variability, opportunities, threats, Osterwalder

1. INTRODUCTION

Business models are the object of interest of the practitioners as well as the theoreticians of management studies for a dozen or so years. Even though the idea of a business model has not been yet explicitly defined it is becoming more and more alternative conceptualization of the problems related to the strategy of enterprise. Business model is described in the source literature in many various contexts, i.e. organizational boundaries[3], outsourcing systems, entrepreneurship, or innovation[4]. The present research paper is only an attempt to embed the business

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[3] Cyfert Sz., Granice Organizacji, Wyd. UE w Poznaniu, Poznań 2012, p. 108-110.

[4] Teece D. J., *Business Models, Business Strategy and Innovation*, "Long Range Planning" 43, 2010, p. 172-194; Baden-Fuller C., Haefliger S., *Business Models and Technological Innovation*, "Long Range Planning", Vol. 46, 2013, p. 419-426; Souto J., *Business model innovation and business concept innovation as the context of incremen-*

model in the environmental context of an enterprise, understood primarily as the source of opportunities and threats. Therefore, the aim of this article is to present the results of the empirical research related to: perception of opportunities and threats among Polish businesses using outsourcing as well as dependency between perception of opportunities and threats and changes made in the business models of the investigated enterprises.

The starting point for the described in the article research is the concept of business model in the conceptualization of Alexander Osterwalder supplemented by the original idea related to the research on variability of the business model.

2. METHODOLOGY OF THE RESEARCH AND CHARACTERIZATION OF RESEARCH SAMPLE

The research tool used during the research described in this elaboration was a survey questionnaire. Four channels of communication were used in order to initiate contact with the respondents: traditional mail, electronic mail, direct contact and via telephone[5]. The research sample included 281 cases, and the data regarding the model of contact with the respondents (including the size of the investigated enterprises) as shown in the table 1:

Table 1. The model of contact with the respondents divided by the size of the enterprise

	Size of enterprise[6]			
Model of contact	**Small**	**Medium**	**Big**	**Sum (%)**
Electronic mail	3	2	2	**7 (2,5%)**
Traditional model	7	2	1	**10 (3,6%)**
Direct contact	18	4	5	**27 (9,6%)**
Telephone	75	101	61	**237 (84,3%)**
Sum (%)	**103 (36,6%)**	**109 (38,8%)**	**69 (24,6%)**	**281 (100%)**

Source: original research.

The research sample was purposive. Alongside the criterion of using outsourcing[7] two additional criteria were used (arising from the specifics of the project, by which the research was financed):

tal innovation and radical innovation, "Tourism Management" Vol. 51, 2015, p. 142-155; Daeyoup K., Jaeyoung K., *Business model innovation through value delivery differentiation: Multiple case studies*, "Indian Journal of Science and Technology", Vol. 8, 2015, p. 2-7; Drzewiecki J., *Relations between outsourcing decisions, business model and organizational boundaries: theoretical framework*, "Kwartalnik Naukowy Organizacja i Zarządzanie" 4 (24) / 2013, p. 43-56.

[5] The telephone contact was conducted with the use of CATI, which stand for *Computer-Assisted Telephone Interview*. The questionnaire was recorded in the electronic form, using specialist software that simplifies conducting interviews, while arrangement and content of questions has not been changed in relation to the questionnaire distributed via other channels.

[6] The size of the enterprise determined according to criteria stipulated in the Act from 2nd July 2004 on Freedom of Economic Activity, Journal of Laws 2004 No. 173, item 1807 (the classification includes two criteria: employment and turnover).

- the source of capital: the research included Polish enterprises[8],
- the size of employment: only enterprises employing at least ten[9] employees[10].

The characterization of the research sample in the cross-section of selected quality features (organizational and legal frame, scope of diversification, and business area) is displayed in table 2.

Table 2. The characterization of the research sample in the cross-section of selected quality features

Organizational and legal frame of business activity	**Size of enterprise**			**Sum (%)**
	Small	**Medium**	**Big**	
State owned enterprise	1	2	7	10 (3.6%)
Joint stock company	3	5	19	27 (9.6%)
Civil law partnership	21	50	13	84 (29.9%)
General partnership	12	9	4	25 (8.9%)
Limited partnership	0	0	1	1 (0.3%)
Limited liability company	22	20	24	66 (23.5%)
Business run by a natural person	44	23	1	68 (24.2%)
Sum	**103**	**109**	**69**	**281**
Area of business				
Activity only on domestic market	66	72	30	168 (59.8%)
Activity mostly on foreign markets	2	3	5	10 (3.6%)
Activity mostly on domestic market	35	34	34	103 (36.6%)
Degree of diversification				
Enterprise operating in one sector (branch)	53	52	21	126 (44.8%)

[7] The criterion of using outsourcing was fulfilled in the situation when an enterprise used outsourcing at least in two functional areas (out of fifteen areas identified in research; more in: Drzewiecki J., *Outsourcing w kontekście obszarów funkcjonalnych polskich przedsiębiorstw – wyniki badań*, „Zarządzanie. Teoria i praktyka" 2/2015, p. 11-18).

[8] The definition of „Polish enterprise" encompasses the business entities whose majority owners are, in case of natural persons, citizens of Poland, and in case of legal entities – enterprises with the dominant Polish capital, the Treasury, or local government units in Poland.

[9] The application of the last criterion was a result of assumption that decisive problems concerning the use of outsourcing and choice of its form gain in significance along with the growth of an enterprise; simultaneously the spectrum of possible forms of outsourcing as well as its more advanced forms is growing (division of costs, joint investments, etc.); Drzewiecki J., *Outsourcing w kontekście obszarów funkcjonalnych polskich przedsiębiorstw – wyniki badań*, „Zarządzanie. Teoria i praktyka" 2/2015, p. 13.

[10] Drzewiecki J., *Outsourcing w kontekście obszarów funkcjonalnych polskich przedsiębiorstw – wyniki badań*, „Zarządzanie. Teoria i praktyka" 2/2015, p. 12.

Organizational and legal frame of business activity	Size of enterprise			Sum (%)
	Small	Medium	Big	
Enterprise operating in several related sectors (branches)	45	53	31	129 (45.9%)
Enterprise operating in several unrelated sectors (branches)	4	3	7	14 (5%)
Enterprise operating in a dozen or so sectors (branches)	1	1	10	12 (4.3%)

Source: original research.

Almost one third of the research sample were comprised of civil law partnerships, around one fourth – limited liability companies and businesses run by a natural person. Roughly every tenth subject being a part of the sample was organized in the form of a joint stock company; in total, share-holding companies equaled to one third of cases. Most of the subjects comprising the research sample (nearly 60%) operated the business only on a domestic market while more than one third was active mainly on the domestic market. The degree of diversification of investigated subjects should be evaluated as low: more than 90% of enterprises operated its business either in one branch or at most few related branches[11].

3. FACTORS OF VARIABILITY OF BUSINESS MODEL

As it was mentioned in the introduction, the factors of variability of a business model were determined based on the definition and construction of business model created by A. Osterwalder[12]. In this conceptualization, the business model is comprised of nine elements presented and described briefly in table 3.

Table 3. Elements of business model according to A. Osterwalder

Main areas of the model	Elements constituting the business model	Description of the elements
Product	Value proposition	Gives general overview on the benefits offered to customers
Customer	Customer segmentation (target group)	Describes the segment(s) of customers to whom a company wants to offer its values
	Distribution channels	Describes the channels of distributing offers, communication and contact points with customers
	Communication with customers (relations with customers)	Explains the way in which a company builds and maintains relations with customers

[11] Drzewiecki J., *Outsourcing w kontekście obszarów funkcjonalnych polskich przedsiębiorstw – wyniki badań*, „Zarządzanie. Teoria i praktyka" 2/2015, p. 11-18

[12] The definition of a business model proposed by A. Osterwalder says: "a business model describes the rationale of how an organization creates, delivers, and makes profit out of value" (Osterwalder A., Pigneur Y., *Tworzenie modeli biznesowych. Podręcznik wizjonera*, Wyd. Helion, Gliwice 2013, p. 18).

Main areas of the model	Elements constituting the business model	Description of the elements
Infrastructure management	Key activities (configuration of activities)	Describes the system of activity which a company undertakes in order to deliver the values
	Key competences (resources)	Identifies key skills essential to use a certain business model
	Partners network	Presents the network of cooperation links essential to create and deliver values to the market
Financial aspects	Structure of costs	Determines the financial consequences of running the business model based on a specific model
	Streams of income	Determines the sources of income tanks to which a company earns money

Source: original research based on: Osterwalder A., Pigneur Y., *Tworzenie modeli biznesowych. Podręcznik wizjonera*, Wyd. Helion, Gliwice 2013, p. 18; Osterwalder A., Pigneur Y., Tucci C.L., *Clarifying Business Models: Origins, Present and Future of the Concept*, "Communications of AIS" 2005, Vol. 15, p.20-45].

Based on the empirical research, and with the consideration of A. Osterwalder's business model concept, an identification of factors of the variability of business model was made[13]. The mentioned factors are presented in table 4.

Table 4. Factors of quantitative and qualitative alterations of a business model

Ingredients of a business model according to A. Osterwalder	Factors of quantitative alterations	Factors of qualitative alterations
Customer segmentation	• The quantity of supported segments/groups of customers	• Changes aiming at reaching more customers in the context of currently supported segment (or segments) of Customers • Change in the way of defining the key customer • Activities tending towards limitation of the number of the least profitable customers
Value proposition	• The quantity of products/ services • The quantity of after-sales services offered by enterprise • Areas of activity (markets, branches, in which an enterprise operates) • The level of process / services	• Improvement of the existing products/ prices • Improvement of after-sales services offered by enterprise • Improvement of problem solving skills offered to a customer

[13] The concept of variability of a business model used in the research was described in detail in: [Drzewiecki 2016].

Ingredients of a business model according to A. Osterwalder	Factors of quantitative alterations	Factors of qualitative alterations
Channels	• The quantity of sales/distribution channels • The quantity of after-sales service channels	• Improvement of ways of supplying products / services to a customer (channels of distribution) • Improvement of ways and channels of after-sales services
Relations with customers	• The channels of communication with customers	• Improvement of customer service • Optimization, or improvement of marketing tools • Change of ways of building and maintaining good relations with customers
Streams of income	• The quantity of streams of income • The quantity of ways (forms) of payment for the products/ services	• Optimization of the sources of income
Key resources	• The quantity of human resources • The quantity of financial resources • The quantity of physical resources	• Acquisition of employees with new and unique competences • Acquisition of employees competences rare on the job market • Acquisition of new technology
Key activities	• The quantity of executed activities crucial for the process of creation of values by an enterprise • Processes / functions realized by an enterprise	• Introduction of activities crucial for the process of creating value, which have not been realized in an enterprise • Improvement of the form of realization of the processes / functions
Key partners	• The quantity of key partner	• Change of criteria to assess a key partner • Change of the type of resources acquired from the key partner • Modification of the forms of cooperation with partners (including: decisions *make or buy)*
Cost Structure	• The quantity of forms of costs	• Activities tending towards optimization of costs

Source: Drzewiecki J., *Zmienność modelu biznesowego w kontekście innowacyjności organizacji*, „Management Forum" 2016, Vol. 4, nr 1, p. 13.

The analysis of above factors should enable the determination of a degree to which the current business model underwent and/or should undergo a change in both, quantitative and qualitative aspects[14].

4. RESEARCH RESULTS – THE PERCEPTION OF OPPORTUNITIES AND THREATS AMONG THE INVESTIGATED ENTERPRISES

The preliminary research (literature and pilot research) managed to identify a list of twelve opportunities (table 5) and threats (table 6). The selection included, most of all, the phenomena occurring in the economic environment which were unanimously allocated by the respondents to a specific group in a way that will sublimely prevent from subjectivism related to the assessment of phenomena[15]. Simultaneously, universal phenomena was sought (the adequacy in the highest possible number of events, e.g. regardless of the branch context or level of diversification – i.e. due to the cross-section character of the research and high level of variability of enterprises constituting the research sample)[16].

At the stage of the proper research, the respondents were asked a question related to the probability of occurrence of the previously identified opportunities and threats. The range of the responses, in both cases, covered six possible versions, ranging from 0 ("minimal probability of occurrence") to 5 ("almost certain occurrence of a threat / opportunity").

The identified opportunities (variables from O_1 to O_{12}) and threats (variables from T_1 to T_{12}) along with the basic descriptive statistics (averages, medians) for the whole of sample, and while divided into groups according to the size of enterprise, are shown in the tables 5 and 6.

Table 5. The probability of occurrence of opportunities (for the sample and according to the size of investigated enterprise)[17]

No. of variable	Opportunity description	Average				Median			
		For the sample	Small	Medium	Large	For the sample	Small	Medium	Large
O_1	Higher level of integration of products and / or services	1.57	1.35	1.81	1.54	1	1	2	1
O_2	More accurate adaptation of the products / services to customers' needs	2.29	2.28	2.39	2.14	2	2	2	2
O_3	Deterioration of quality of the products / services of competitors	1.52	1.10	1.89	1.55	2	1	2	2

[14] Drzewiecki J., *Zmienność modelu biznesowego w kontekście innowacyjności organizacji*, „Management Forum" 2016, Vol. 4, nr 1, p. 11-16.

[15] The experience of the author of the research related to, among all, execution of the SWOT method in practice show high subjectivism of opportunities and threats, and at the same time, potential problems related to unambiguous allocation of a specific phenomenon to one of the groups.

[16] Due to the subject of the research project, the opportunities and threats were formulated in the language of the business model.

[17] In the tables 4 and 5 the borderline values of the variables were marked in color, respectively: blue for the highest, red for the lowest values.

No. of variable	Opportunity description	Average				Median			
		For the sample	Small	Medium	Large	For the sample	Small	Medium	Large
O_4	Emergence of new potential customer segments	1.83	1.67	2.04	1.72	2	1	2	2
O_5	Customers leaving the competitors	2.06	1.82	2.47	1.80	2	1	2	2
O_6	Emergence of new potential suppliers / business partners	1.90	1.64	2.17	1.86	2	1	2	2
O_7	The possibility to use the channels of the partners	1.58	1.32	1.82	1.58	2	1	2	2
O_8	The possibility to acquire cheaper key resources crucial for the enterprise	1.72	1.42	1.97	1.77	2	1	2	2
O_9	The possibility to more effectively use owned resources	1.88	1.50	2.23	1.90	2	1	2	2
O_{10}	The possibility of higher standardization of the activities of enterprise	1.65	1.29	1.83	1.88	2	1	2	2
O_{11}	The possibility of new technology implementation	2.24	1.80	2.68	2.22	3	2	3	3
O_{12}	Strengthening the relations with customers	2.46	2.20	2.87	2.17	3	2	3	2
	The average of readings for the opportunities	**1.89**	**1.61**	**2.18**	**1.84**				

Source: original research.

The investigated sample indicated that the most probable opportunities are: strengthening relations with customers (O_{12}), more accurate adaptation of the products / services to customers' needs (O_2) as well as the possibility of new technology implementation (O_{11}). The lowest probability of occurring opportunities pertained to: the deterioration of quality of the products / services of competitors (O_3), higher level of integration of products and / or services (O_1) as well as the possibility to use the channels of the partners (O_7). Based on the comparison of the responses in the specific groups according to the size of enterprise two main observations arise. First of all, substantial differences have occurred in the perception of opportunities between groups, especially important in case of medium size enterprises (O_5, O_9). Second of all, the probability of occurrence of opportunities has been deemed as the highest by the medium size enterprises, while the marks were significantly higher than the marks given by the small and medium size enterprises.

Table 6. The probability of occurrence of threats (for the sample and according to the size of the investigated enterprises)

No. of the variable	Opportunity description	Average				Median			
		In the sample	Small	Medium	Large	In the sample	Small	Medium	Large
T_1	Emergence of substitutive services / products	1.75	1.50	2.06	1.62	2	1	2	2
T_2	Emergence of new competitors	2.41	2.22	2.80	2.09	2	2	3	2
T_3	Improvement of products / services of competitors	2.09	1.75	2.43	2.04	2	2	3	2
T_4	Occurrence of disruptions in the deliveries of the resources crucial for enterprise's activity	1.74	1.55	1.95	1.68	2	1	2	2
T_5	Sudden loss of a key resource	1.65	1.50	1.90	1.51	2	1	2	2
T_6	Rise in prices of the key resources	1.85	1.60	2.08	1.84	2	1	2	2
T_7	Loss of customers in favour of previous competitor	2.06	1.79	2.45	1.84	2	1	2	2
T_8	Loss of customers as a result of the emergence of substitutive products / services	1.74	1.29	2.19	1.68	2	1	2	1
T_9	Loss of a key partner	1.60	1.35	1.87	1.55	2	1	2	2
T_{10}	Establishing partnership by the key partner with competitor	1.65	1.39	1.95	1.58	2	1	2	2
T_{11}	Overdependence on a partner	1.28	0.91	1.60	1.32	1	1	2	1
T_{12}	Deterioration of relations with customers	1.71	1.21	2.16	1.74	2	1	2	2
	The average of readings for the threats	**1.79**	**1.51**	**2.12**	**1.71**				

Source: original research.

Emergence of new competitors (T_2), improvement of products / services of competitors (T_3) and loss of customers in favor of previous competitor (T_7) were recognized as the most probable threats. The lowest probability of the occurrence of threats included: overdependence on the partner (T_{11}), loss of key partner (T_9) as well as establishing partnership by the key partner with competitor (T_{10}). The readings can be explained by the use of outsourcing in the investigated enterprises. Parallely to opportunities, also in case of threats discrepancies in the assessment based on the size of enterprise occurred.

Comparing the results of research described in tables 4 and 5, although the investigated enterprises assessed the probability of the occurrence of opportunities slightly higher than the occurrence of threats, the differences in the assessment cannot be recognized as high.

5. RESULTS OF THE RESEARCH – OPPORTUNITIES AND THREATS AND VARIATIONS IN BUSINESS MODELS OF THE INVESTIGATED ENTERPRISES

Due to constraints related to the volume of the paper it focuses mainly on the analysis of the dependency between **qualitative factors** of variation of a business model and the evaluated probability of the occurrence of opportunities and threats[18]. The tables 7 and 8 present correlation coefficients[19] between the identified opportunities and threats as well as the qualitative alterations made by the investigated enterprises in their business models:

Table 7. Correlation matrix: opportunities and alterations of the elements of a business model[20]

Element of business model	Variable - opportunities											
	O_1	O_2	O_3	O_4	O_5	O_6	O_7	O_8	O_9	O_{10}	O_{11}	O_{12}
Value proposition	0.50	0.46	**0.52**	**0.52**	**0.56**	0.44	0.44	0.48	0.46	**0.51**	0.50	**0.54**
Customer segments	**0.54**	0.46	**0.54**	0.50	**0.54**	**0.54**	**0.56**	**0.62**	**0.52**	**0.58**	**0.54**	**0.56**
Relations with customers	0.41	0.45	**0.51**	0.43	**0.56**	0.47	0.40	0.50	**0.51**	0.42	**0.53**	**0.58**
Channels	0.49	0.37	**0.57**	0.42	0.48	0.47	0.50	0.50	0.47	0.45	**0.51**	0.48
Key activities	0.46	0.37	**0.57**	0.43	0.47	0.47	0.48	**0.52**	**0.51**	**0.59**	0.46	0.48
Key resources	0.46	**0.29**	**0.54**	0.38	0.42	0.36	0.48	0.44	**0.51**	0.46	**0.52**	0.45
Key partners	0.49	**0.27**	**0.53**	0.36	0.43	0.36	0.45	0.47	0.47	0.49	0.47	0.45

Source: original research.

The strongest correlations with the alterations of the business models prove to have the following opportunities: deterioration of quality of the products / services of competitors (O_3), Customers leaving the competitors (O_5), the possibility to more effectively use owned resources (O_9), the possibility of higher standardization of the activities of enterprise (O_{10}), the possibility of new technology implementation (O_{11}), strengthening the relations with customers (O_{12}). The weakest correlation was found in: more accurate adaptation of the products / services to customers' needs (O_2), emergence of new potential suppliers / business partners (O_6), the possibility to use the channels of the partners (O_7).

[18] The correlations between the variables related to opportunities and threats and quantitative alterations factors made in business models of the investigated enterprises were weaker than in the case of the qualitative alterations, while a part of them was not statistically significant (for $p<0,05$).

[19] All of the correlations presented in tables 7 and 8 are statistically significant for the significance level $p<0,05$.

[20] In the tables 7 and 8 the borderline values of the variables were marked in color, respectively: green for the values >0,6, blue in the range (0,5;0,6>), red for values <0,3.

Table 8. Correlation matrix: threats and alterations of the elements of a business model

Element of business model	Variables - threats											
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}
Value proposition	0.47	**0.54**	**0.55**	0.38	0.41	0.39	0.43	0.45	0.39	0.50	0.38	0.43
Customer segments	0.48	**0.55**	**0.57**	**0.53**	0.42	**0.56**	0.47	0.46	0.48	**0.56**	0.50	0.48
Relations with customers	0.43	0.50	**0.55**	0.40	0.35	0.43	0.48	**0.51**	0.41	**0.51**	0.35	0.43
Channels	0.43	0.40	**0.52**	0.42	0.40	0.47	0.42	0.48	0.48	**0.53**	0.47	0.41
Key activities	0.40	0.39	**0.53**	0.46	0.38	0.39	0.34	0.38	0.41	**0.54**	0.47	0.44
Key resources	0.48	0.36	0.50	0.32	0.38	0.40	0.41	**0.53**	0.43	**0.55**	0.47	0.47
Key partners	0.48	0.42	**0.57**	0.32	0.38	0.42	0.40	0.43	0.38	**0.54**	0.50	0.42

Source: original research.

The strongest correlations with the alterations of the business models prove to have the following threats: improvement of products / services of competitors (T_3), loss of customers as a result of the emergence of substitutive products / services (T_8), establishing partnership by the key partner with competitor (T_{10}). The threats that display the weakest correlation with the alterations in business models are: emergence of substitutive services / products (T_1), sudden loss of a key resource (T_5), loss of customers in favour of previous competitor (T_7), loss of a key partner (T_9).

The particular importance is attached to the fact that all of the correlations between the perceived probability of the occurrence of opportunities and threats and the alterations in the business models of the investigated enterprises are positive. The value of correlation coefficients exceeds 0,4 in a definite majority. It can denote the following: business model is significant as a tool for adapting an organization to its environment, and the investigated enterprises' managers are aware that opportunities and threats are significant for the alterations in the areas of business model that are important for the success of endeavor, including a value proposition and segments of customers. The comparison of the tables 8 and 9 allows to draw an interesting conclusion that the investigated enterprises modified other elements of business model in case of opportunities and threats.

6. SUMMARY

The results of the research described in this paper indicate a significance of a business model as a strategic management tool, in particular in change management that has strategic significance as a response to the anticipated opportunities and threats. The indicated dependencies between the variables included in the research are a premise denoting the possibility to

use business model in the context of adaptation of organization to its environment. The differences originating from a different perception of opportunities and threats in medium enterprises in comparison to the remaining groups of the investigated subjects seem to be also very interesting. The interpretation of the research results is, however, impeded and requires to conduct an intensified research, also of a qualitative nature.

Simultaneously, the author of the research paper is aware of the constraints in the described research resulting from the criteria of sampling (Polish enterprises using outsourcing). Although the fact of using outsourcing does not seem to have a direct influence on the majority of aspects described in the elaboration, the research should be extended and include the enterprises that do not use outsourcing in order to prove the described in the article dependencies.

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SZANSE, ZAGROŻENIA A ZMIENNOŚĆ MODELI BIZNESU POLSKICH PRZEDSIĘBIORSTW STOSUJĄCYCH OUTSOURCING – WYNIKI BADAŃ

Streszczenie: Celem artykułu jest prezentacja wyników badań empirycznych dotyczących: postrzegania szans i zagrożeń wśród polskich przedsiębiorstw stosujących outsourcing oraz zależności pomiędzy percepcją szans i zagrożeń a zmianami dokonywanymi w modelach biznesowych badanych przedsiębiorstw. Opracowanie składa się z wprowadzenia, podsumowania oraz czterech głównych części. Pierwsza z nich zawiera opis metodyki i charakterystykę próby badawczej w przekroju wybranych cech jakościowych. W części drugiej omówiono pokrótce autorską koncepcję zmienności modeli biznesu opartą na koncepcji modelu biznesowego w ujęciu

A. Osterwaldera. Część trzecia zawiera wyniki badań dotyczące percepcji szans oraz zagrożeń wśród badanych przedsiębiorstw. Artykuł zamyka prezentacja wyników badań dotyczących korelacji między zmianami dokonywanymi w poszczególnych obszarach modeli biznesu badanych podmiotów a szacowanym przez nie prawdopodobieństwem wystąpienia zidentyfikowanych szans i zagrożeń. Opisane w opracowaniu wyniki badań wskazują na znaczenie modelu biznesowego jako narzędzia zarządzania strategicznego, w szczególności – zarządzania zmianą o strategicznym znaczeniu w odpowiedzi na oczekiwane szanse i zagrożenia. Wskazane zależności między zmiennymi uwzględnionymi w badaniu są przesłanką świadczącą o możliwości wykorzystania modelu biznesowego w kontekście adaptacji organizacji do jej otoczenia. Interesujące wydają się być również różnice wynikające z odmiennej percepcji szans i zagrożeń w firmach średnich w porównaniu z pozostałymi grupami badanych podmiotów. Interpretacja tych rezultatów badań jest jednak utrudniona i wymaga przeprowadzenia pogłębionych badań, również o charakterze jakościowym.

Słowa kluczowe: model biznesu, zmienność, szanse, zagrożenia, Osterwalder

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SMART SPECIALISATIONS OF REGIONS AND CREATIVE BUSINESSES IN THE REGIONAL DEVELOPMENT

The aim of this article is to draw attention to a strengthening tendency in the country to introduce targeted and synergistic development of macro-regions through effective use of leading potentials of provinces. Smart specialization and development of the sector of creative businesses are now key and integral pillars of regional development in the EU, which is due to the strategy Europe 2020. The paper contains an overview of selected theories on regional development. It discusses concepts such as smart specialization, regional development, and creative businesses.

The development of Macro-region of Central Poland illustrates the national and EU tendency to a deliberate and purposeful selection of those smart specializations and a potential of the creative sector which decide about its competitiveness. It is based on potentials of mainly large cities; the potential of rural areas is omitted. The Municipality of Puszcza Mariańska (Mazovian Voivodeship) is an example of a rural commune where ca. 28% of all entities build a creative sector. As the only municipality in Poland it has its own map of creative businesses. Symbolically, it represents many other rural municipalities, whose own creative potential is not widely known and is not supported by the authorities at various levels through the creation of appropriate infrastructure, as is the case for example in Ireland (the activity of local authorities, national and international programs, proper promotion).

The presented material shows that support for the development of regions, forming a given macro-region, with activities related to the innovative and creative development is necessary; however, it requires in-depth perception of its potentials.
Keywords: regional development, smart specializations, creative businesses.

1. INTRODUCTION

Undoubtedly, high hopes for dynamic development of the European Union implies acceptance of the new Strategy Europe 2020. It became for the EU member states an impulse to profiling own regional development in line with the three priorities, i.e.: intelligent development of economies based on knowledge and innovation, sustainable development, based on the economy more efficiently using the resources, greener and more competitive, and development conducive to social inclusion[3].

Smart specialization is a young concept of development policy of the European Union to particular regions. It is referred to as "the entrepreneurial process of identifying the

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[3] Europe 2020. Strategy for intelligent and sustainable development conducive to social inclusion, The Commission Communication, Brussels, 3.3.2010 COM (2010) 2020 final draft, p. 5, 11.

areas of science and technology, whose expertise can be used by the selected region"[4]. So formulated a concept for innovation policy and entrepreneurship in organizations allows for synergistic and efficient use of public support for strengthening innovation capacity in the areas that provide a visible competitive advantage. The support of the European Commission initiated work on the implementation of smart specializations by creating the so-called "Smart specialization platform"[5], on which various organizations exchange experience whose aim is to define needs or assess the competitiveness potential. In Poland, smart specializations have priority over the regional ones. The progress of work in the country on the definition of regional smart specializations is varied. There is a noticeable convergence of already selected specializations at national and regional level; so these actual specializations are focused on the growth and development of the economy of the whole country.

In the development strategies of macro-regions and regions in Poland, smart specializations are one of the pillars of obtaining the effect of accelerated development, based on endogenous development potentials of the territory. In this approach, regions are defined not only in terms of administrative boundaries, but in particular their functional properties are exploited (functional regions).

Smart specializations in the regions also draw on the potential of creative sector, which has relatively recently been noticed and appreciated in Europe. However, its potential is significant enough that in the strategies of many regions it is one of the main pillars of the development. In the program documents of Poland it is assumed that the creative sector is divided into two groups of activities[6]:

- creative activities including advertising, architecture, art, crafts, design, and fashion design, video, movie, as well as musical, photographic, artistic, entertainment and publishing activities, activity in the field of software and
- activities of the large use of knowledge, including manufacturing and services in the field of information and communication technologies (ICT), financial services, legal services and other business services (e.g. consulting, market research, research and development - R & D and higher education).

In a broader scope, creative entrepreneurs belong to the so-called creative class. These are people whose work is based on creativity, or "creating new, meaningful forms."[7] In the case of Macro region of Central Poland, one of its five directions of development is the creative sector.

The aim of this article is to present the changes taking place in our country with regard to models of regional development. Essential for the development of regions - NTS1 and NUTS 2 - are the adopted in the program documents and implemented strategies of: smart specializations and creative businesses. The article provides an overview of selected theories regarding the understanding of regional development and its conditions. Examples

[4] J. Brzóska, J. Pyka, *Model projektowania Regionalnej Strategii Innowacji na przykładzie RSI Województwa Śląskiego*, Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie, Vol. 83, No col. 1941, 2015, p. 71.

[5] *The European Commission's science and knowledge service, Join Research Centre* [in:] http://ipts.jrc.ec.europa.eu/activities/research-and-innovation/s3platform.cfm, (access 27.04.2016).

[6] *Strategia Rozwoju Województwa Łódzkiego 2020*, Łódź, April 2013, p. 78.

[7] S. Szultka, *Klastry w sektorach kreatywnych – motory rozwoju miast i regionów*, Wyd. PARP, Warszawa 2012, p. 15.

cited in the article on the one hand illustrate the positive changes taking place in the area of innovation policy of the EU, on the other hand, point to the weaknesses of these activities.

2. REGIONAL SPECIALIZATIONS AND REGIONAL DEVELOPMENT CONCEPTS

Regional development must be analyzed for its ability to continuously generate and adapt new solutions, technologies and new knowledge[8]. Today, in an economy based on knowledge, a model of innovative, entrepreneurial and creative activity, based on technical and technological progresses, is widely promoted. Knowledge is often a factor of greater rank than expenditures and condition of assets, determining the pace and level of economic development[9]. According to S Korenik innovativeness is a process ensuring development, and should be treated as such[10] .

The genesis of the concept of regional development goes back to the theory of location, whose precursor was J.H. von Thünen (1826)[11]. Theories of regional development are characterized by the process-and-research approach aimed at exploring the mechanisms of development on a regional scale and the identification of differences in this regard. They can be divided into two main groups, corresponding to alternative models of the economy. In practice, both models are inter-permeative. They are: the theories of the neo-liberal stream (neoclassical), the essence of which is to minimize government intervention[12], and the theories of New Keynesian stream, treating intervention as desirable and important regulatory mechanism optimizing regional development[13].

Regional development depends on various factors of the exogenous and endogenous nature. According to D. Strahl, external factors (exogenous), which define the region's ability to respond to changes, include among other things: own resources of the region, demographic resources, technical and technological resources, budget, foreign investments, infrastructure related to eco-development, environmental awareness of community , entrepreneurship, competitiveness of the region, spatial order and the marketing effectiveness of space [14]. Whereas K. Secomski mentioned among the exogenous factors: economic, spatial, social, environmental, local, technical and technological, highlighting the factors that stimulate regional development directly and indirectly[15]. Endogenous factors,

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[8] B. Gruchman, *Nowy paradygmat rozwoju regionalnego*, Ruch Prawniczy, Ekonomiczny i Socjologiczny, vol. 2, Poznań 1992, p. 19.

[9] L. Zienkowski, *Gospodarka „oparta na wiedzy" – mit czy rzeczywistość*? [in:] *Wiedza a wzrost gospodarczy*, L. Zienkowski (ed.), Wyd. Naukowe Scholar, Warszawa 2003, p. 15.

[10] S. Korenik, *Gospodarka oparta na wiedzy i jej znaczenie dla kształtowania się e-regionu, rekomendacje dla Dolnego Śląska*, [in:] *Innowacyjność w strategiach regionów UE oraz Dolnego Śląska – Gospodarka oparta na wiedzy o przestrzeni Dolnego Śląska*, S. Korenik, J. Kaleta (ed.), Wyd. Dolnośląskie Centrum Studiów Regionalnych, Wrocław 2006, p. 34.

[11] S. Korenik, *Teorie rozwoju regionalnego w świetle zmian społeczno-gospodarczych*, [in:] *Ekonomiczne i organizacyjne instrumenty wspierania rozwoju lokalnego i regionalnego*, Ekonomiczne Problemy Usług No 14, vol. I, Zeszyty Naukowe No 471, Wyd. Naukowe Uniwersytetu Szczecińskiego, Szczecin 2007, p. 183.

[12] J. Szlachta, *Rozwój regionalny w warunkach transformacji gospodarczej*, Wyd. Friedrich bert Stiftung – Przedstawicielstwo w Polsce, Warszawa 1993, p. 72.

[13] P. Churski, *Rozwój regionalny w warunkach transformacji gospodarczej i integracji europejskiej*, www.staffamu.edu.pl, (access 28.04.2016).

[14] D. Strahl (ed.), *Metody oceny rozwoju regionalnego*, Wyd. AE we Wrocławiu, Wrocław 2006, p. 16.

[15] K. Secomski, *Teoria regionalnego rozwoju i planowania*, Wyd. PWE, Warszawa 1987, pp. 48-98; W. Kosiedowski, *Teoretyczne problemy rozwoju regionalnego*, [in:] *Zarządzanie rozwojem regionalnym i lokalnym.*

on which the region has no influence, even though it participates in these processes, include globalization of processes occurring in the country, and European integration. The literature emphasizes the need for complementarity of these concepts of local development. Also, it points to the need to preserve the cohesion between the "bottom-up" and the "top-down" interests[16]. According to Z. Strzelecki, the identification of stimulants and barriers at the regional level is one of the most important actions to determine the scope and direction of supporting the development of entities in these areas. Into modern factors of regional development, he includes: science, new styles of management, computer science, and alongside the stimulants of regional development he correlates the difficulties and costs of socio-economic adaptation to new developmental directions[17].

The old paradigm for regional development policies in EU countries, consisting in overcoming differences in the level of development of regions, and in sectoral approach to the measures taken, is now being replaced with a new model - a policy territorially oriented (Place-based approach). The result of this approach is the creation in Europe of macro-regional strategies for the Baltic Sea region, the Danube region, the Adriatic-Ionian region and the Alps region. A key factor in the regional development policy (NUTS 2) becomes a process of building macro-regions on the basis of their potential - (NTS1). Identifying common potentials and challenges as well as exchange of experience and cooperation have led to a competitive advantage. The territorial approach in the development policy is characterized by[18]:

- the use of endogenous development potentials of the territory, together with the absorption of exogenous factors (knowledge from the "outside"),
- defining the territory also through the prism of its functional and not just administrative qualities,
- cooperation, dialogue and partnership as essential elements in the context of collecting and systematizing the knowledge and preferences of local entities,
- adapting interventions to the specific territorial contexts to the spatial relationships between them,
- an integrated and coordinated package of investments that takes into account the diversity of social, economic and territorial conditions of individual territories

National document – "Strategie ponadregionalne – wymiar terytorialny polityki rozwoju", shows the evolution of "territorial" thinking , including macro-regional thinking in Europe, as well as the solutions for the introduction of this approach to the national cohesion policy by 2020. In Poland, four trans-regional strategies have been created so far, covering the scope of time up to 2020, i.e. strategies for socio-economic development for Eastern, Southern, Western and , recently, Central Poland (with the prospect up to 2030). This model of development of regions, as macro-regions, contributes in our coun-

Problemy teorii i praktyki, ed. J. Adamiak, W Kosiedowski, A. Potoczek, B. Słowińska, Wyd. TNOiK Dom Organizatora, Toruń 2001, p. 32.

[16] Z. Szymla, *Determinanty rozwoju regionalnego*, Wyd. Zakład Narodowy im. Ossolińskich, Wrocław – Warszawa – Kraków 2000, p. 44.

[17] Z. Strzelecki, *Strategiczne wyzwania Polski a polityka regionalna* (wybrane problemy), [in:] *Nowy paradygmat rozwoju – najnowsze trendy i perspektywy polityki regionalnej*, M. Kolczyński, P. Żuber (ed.), Ministerstwo Rozwoju Regionalnego, Warszawa 2011, p. 9.

[18] *Strategie ponadregionalne – wymiar terytorialny polityki rozwoju*, Ministerstwo Infrastruktury i Rozwoju, Warszawa, March 2015, p.5.

try to sorting out of the development policy through the creation of a coherent hierarchy of basic programming documents shaping the Polish development policy along with specifying the procedures for their creation, implementation, monitoring and updating. Unfortunately, there is currently a lack of full order in the country in terms of the coherence of development planning instruments between levels: national and regional and county and municipal governments. This situation affects the relationship between the provincial and local levels, which may have a bearing on the objectives and directions of development adopted for macro-regional and regional strategies.

The Macro-region of Central Poland covers an area of two provinces: Lodz Voivodeship and Masovian Voivodeship, a total area constituting 17.2% of the country and with a population of approx. 7.8 million people, which represents approx. 20.3% of the Polish population[19]. A bipolar system Warsaw-Lodz is of great significance to the macro-region. In its development strategy, the following priorities were adopted: innovation and creativity, accessibility and integration, reindustrialization and internationalization. Specialisations of the macro-region are the developed areas of cooperation, contributing to the strengthening of its competitiveness at the national and international levels. These include: science, research and development, creative sector, medicine and pharmaceuticals, agriculture and food processing as well as transport and logistics. The use of unique and complementary potentials of Lodz and Masovian voivodships is consistent with the principle of subsidiarity. The macro-region development strategy is based primarily on the potential of large cities: Lodz, Plock, Radom, Siedlce, Skierniewice and Warsaw. The participants of consultations of the strategy were mainly local governments (cities), universities, only one non-governmental organization and several dozen individuals. This shows that the macro-region strategy marginalizes creative potential of rural areas, despite the existence of the phenomenon of diffusion of potentials, which include creativity and innovation.

In Macro-region of Central Poland in 2012 in the field of research and development operated 849 units (31.1% of the country resources); internal expenditure on R & D per capita were nearly twice as high as in the country, and the share of these expenditures in GDP in the region accounted for 1.25% (0.89% in the country). This is an area with the highest concentration of science in the country in which the research units deal with modern technologies, including biotechnology, nanotechnology, ICT, photonics, mechatronics, radiopharmacy and space sciences. Unfortunately, the share of innovative industrial enterprises in the total number of industrial enterprises both in Masovian Voivodeship (15.3%) and the Lodz region (13.7%) was among the lowest in the country. In the macro-region there is a high concentration of universities (137), which accounted for 30% of the total number of universities in Poland. It is characterized by high intellectual capital of society; more than 21% of the population had higher education (2011). Students accounted for over 75% of the population in the macro-region aged 20 to 24 years (UE28 - 64.1%). Significant potential of Central Poland comes from a rich resource of "knowledge workers", who derive from all sectors of the economy and comply with certain character-

[19] *Koncepcja Strategii Rozwoju Makroregionu Polski Centralnej 2030*, BPPW, MBPR, Łódź-Warszawa, September 2014, p.4.

istics defined by science, which include creativity and the ability to work outside existing structures[20].

3. CREATIVE BUSINESS – GROWING SECTOR OF REGION AL DEVELOPMENT

At the moment, there is no unified global, EU and national definition of creative businesses. Terms, such as "creative economy", "cultural industries", "creative industries" and "cultural and creative industries", function interchangeably in the literature alongside the various models describing the structure of entities of creative businesses. Unfortunately, this situation makes the measurement and assessment of the significance of creative businesses often vague and incomparable, when taking into account various sources. These analysis are still rare and do not fall within the scope of work of the institutions responsible for collecting statistical data and measurement of economic reality.

The definition of the creative sector adopted in the Strategy of Macro-region of Central Poland includes "actions that stem from individual creativity and talent and they have also the potential to create wealth and jobs." Industries considered as creative are: advertising, film and video, architecture, music, arts and crafts, performing arts, publishing, computer software, radio and television, design, fashion design, literature and visual arts"[21]. The increasing role of creative businesses in the years 2002 - 2008 is illustrated by an international report "Creative Economy Report 2010"[22], according to which the creative industries include the production of goods and services provided by the cultural industries and those that depend on innovation, including many types of software research and development. The creative sector in Poland in 2005 and 2006 accounted for 2.7% of national GDP[23]. The value of trade in goods produced by creative businesses in the case of Poland in 2002 amounted to $ 0.75 billion, and in 2008 almost doubled and amounted to $ 1.41 billion, which in both cases gave Poland 10th place[24]. The employment in the creative sector in Poland in 2013 amounted to 3.41%[25].

In 2012, the creative entities in the Central region accounted for 31.7% of all entities of the creative sector in Poland, which is associated with well-developed infrastructure facilities for creative businesses. According to the European Commission, in Central Poland in 2011 there functioned over 51 thousand creative sector entities in total. In this macro region, the professional structure of entities in the creative sector was composed of: advertising - 22.47% computer software - 18.82%, the architecture - 10.40%, media (radio and television) - 10.05%, publishing - 9.29 %, film and video - 6.55%, photography - 5.84%, fashion design and design - 5.07%; performing arts - 4.09%; literature and the

[20] *Strategia Rozwoju Polski Centralnej do roku 2020 z perspektywą 2030*, Warszawa,07.2015, [in:] Resolution No 107 of the Council of Ministers of 14 July 2015 on the adoption of the „Strategia Rozwoju Polski Centralnej do roku 2020 z perspektywą 2030" (MP of 19 August 2015 pos. 736), pp. 14 - 18.

[21] Ibidem, p.19.

[22] *Creative Economy Report 2010: Creative Economy – A Feasible Development Opinion*, United Nations 2010.

[23] Ibidem, p. 31.

[24] Ibidem, p. 134.

[25] *Creative Economy Report 2013 Special Edition: Widening local development pathways*, United Nations/UNDP/UNESCO, 2013, p. 171.

visual arts - 3.29%, handicraft - 2.38% and musical activities -1.27% of all entities[26]. The report of the Ministry of Economy shows that the activities of persons conducting creative businesses fulfil primarily economic function, which directly contributes to the local development. This publication highlights the barriers to the development of the creative sector, which include: unfavourable urbanization processes, poor quality of public space and the degradation of urban structures[27].

4. CREATIVE BUSINESS IN RURAL AREAS

Municipality of Puszcza Mariańska is the only municipality in Poland, a rural one as well, which has its own map of creative businesses, prepared in 2014 by Sylvia Mazgajska. It distinguishes itself also by the fact that it is located in Masovian Voivodeship and belongs to Macro-region of Central Poland, where the participation of entities in the creative sector in the total number of REGON entities by NUTS 1 regions was over 30%[28]. The municipality includes 39 villages and, like most of the neighbouring rural municipalities, is growing mainly due to agriculture, and industrial plants in Żyrardów and Skierniewice.

It can be estimated that entrepreneurs running creative businesses represent in the municipality approx. 1.7% of the population of working age. At the end of 2014 in the village there were registered 463 companies (active and inactive), while the number of entities running the so-called creative businesses amounted to a total of 91 (19.7% of the entrepreneurs)[29]. 80 entities were active, i.e. approx. 87.9% of creative entrepreneurs and approx. 17.3% of all entrepreneurs in the community. Taking into account the financial services, (i.e. environment supporting these businesses), in the municipality there were a total of 129 creative entities (27.9% of their total number). Two-thirds of these entities are located in 24 towns. Creative entrepreneurs are active in 12 types of activity, i.e. in: financial services - 52.7%, architecture - 26.4%, advertising - 17.8%, computer games (software) - 17.1%, music and performing arts - 10.1%, and the film, video and photography - 10.1%, art, art and antiques market - 8.5%, crafts - 8.5%, specialist design - 5.4%, fashion design and model manufacture - 1 6% of all entities of the creative sector. Most entrepreneurs run their businesses individually. Many of them are active in several categories of creative businesses. According to the author, in this municipality there was no significant activity of local authorities in strengthening the local economy, the development of contacts and cooperation with the environment, the promotion of the potential and creating the image of the municipality. The residents wanting to improve their quality of life showed initiative, set up businesses, or sought work outside their place of residence[30].

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[26] *Strategia Rozwoju Polski Centralnej do roku 2020 z perspektywą 2030.* Warszawa July 2015, [in:] Resolution No 107 of The Council of Ministers of 14 July 2015 On the adoption of the „Strategia Rozwoju Polski Cetralnej do roku 2020 z perspektywą 2030" (MP of 19 August 2015, pos. 736), p.27.

[27] *Analiza potrzeb i rozwoju przemysłów kreatywnych*, Ministerstwo Gospodarki, Warszawa 2009.

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[29] https://prod.ceidg.gov.pl/CEIDG/ceidg.public.ui/search.aspx.

[30] S. Mazgajska, *Dziedzictwo kulturowe i przyrodnicze oraz kreatywne biznesy jako podstawa rozwoju gminy Puszcza Mariańska*, Praca inżynierska przygotowana pod kierunkiem dr inż. Elżbiety Strzeleckiej, Kolegium Gospodarki Przestrzennej Politechniki Łódzkiej, Łódź 2015, pp.69-70.

The question is whether a municipality with 27.9% creative entities can remain in the centre of attention of regional authorities, who declare that Masovian voivodeship in the next few years will become one of 50 creative regions in the EU (project Creative Masovia)? In the outdated already commune development strategy for the years 2002-2011 the vision of the municipality has been recorded as: "Entrepreneurial Municipality of Puszcza Mariańska - offering attractive conditions for residence, business development and recreation" With Warsaw to Europe "[31]. This highlights the functional, social and economic relationships of the municipality with the agglomeration of Warsaw. Unfortunately, this creative human capital was not included in the program for Macro-region of Central Poland.

Research and the development policy of the creative sector in the country should not only be focused on "creative cities" but also on „creative rural areas." In our country, there is still too little awareness of the potential of rural areas, as a "healthy" alternative to running creative businesses on a large scale and without complexes, as well as with the support of various levels of territorial authority, as is the case in Ireland. In this country the strong pillars of the development are both the creative sector and the knowledge service, but they are stimulated by, among others, promotional and informational activities, various national and EU funds and creating networks of cooperation[32].

5. SUMMARY

The changes occurring now in Poland concern the model of regional development, based on synergistic and targeted development of macro-regions, which draws on the development potentials of regions included in their composition. The new model of development of regional policy, which is territorial orientation, is based on such important pillars like smart specializations of regions and creative sectors, as exemplified by, among others, Macro-region of Central Poland.

The described development is focused on the potential of cities, while the creative potential of rural areas is marginalized, despite the existence of the phenomenon of diffusion of potentials of creativity and innovativeness, as exemplified by the municipality of Puszcza Mariańska.

The development of regions and macro regions requires monitoring and correction of assumptions, in particular, in the face of still insufficient ordering of program documents and their impact on local policy.

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INTELIGENTNE SPECJALIZACJE I KREATYWNE BIZNESY W ROZWOJU REGIONALNYM

Celem artykułu jest zwrócenie uwagi na umacniającą się w kraju tendencję do wprowadzania ukierunkowanego i synergicznego rozwoju makroregionów poprzez efektywne wykorzystywanie wiodących potencjałów województw. Inteligentne specjalizacje i rozwój sektora kreatywnych biznesów są obecnie kluczowymi i integralnymi filarami rozwoju regionalnego w UE, co wynika ze strategii Europa 2020. Artykuł zawiera przegląd wybranych teorii dotyczących rozwoju regionalnego. Omówiono takie pojęcia jak: inteligentna specjalizacja, rozwój regionalny, kreatywne biznesy.

Rozwój Makroregionu Polski Centralnej ilustruje krajową i unijną tendencję do przemyślanego i celowego wyboru tych inteligentnych specjalizacji oraz potencjału kreatywnego sektora, które stanowią o jego konkurencyjności. Oparty jest on na potencjałach głównie dużych miast; potencjał terenów wiejskich jest pomijany. Gmina Puszcza Mariańska (woj. mazowieckie) jest przykładem gminy wiejskiej, w której ok.28% wszystkich podmiotów tworzy kreatywny sektor. Jako jedyna gmina w Polsce posiada własną mapę kreatywnych biznesów. Symbolicznie reprezentuje wiele innych gmin wiejskich, których własny potencjał kreatywny nie jest powszechnie znany i nie jest wspierany przez władze różnego szczebla, poprzez tworzenie właściwej infrastruktury, jak to ma miejsce np. w Irlandii (aktywność władz lokalnych, programy krajowe i międzynarodowe, właściwa promocja)

Przedstawiony materiał pokazuje, iż wsparcie rozwoju województw, tworzących dany makroregion, działaniami związanymi z innowacyjnym i kreatywnym rozwojem jest konieczne, wymaga jednak pogłębionego postrzegania jego potencjałów.

Słowa kluczowe: rozwój regionalny, inteligentne specjalizacje, kreatywne biznesy.

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MAIN FACTORS FOR THE FORMING OF REPUTATION IN THE PROCESS OF BUILDING A COMPETITIVE ADVANTAGE OF DEVELOPMENT ENTERPRISES – THE RESULTS OF EMPIRICAL RESEARCH

The paper analyzes the factors influencing the reputation of development enterprises. The text provides an answer to the question of what factors are important in shaping the reputation in the process of obtaining a competitive advantage for a development company. An analysis of secondary sources verified the results of the empirical research in the form of a panel of experts. The most important factors in building the reputation were distinguished on the basis of expert evaluations. They include: level of the customer service, previous reputation, the credibility of the company, trust in the company, the company's experience, relations with entities of the market environment, relations with subcontractors, safety of the financial situation, payment terms, the price level, unit cost of the production, the quality of work, locations of completed investments, timely delivery, functionality of products, diversity of housing offer, the quality of materials used, the scope and quality guarantee, the recognition of brand of products, brand identification of the enterprise, organizational culture, skills of the management of developer, professionalism of employees. In addition, an analysis has been carried out with a cross-impact method using the MIC-MAC program. The conclusions of the conducted studies allowed to extract a list of the most important factors in forming the reputation in the process of building a competitive advantage by developers There has also been a systematization of factors affecting the reputation of the development enterprises and the factors which the reputation of the development companies is affected by.

Keywords: reputation, competitiveness, development enterprises, a panel of experts, the cross-impact method

1. INTRODUCTION

Managing a business in the dynamic environment encourages participants to seek more effective ways to improve their competitiveness. Today it is recognized that being competitive is the primary aim of all economic organizations. Reputation is one of the most important intangible resources, in the process of building a competitive advantage of development enterprises.This is due to the fact that it is closely linked to confidence which these organizations are endowed by the participants of the market. A positive reputation provides a tool for development and economic security of a development company.

The primary purpose of the article is the answer to the question of what factors are crucial in forming the reputation in the process of obtaining a competitive advantage for a

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development enterprise. Particular attention was paid both to the factors affecting the reputation of development companies, but also the factors that are affected by the reputation of a development enterprise.

2. THEORETICAL ASPECT OF THE NOTION OF REPUTATION

Reputation is "the general opinion or judgment of the public about a person or thing"[2]. Reputation of a company is the general assessment of a unit, made by stakeholders. It is based on direct experiences of stakeholders with the enterprise, communication, symbolism, which provide information about the company and its actions, and also allow for comparison with the actions taken by key competitors Reputation is therefore based on mutual relationships with stakeholders[3].

A company's reputation affects the behavior of other participants of the market, in particular the activities of customers, competitors, strategic partners, subcontractors or employees. Therefore, it mobilizes all business developers to care about positive relationships with the participants of the market. In this context a feedback should be noted – positive relationships with stakeholders contribute to forming a positive reputation in the market. Reputation, associated with a number of attributes, such as: credibility, confidence, responsibility, influences the relationships with the entities of the market: purchasing behavior of customers, ability to find partners for cooperation, the attractiveness of the company as a place of work, a positive attitude of the media, recommendations of banks, any decisions of potential investors. This broad set of benefits, to a large extent influencing the smooth functioning of a company, which justifies the importance to shape and protect the reputation of the company should be noted by all development enterprises.

3. METHODOLOGY OF THE SURVEY

A study on the essence and the importance of reputation in the process of shaping a competitive advantage of development companies was carried out in July 2015 with a method of the panel of experts. The survey was directed to selected people associated with the development industry in Podlaskie who are experts in their fields. A group of 10 experts, connected professionally directly or indirectly to the development industry, participated in a panel discussion. Among the experts were:

- representatives of business development – 2 people;
- media representatives – 2 people;
- owners of real estate agency – 1 person;
- employees of banks / financial analysts – 2 people;
- people from business market – 1 person;
- architects (designers of the housing industry) – 1 person;
- representatives of the scientific community dealing with the issues of construction – 1 person.

[2] *The American Heritage Dictionary of the English Language, Fifth Edition*, Houghton Mifflin Harcourt Publishing Company 2016, https://www.ahdictionary.com/word/search.html?q=reputation&submit.x=29&submit.y=13 [access: 12.12.2016].

[3] M. Gotsi, M.A. Wilson, *Corporate Reputation: seeking a definition*, "Corporate Communitation: An International Journal", vol. 6, no. 1, 2001, p. 29.

The main purpose of the study was to know the opinion of the experts on the essence of the reputation and the factors shaping the reputation of business development in the process of building a competitive advantage.

In the first stage of the research, the experts assessed sources of obtaining the competitive advantage through business development and identified the main factors of building the competitive advantage. Then the experts were asked to evaluate the role of analogous factors in building the reputation for the development enterprises.

Based on the literature review and based on the author's experience with internships in development enterprises, 31 factors were extracted that can contribute the most to building a competitive advantage and building the reputation of the development companies. Isolated factors were systematized in eight areas:

- factors in the area of the enterprise market included: the company's experience, size of the company, perspective for development of the enterprise, the market share and scale of the company's presence in a given market;
- factors in the area of relations included: relations with the participants of the market (customers, suppliers, media, banks, etc.), relations with subcontractors, level of customer service, previous reputation, the credibility of the company, trust in the company, brand identification of the enterprise;
- factors in the area of finances included: safety of the financial situation, high profitability, creditworthiness, unit cost of the production (on sqm. sold surface);
- factors in the area of product included: the recognition of brand of products, the quality of materials used, the quality of work, functionality of products, locations of completed investments, diversity of housing offer, timely delivery, the scope and quality guarantee and the involvement of the consumer by the ability to impact on the product;
- factors in the area of pricing policy included: the price level, payment terms and promotions, discounts;
- factors in the area of human resources included: skills of the management of developers, and also professionalism of employees;
- factors in the area of organizational included: the organizational structure and organizational culture;
- factor in the material area was the state of technical equipment of the company.

4. AN ASSESSMENT OF THE ROLE OF SELECTED FACTORS IN THE SHAPING OF THE REPUTATION OF A DEVELOPMENT ENTERPRISE – THE RESULTS OF EMPIRICAL RESEARCH

The task of each of the experts was to assess the role of each of the above-mentioned factors in building of the reputation of a development enterprise in a scale of 1 to 5, with 1 meaning an invalid factor, 2 – an unimportant factor, 3 – a factor of average importance, 4 – an important factor, and 5 – a very important factor. The results of the statistical analysis of each of the listed factors was shown in Table 1.

Table 1. The importance of factors in building the reputation for a development enterprise

Lp.	Factors	Arithmetic meaning (x)	Median (Me)	Modal value (Do)	Standard deviation (Sx)
1.	The company's experience	4,4	5	5	0,7
2.	Size of the company	3,2	3	3	0,6
3.	Perspective for development of the enterprise	3,6	3	3	0,8
4.	The market share and scale of the company's presence in a given market	3,8	4	4	0,8
5.	Relations with the participants of the market (customers, suppliers, media, banks, etc.)	4,4	5	5	1,0
6.	Relations with subcontractors	4,2	4	4	0,6
7.	Level of the customer service	4,7	5	5	0,5
8.	Reputation, the credibility of the company (previous)	4,7	5	5	0,5
9.	Trust in the the company	4,5	5	4; 5	0,5
10.	Brand identification of the enterprise	4,0	4	4	0,7
11.	Safety of the financial situation	4,7	5	5	0,7
12.	High profitability	3,6	4	4	0,7
13.	Creditworthiness	3,9	4	4	0,7
14.	Unit cost of the production (on sqm. sold surface)	4,2	4	4; 5	0,8
15.	The recognition of brand of products	4,3	4	4	0,7
16.	The quality of materials used	4,1	4	4	0,3
17.	The quality of work	4,7	5	5	0,5
18.	Functionality of products	4,3	4	4	0,5
19.	Locations of completed investments	4,6	5	5	0,5
20.	Diversity of housing offer	4,1	4	4; 5	1,0
21.	Timely delivery	4,6	5	5	0,5
22.	The scope and quality guarantee	4,6	5	5	0,5
23.	The involvement of the consumer by the ability to impact on the proproduct	3,6	4	4	0,5
24.	The price level	4,6	5	5	0,7
25.	Payment terms	4,3	4	4	0,7
26.	Promotions, discounts	3,9	4	4	0,7
27.	Skills of the management of developer	4,1	4	4	0,7
28.	Professionalism of employees	4,0	4	4	0,7
29.	The organizational structure	3,3	3	3	0,9
30.	Organizational culture	4,2	4	4	0,6
31.	The state of technical equipment of the company	3,0	3	3	0,9

Source: author's own study based on data obtained from the panel of experts (n = 10)

The opinions of experts confirmed the dominating influence of factors in relational area on the forming of the reputation of development enterprises. Moreover, what is characteristic for the development industry, no less important are the factors in the area of product, in the present case – apartments. Therefore, the most important factors in forming the reputation of development enterprises are:

- previous reputation;
- the credibility of the company (average 4,7; median 5);
- level of the customer service (average 4,7; median 5);
- the quality of work (average 4,7; median 5);
- safety of the financial situation (average 4,7; median 5).

Among the factors of the product area, high ratings was obtained by: locations of completed investments (average 4,6; median 5), timely delivery (average 4,6; median 5), the scope and quality guarantee (average 4,6; median 5), and also the recognition of brand of products (average 4,3; median 4), functionality of products (average 4,3; median 4), the quality of materials used (average 4,1; median 4) and diversity of housing offer (average 4,1; median 4).

The factors assessed at most from relational area, beyond the previously indicated, included: trust in the the company (average 4,5; median 5), relations with entities of the market environment – customers, suppliers, media, banks, etc. (average 4,4; median 5), relations with subcontractors (average 4,2; median 4). The experts considered moreover, that on the reputation of the developer companies affected, among other: the company's experience (average 4,4; median 5), the price level (average 4,6; median 5) or payment terms (average 4,3; median 4).

With the lowest assesment similarly as in the case of factors affecting competitive advantage, were factors such as: the state of technical equipment of the company (average 3,0), size of the company (average 3,2) and the organizational structure (average 3,3).

The factors assessed definitely higher in the case of forming a reputation than in case of factors affecting the buildinga competitive edge were: organizational culture and the quality of materials used. It is also worthwhile to note that almost all factors were recognised by experts as very important (evaluation 5) or important (evaluation 4) as evidenced by the other statistical measures.

5. IMPORTANT FACTORS IN THE FORMING OF REPUTATION

Based on the assessment made by the experts on the importance of specified factors in the forming of reputation of the development companies it was possible to distinguish the key factors in building of reputation.

As the recognized key factors in building of reputation were those that were rated as the least important, that their arithmetic mean was 4,0 and above. This assessment was received for 22 out of 31 analyzed factors. The key factors in building of reputation for development enterprises are therefore::

- level of the customer service;
- previous reputation, the credibility of the company;
- the quality of work;
- safety of the financial situation;
- locations of completed investments;
- timely delivery;

- the scope and quality guarantee;
- the price level;
- trust in the the company;
- the company's experience;
- relations with entities of the market environment (customers, suppliers, media, banks, etc.);
- the recognition of brand of products;
- functionality of products;
- payment terms;
- relations with subcontractors;
- unit cost of the production (on sqm. sold surface);
- organizational culture;
- the quality of materials used;
- diversity of housing offer;
- skills of the management of developer;
- brand identification of the enterprise;
- professionalism of employees.

6. THE DISTINCTION OF THE MOST IMPORTANT FACTORS ASSOCIATED WITH A REPUTATION OF A DEVELOPMENT ENTERPRISE – THE RESULTS OF THE ANALYSIS

Because of the fact that the selected group of the key factors forming the reputation is quite extensive, an attempt to reduce the amount of the most important factors was made. For this purpose, the structural analysis of influence was used, which is one of the methods of organizing and analyzing sets, including a large number of interacting variables. A cross-impact analysis begins with determining the set of factors which can potentially constitute some key variables in a given system. The analyzed factors, trends and events are seemingly unrelated, but the method of cross-impact allows to specify their mutual influence and overlapping relationships between them[4]. The primary purpose of a cross-impact analysis is to identify the variables that influence the behavior of the analyzed system (eg. forming the reputation) the strongest.

As a part of the survey of the panel of experts, a structural analysis was conducted. The first stage of the analysis consisted of making a list of factors affecting the operation of the development enterprises and relationship building with stakeholders. As a result, a list of 18 variables shown in table 2 was developed.

The identification of key variables was conducted using the MIC-MAC program (Impact Matrix Cross – Reference Multiplication Applied to a Classification). As a part of the analyzed factors influencing the reputation of development enterprises and the factors to which the reputation has the strongest impact,a graph was created showing the direct impact of the factors. Figure 1 includes only factors associated with reputation.

[4] J.M. Wójcicki, P. Ładyżyński, System monitorowania i scenariusze rozwoju technologii medycznych w Polsce, Konsorcjum ROTMED, Warszawa 2008, p. 197.

Table 2. Variables and trends for a cross-impact analysis

Lp.	Name of the factor (long label)	Shortcurt (short label)
1.	The company's experience	CZ1
2.	Good financial condition	CZ2
3.	Good reputation, the credibility of the company, opinions	CZ3
4.	Relations with customers/ Level of the customer service	CZ4
5.	Relations with suppliers and subcontractors	CZ5
6.	Cooperation with media	CZ6
7.	Relations with banks	CZ7
8.	The price level	CZ8
9.	The quality of work	CZ9
10.	Timely delivery	CZ10
11.	Awards and recognitions	CZ11
12.	Advertising active policy	CZ12
13.	Social responsibility, charity activities	CZ13
14.	Name and logo of the company	CZ14
15.	Commercial materials	CZ15
16.	Decor of the registered office and office interiors of the company	CZ16
17.	Participation in fairs / exhibitions	CZ17
18.	Lobbying in the local environment	CZ18

Source: author's own study using the MIC-MAC program

The results contained on the above graph can be used to group the factors according to their strength of influence on the reputation of development enterprises (Table 3).

Table 3. Factors affecting the reputation of development enterprises

Factors having a strong impact on the reputation	Factors having a moderate impact on the reputation	Factors having a weak impact on the reputation
The company's experience	Good financial condition	Awards and recognitions
Relations with customers/ Level of the customer service	Cooperation with media	Name and logo of the company
Relations with suppliers and subcontractors	Relations with banks	Commercial materials
The quality of work	The price level	Decor of the registered office and office interiors of the company
Timely delivery	Social responsibility, chari-ty activities	Participation in fairs / exhibitions
Actieve advertising policy		Lobbying in the local environ-ment

Source: author's own study based on data obtained from the panel of experts (n = 10)

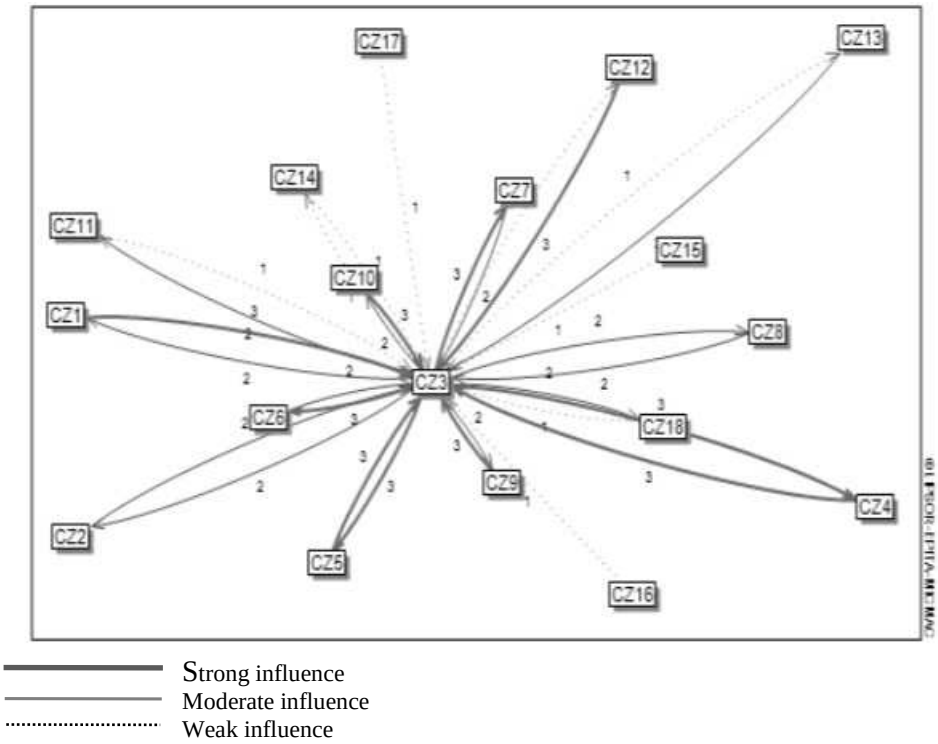

Fig. 1. The graph of direct impacts which includes factors connected to the reputation of development enterpises

Source: author's own study based on data obtained from the panel of experts (n = 10) using the MIC-MAC program

The results of the research indicate that the factors influencing the reputation of development companies the strongest are those connected with the relationship with clients, suppliers and subcontractors. Reputation is formed based on the assessment of the quality of work and timely delivery of the investment, it is built with the acquisition of experience by the company, it is also affected by the active advertising policy.

A cooperation with media and banks has a moderate influence on the reputation. These units, due to the carried out policy and gradually built confidence, rarely make a public assessment of their relationship with the market entities, and do not have the biggest impact on the formation of reputation. Factors with an average impact on building the reputation are: a price level, good financial condition of the development enterprise and charity activity conducted by them, as well as social responsibility.

Factors with a small impact on the reputation, affecting the image of the enterprise are: name and logo of the company, decor of the registered office and office interiors of the company, awards and recognitions, commercial materials, participation in fairs / exhibitions, and also lobbying in the local environment.

The data presented in the graph can also be used to group the factors according to the impact on reputation (Table 4).

Table 4. Factors which are affected by the development enterprises' reputation

Factors that reputation has a strong impact on	**Factors that reputation has a moderate impact on**	**Factors that reputation has a weak impact on**	**Factors that reputation has no impact on**
Relations with customers/ Level of the customer service	The company's experience	Active advertising policy	Commercial materials
Relations with suppliers and subcontractors	Good financial condition	Social responsibility, charity activities	Decor of the registered office and office interiors of the company
Cooperation with media	The price level	Name and logo of the company	Participation in fairs / exhibitions
Relations with banks	The quality of work		
	Timely delivery		
	Awards and recognitions		
	Lobbying in the local environment		

Source: author's own study based on data obtained from the panel of experts (n = 10)

An analysis of the carried out systematization indicates that the reputation of a development company has the biggest impact on building its relationship with stakeholders: customers, suppliers and subcontractors, media and banks. In a moderate way reputation affects the experience of the company and its financial condition, prizes and awards received by the company and lobbying in the local environment, as well as features concerning carried out investments: the quality of the workmanship, timely delivery, price level of flats.

Reputation has little or no effect at all on the image factors: name and logo of the company, active advertising policy, social responsibility, charity activities, commercial, decor of the registered office and office interiors of the company and participation in trade fairs/exhibitions.

7. SUMMARY

The summary of the results of both types of research, that is the cross-impact method using the MIC-MAC program and the assessment of the individual factors by experts, on the basis of which the key factors in building of reputation were extracted, confirms that the reputation of development enterprises in building their competitive advantage is to the greatest extent influenced by factors related to building relationships with the various stakeholders, the developer's experience, good financial standing, etc.

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KLUCZOWE CZYNNIKI KSZTAŁTOWANIA REPUTACJI W PROCESIE BUDOWANIA PRZEWAGI KONKURENCYJNEJ PRZEDSIĘBIORSTW DEWELOPERSKICH – WYNIKI BADAŃ EMPIRYCZNYCH

W artykule dokonano analizy czynników kształtujących reputację przedsiębiorstw deweloperskich. Tekst stanowi odpowiedź na pytanie, jakie czynniki są istotne w kształtowaniu reputacji w procesie uzyskiwania przewagi konkurencyjnej przez przedsiębiorstwa deweloperskie. Analizę źródeł wtórnych zweryfikowano wynikami badań empirycznych w formie panelu ekspertów. Najważniejsze czynniki budowania reputacji wyodrębniono na podstawie ocen ekspertów. Należą do nich: poziom obsługi klienta, dotychczasowa reputacja, wiarygodność przedsiębiorstwa, zaufanie do przedsiębiorstwa, doświadczenie firmy, relacje z podmiotami otoczenia rynkowego, relacje z podwykonawcami, bezpieczna sytuacja finansowa (płynność), warunki płatności, poziom cen, koszt jednostkowy produkcji, jakość wykonania robót budowlanych, lokalizacje realizowanych inwestycji, terminowość realizacji, funkcjonalność produktów, zróżnicowanie oferty mieszkaniowej, jakość stosowanych materiałów, zakres i jakość gwarancji, rozpoznawalność marek produktów, rozpoznawalność marki przedsiębiorstwa, kultura organizacyjna, umiejętności kadry kierowniczej dewelopera, fachowość pracowników. Ponadto przeprowadzono analizy metodą cross-impact przy użyciu programu MIC-MAC. Wnioski płynące ze zrealizowanych badań umożliwiły na wyodrębnienie listy najważniejszych czynników kształtowania reputacji w procesie budowania przewagi konkurencyjnej przez deweloperów. Wyniki badań wskazały, że na reputację przedsiębiorstw deweloperskich najsilniej wpływają czynniki dotyczące relacji z klientami oraz dostawcami i podwykonawcami. Reputacja kształtuje się w oparciu o ocenę jakości wykonania oraz terminowość realizacji inwestycji, istotne jest doświadczenie firmy oraz prowadzona przez nią aktywna polityka reklamowa. Dokonano także systematyzacji czynników, na które reputacja przedsiębiorstw deweloperskich ma wpływ.

Słowa kluczowe: reputacja, konkurencyjność, przedsiębiorstwa deweloperskie, panel ekspertów, metoda cross-impct.

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THE CAPITAL MARKET AS A SOURCE OF FINANCING FOR SMALL INNOVATIVE COMPANIES IN THE MEDICAL INDUSTRY

The objective of the paper is to present the possibilities of financing the development of companies in the pharmaceutical, biotechnological, and medical sectors through the capital market. The trading prices of selected companies on the Polish stock exchanges (NewConnect and WSE) are discussed. Furthermore, the work analyzes the evolution of the WSE in the years 2007–2015 with a particular focus on the trading volumes and the maximum and minimum prices of the stocks of selected biotechnological and medical companies between January 2015 and April 2016. Using DbNotowania software from Statica, the selected companies were analyzed visually to identify abnormal price changes. Data were obtained from the at-skaner.pl database, normalized, and imported to Microsoft Access for more detailed analysis. It was concluded that the WSE may play a more prominent role in the development of innovative biotechnological, pharmaceutical, and medical companies if the changes recommended in this paper are implemented. Given the tendency towards capital market consolidation, it is logical that following an IPO on less liquid markets, companies will gradually try to transition to the more liquid ones. It would be advisable for small innovative companies to attract the attention of recommendation-issuing companies such as Edison Investment Research. The government should encourage individual and institutional investors to participate and finance the Polish capital market by appropriate regulations and tax exemptions.

Keywords: Polish biotechnology companies, Polish capital market, Financing Small innovative companies

1. INTRODUCTION

Innovative companies in the medical, biotechnological, and pharmaceutical industries face considerable difficulties acquiring capital. The development of new drugs in the preclinical phase (prior to approval) and the commercialization of new medical solutions, technologies, and equipment entail a high risk of failure. Due to that, financial institutions

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are reluctant to finance the operations and development of such companies, which take recourse to grants and the capital market.

The objective of the paper is to analyze high-technology companies in the pharmaceutical, biotechnological, and medical companies listed on Polish stock exchanges, that is NewConnect and the Warsaw Stock Exchange (WSE). NewConnect is a stock exchange for companies which publish simplified financial reports, thus exposing the investors to higher risk. This exchange is much less liquid than the WSE. Table 1 gives a classification of investors in the Polish capital market by capital source and investor type.

Table 1 Classification of investors in the Polish capital market

Type of investor / capital	Domestic	Foreign
Institutional	Open pension funds, investment funds, venture capital funds	Investment fund associations, sovereign funds (e.g., Norges Bank)
Individual		

Source: Own work

There are no exact data on the percentage contribution of foreign capital from individual investors to the WSE trading volume. It should be noted that a foreign investment is largely affected by the PLN to USD and EUR exchange rates as well as by the prevalent sentiment towards the emerging markets (including Poland). Due to risk considerations and investment goals, individual and institutional investors may adopt different time horizons. As entry or exit decisions may be influenced by all factors and information pertaining to the emerging markets, investors pay great attention not only to potential profits, but also to the liquidity of company securities. Furthermore, the WSE is not always able to ensure financing to small and medium-sized innovative companies without exposing them to the risk of takeover by larger corporations. Other negative issues affecting the stock exchange in Poland include:

- low stock liquidity and trading volumes, which may lead to unwarranted large price fluctuations;
- insufficient presence of institutional investors;
- absence of international companies monitoring the various market segments and issuing recommendations for individual company stocks.

Of interest to this paper are the following questions:

- What trading volume can lead to an increase or decrease in stock prices?
- Do the innovative companies in the medical industry listed on NewConnect and the WSE differ in terms of their stock liquidity?
- If companies transition to the WSE, does this lead to higher trading volumes? If so, what is the difference?
- In what ways do the proportions of shares owned by the company's founders and top managers, as well as institutional investors (holding at least 5% of the stock) affect stock liquidity? What is the relationship between the free float volume and stock liquidity?

The selected companies were analyzed based on daily data characterizing stock exchange transactions, that is, trading prices and volumes for January 2015–March 2016,

obtained from the Google Stock Screener[5] database. In order to enable international comparisons, all variables were converted into EUR at the exchange rates as of the end of a given period, quoted on the WSE website[6].

2. RESEARCH METHODOLOGY

Innovative products or exports accounting for at least 50% of a company's sales were adopted as criteria for innovativeness. Trading price and volume changes following a transition from NewConnect to the WSE, as well as minimum and maximum trading prices were analyzed. The two Polish stock exchanges, NewConnect and the WSE were compared based on analysis of some indicators characterizing the capital market for innovative companies in the medical industry. Using DbNotowania software from Statica, the selected companies were analyzed visually to identify abnormal price changes.
Data obtained from the Google Stock Screener database were normalized in a spreadsheet prior to importing to MS Access (spaces between digits and the abbreviation "zł" were removed, numbers were formatted to display two decimal places. The data on the transactions of all companies were imported as an external table. Using MS Access 2010, periods of abnormal price changes were analyzed in greater detail. To facilitate analysis and the investment decision-making process, daily tables were aggregated into monthly ones.

The advantage of adopting volume as a criterion of liquidity is that it enables easy comparison of companies with different capitalizations. By dividing the average daily trading volume by the number of listed companies, one can obtain the "average" daily volume per one listed company. In turn, that divided by the average value of one transaction returns the daily number of transactions. It is difficult to use the P/E indicator for innovative start-ups as for the first several years they generally do not generate revenues. Therefore, the methodology described by Goedhart, Koller, and Wessels[7] seems to be more appropriate.

To analyze the effect of transitioning between the stock exchanges, innovative companies in the medical industry were selected from NewConnect and the WSE.

3. BRIEF CHARACTERIZATION OF WSE DEVELOPMENT IN 2007–2015

Prior to analyzing the selected innovative companies in the medical sector, a brief characterization of WSE development in the years 2007–2015 is given. If investors wish to exit a company, they must sell the shares they hold. If the company stock is not liquid, the sale may extend over several days or lead to a dramatic drop in the share price. In that event, losses are incurred not only by the exiting investor, but also by the company concerned. The lack of stock liquidity hinders accurate assessment of the company's value, which may easily be over- or under-estimated without actual reasons based on company operations and prospects.

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[5] Google Stock Screener. Online: https://www.google.com/finance#stockscreener. Accessed, 2.03.2016.

[6] GPW. Podstawowe statystyki GPW. Online: https://www.gpw.pl/analizy_i_statystyki_pelna_wersja Accessed 24.02.2016.

[7] M. Goedhart, T. Koller, D. Wessels. *Valuing high-tech companies.* McKinesy. 2016. Online: http://www.mckinsey.com/Business-Functions/Strategy-and-Corporate-Finance/Our-Insights/Valuing-high-tech-companies?cid=other-eml-alt-mip-mck-oth-1602. Accessed 24.02.2016

A major influence on the Polish capital market has been exerted by open pension funds, which can be illustrated with data on the amount of money they collected[8]. Table 2 shows the investor structure on the WSE.

As can be seen from Table 2, the average annual volume in 2015 amounted to only 75% of that in 2007. In 2015, the average transaction value dropped to 2,903 EUR, which was by 31.29% less than in 2007. Furthermore, in 2015 the average daily trading volume per company was 39,257 EUR, which means a 46.37% decline as compared to 2007. The criterion of company liquidity was adopted as a daily volume of at least 100,000 EUR, which corresponded to approx. 34 transactions a day in 2015 (it should be noted that under this criterion, daily volume depends on the trading prices of the stock of a given company). In 2015, this parameter reached 13.5 transactions daily. This shows that in the studied period stock liquidity exhibited a decreasing tendency on the WSE. Obviously, the companies included in the WIG20 index had much higher trading volumes (are much more liquid) than companies included in the mWIG80 index.

A comparison on averaged data for selected innovative companies in the medical industry enables a more accurate assessment of the possibility of their financing through the WSE.

One shortcoming of the statistics given in Table 2 is that foreign investors are not subdivided into individual and institutional ones. However, it is the latter that play a decisive role in financing the development of new innovative companies. Indeed, they are often the next step in the financing cycle, following grants and venture capital. The basic prerequisites for individual and foreign investors to take interest in small and medium-sized companies on the stock exchange are:

- for the company founders and top managers to own approx. half of the capital;
- for institutional investors to hold approx. 20–30% of the capital.

Unfortunately, the number of individual investors is on the decline. While it is them who saved the WSE in 2009, at a time when foreign investors and Polish institutional investors were selling out, since then their share in the trading volume on the WSE has decreased, to reach a minimum in 2015. The WSE primarily lists Polish companies and if their development is to be financed by Polish institutional and individual investors, appropriate conditions must be created. Otherwise, the WSE is poised to face a continuing downward trend in trading volume. A factor that may limit the contribution of Polish individual investors to financing innovative companies through the WSE is insufficient capital among the general population. The inhabitants of countries with emerging markets, such as Poland, have much lower disposable resources, both in relative and absolute terms, than those of the developed countries, mostly due to:

- a lower level of socioeconomic development;
- much lower incomes per capita than in OECD countries.

[8] M. Stopka, 2016. *Rekordowa dziura budżetowa i nadwyżka: Polska i Niemcy*. Online: http://www.michalstopka.pl/rekordowa-dziura-budzetowa-i-nadwyzka-polska-i-niemcy. Accessed 24.02.2016.

Table 2. Percentage contributions of the various investors to WSE trading and changes in those contributions

Investor type \ Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Average annual volume, million EUR	63978	38455	40559	52237	56694	46082	53049	47633	47987
Number of listed companies	351	374	379	400	426	438	450	471	487
Average daily volume, million EUR	256.94	153.21	160.95	206.47	225.87	185.07	214.77	191.30	191.18
Average daily volume per company, thousand EUR	73,2	40,97	42,47	51,62	53,02	42,25	47,73	40,62	39,26
Average value of one transaction, EUR	4225	4010	3132	4267	4081	3991	4137	3446	2903
Block trade transaction share in trading	3.66	3.20	5.26	11.71	6.55	7.55	14.05	11.84	9.69
Number of initial public offerings	81	33	13	34	38	19	23	28	30
Capital collected by open pension funds, billion PLN				23	16	8	11	8	3
Foreign		43	36	47	47	48	47	49	52
Polish institutional investors		39	37	34	35	34	38	38	36
Polish individual investors		18	27	19	18	18	15	13	12
Foreign, percentage change versus previous year			-7	+11	0	+1	-1	+2	+3
Polish institutional investors, percentage change versus previous year			-2	-3	+1	-1	+4	0	-2
Polish individual investors, percentage change versus previous year			+9	-8	-1	0	-3	-2	-1

Source: Basic WSE statistics[9,10,11]

Source: Basic WSE statistics[9,10,11]

[9] M. Stopka, *op. cit.*

[10] P. Cymcyk. 2016. *Udział inwestorów w handlu na GPW*. DNA Rynków. 29 02 2016 roku. Online: http://dnarynkow.com/2016/02/29/inwestor-gatunek-zagrozony/ Accessed 24.02.2016.

[11] GPW. Podstawowe statystyki GPW. Online: https://www.gpw.pl/analizy_i_statystyki_pelna_wersja Accessed 24.02.2016.

Research shows that following the reversal of the pension reform and limitation of the freedom of open pension funds, the "Average annual volume, million EUR" on the WSE decreased by 25% in the period 2007 – 2015 year (Table 2).

Investors are not always interested in the financing of the development of small innovative companies due to the following features of the Polish capital market:

- Absence of tax exemptions for entities investing in small innovative companies; all investors pay a capital gains tax amounting to 19%.
- The information that companies are required to divulge to the investors is highly insufficient. Companies are not obligated to communicate frequently (except for some cases defined in relevant regulations). Moreover, companies often ignore queries from investor organizations and associations, such as the Association of Individual Investors.

4. BRIEF CHARACTERIZATION OF INNOVATIVE COMPANIES IN THE BIOTECHNOLOGICAL, PHARMACEUTICAL, AND MEDICAL INDUSTRIES

A short description of innovative companies in the biotechnological, pharmaceutical, and medical industries will enable a better understanding of the role of the capital market (the WSE) in financing their development.

In selecting companies for analysis, we excluded those financing health care entities (MAGELLAN, MWTRADE) and distributors of medical products (PELION, FARMACOL, NEUCA) as well as companies which own or operate hospitals or clinics (ENELMED, SWISSMED, SCANMED MULTIMEDIS). Brief characteristics of the selected companies are given below:

Mabion Poland SA is "a leading biotechnology company that was created in order to market the latest generation of biotech drugs based on humanized monoclonal antibodies"[12].

Medicalgorithmics S.A. offers a solution termed PocketECG, which employs mobile technologies to monitor and analyze heart function, with its main markets being the United States and Asia[13].

The main area of activity of the Inno-Gene Capital Investment Group is "the genetic testing market in Poland, with time, around the world"[14].

The business of the Cormay Group is the development and manufacturing of diagnostic reagents and laboratory analyzers (blood, urine)[15].

Milestone Medical Inc. is a joint venture "for the development, commercialization, manufacturing and marketing of epidural and intra-articular injection instruments"[16].

Selvita can be described as "a drug discovery company engaged in the research and development of breakthrough therapies in the area of oncology, as well as provision of integrated drug discovery services"[17].

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[12] Mabion S.A. https://mabion.eu/en. Accessed, 27.03.2016.

[13] MEDICALgorithmics S.A.. *Pocket ECG*. Online: http://www.medicalgorithmics.com. Accessed, 2.03.2016.

[14] Inno-Gene S.A. Group. About us. http://wwww.en.inno-gene.eu/about-us. Accessed, 27.03.2016.

[15] Cormay Group.About Cormay Group.http://cormay.eu/ Accessed, 27.03.2016.

[16] Milestone Medical. *Company Overview*.http://www.medicalmilestone.com/Accessed,27.03.2016.

[17] Selivta S.A. Company profile. http://www.selvita.com/about-us/about-us. Accessed, 27.03.2016.

Pahrmena SA, being part of the Pelion Group[18], is focused on the research and commercialization of anti-atherosclerosis drugs, dietary supplements, and dermocosmetics[19].

Small innovative companies usually access the stock market through NewConnect, which requires only limited reporting from the listed companies. However, by the same token, the investors do not have complete information needed for decision-making and thus run a higher risk than those investing on the WSE. Due to the absence of mechanisms protecting the interests of small investors, they typically lose all their capitals in the event of company bankruptcy[20]. Additional investment risk is attributable to the fact that the technologies and medicinal products being developed may not be approved by the FDA, EMA, etc. Once the medical product successfully passes clinical trials, biotechnological / pharmaceutical companies greatly accelerate their growth, with a concomitant increase in the trading prices of their stocks and capitalization (higher company value)[21]. The initial public offering implies the risk of share prices falling below the IPO levels[22], which is more likely in a volatile market[23].

Insufficient stock liquidity, implying difficulties with converting the invested capital into cash, is particularly severe in the case of innovative companies in the medical sector. Other important data concern the relationship between price fluctuations and stock volume. Table 3 provides such data for selected companies in the medical industry.

It should be determined whether the maximum and minimum trading prices were actually influenced by information concerning the company. In that case, those changes should be accompanied by increased trading volumes. However, as it can be seen from Table 3, in the case of Inno-gene S.A., Milestone Medical, Pharmena and Selvita trading price fluctuations occurred at low volumes, which means that a decisive role was played by speculators. Small innovative companies are exposed to the risk of their stocks being accumulated by their competitors at times of price drops, leading to the risk of a hostile takeover. The table shows that the trading prices of company stocks can be influenced by investors with very low amounts of capital, which is very detrimental to companies whose management board does not own sizeable capital.

Such situations are aggravated under adverse macroeconomic situations. The small number of transactions and low liquidity prevent the use of the methods described by Steinki and Mohammad[24]. Even in developed markets, such as Great Britain, investors are

[18] Pelion Healthcare Group SA. Acquisition by Pelion Group of control of its associate Pharmena S.A.http://www.pelion.eu/en/current_reports/0/11384.htmlAccessed, 27.03.2016.

[19] Pharmena SA. *Research*.http://www.pharmena.eu/ Accessed, 27.03.2016.

[20] F. Kowalik. *Kto pomaga inwestorom na GPW tracić pieniądze*. Forbes. 06.11.2015. Online: http://www.forbes.pl/inwestorzy-na-gpw-traca-pieniadze-warszawska-gielda-w-kryzysie,artykuly,199892,1,1.html. Accessed 24.02.2016.

[21] B. Orelli. *9 Things you need to know about biosimilar drugs*. The Motley Fool. 2016. Online:http://www.nasdaq.com/article/9-things-you-need-to-know-about-biosimilar-drugs-cm598394. Accessed, 27.03.2016.

[22] T. Yuko, T. Hasegawa. Japanese IPOs Struggle to Gain Ground. BloombergBusiness. March 27, 2016. Online: http://www.bloomberg.com/news/articles/2016-03-27/woes-descend-on-japanese-ipos-as-stocks-tank-at-start-of-trading. Accessed, 27.03.2016.

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[24] Ibidem

sensitive to external signals[25]. Therefore, alternative ways of financing innovative companies in the medical sector should be considered. For instance, venture capital offers some advantages to small and medium-sized companies over the stock market; these include:

- venture capital investors work with the company for several years;
- company managers learn from the venture capital investors and accumulate experience in terms of management, marketing, etc., which is often more important than financing itself.

Finally, the acquisition of a small innovative company by a large corporation represents an alternative to venture capital or indeed, an exit strategy following a round of venture capital financing. An example here is Iwona Software, which was acquired by Amazon[26].

Small companies which would like to enter the stock market should consider the consequences of the merger of the Deutsche Börse with the London Stock Exchange[27] as that event may have ramifications even for such players as the Euronext stock exchange. Given the tendency towards capital market consolidation, it is logical that following an IPO on less liquid markets, companies will gradually try to transition to the more liquid ones. If this happens, the WSE may become marginalized as investors move elsewhere. Examples of companies which already follow that trend with a view to acquiring more capital include WorkService with dual listing on the WSE and the LSE and LiveChat aiming at transitioning to Nasdaq.

It would be advisable for small innovative companies to attract the attention of recommendation-issuing companies such as Edison Investment Research[28]. The development of a Market Volatility Index for biotechnological and medical companies and a comparison with a corresponding index for the WSE and WIG20 companies would allow investors to make more rational decisions[29,30].

[25] J. Kahn, A. Satariano. *Brexit Nerves Cost This London Tech Startup $142,00i0 Already*. Bloomberg. March 9, 2016. Online http://www.bloomberg.com/news/articles/2016-03-09/-brexit-nerves-cost-this-london-tech-startup-142-000-already. Accessed, 27.03.2016.

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[27] J. Detrixhe. *Exchanges Talk Marriage While Their Nations Contemplate Divorce*. Online: http://www.bloomberg.com/news/articles/2016-02-24/exchanges-talk-marriage-while-their-nations-contemplate-divorce. Accessed February 24, 2016.

[28] Edison Investment Research Limited. Online: http://www.edisoninvestmentresearch.com. Accessed, 27.03.2016.

[29] M. Kiran. *Stock Market Volatility during the 2008 Financial Crisis.* The Leonard N. Stern School of Business. Glucksman Institute for Research in Securities Markets. April 1, 2010. Online: http://www.stern.nyu.edu/sites/default/files/assets/documents/uat_024308.pdfAccessed, 20.03.2016.

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Table 3. Statistical data for selected medical companies from January 1, 2015 to April 30, 2016

Company	Listed on	Number of shares	Closing price of stock as of April 29, 2016	Percentage of free-float	Minimum and maximum trading price	Date	Daily volume	Number of days in the period January 1, 2016 to March 31, 2016 with trading volume of
Cormay	WSE	63723954	2.42zł	77.04%	1,51zł	2016-03-16	153295	20
					3,80zł	2015-05-26	647207	
Inno-gene S.A.	New Connect	5701081	4.03zł	37.26%	3,62zł	2016-03-17	9440	0
					10,88zł	2015-09-17	6505	
Mabion	WSE	11500000	55.00zł	37.61%	37,05zł	2015-02-05	10920	1
					75,00zł	2015-05-20	21777	
Medicalgorithmics	WSE	3455526	288.50zł	43.48%	187,00zł	2015-04-14	25676	32
					288,50zł	2016-04-22	1414	
Milestone Medical	New Connect	22000000	4.20zł	12.84%	2,38zł	2016-03-02	749	0
					9,99zł	2015-08-14	4917	
Pharmena	New Connect	8795052	21.40zł	19.62%	9,60zł	2015-01-02	3802	0
					25,47zł	2016-01-04	2219	
Selvita	WSE	13115457	22.43zł	44.48%	14,29zł	2015-01-09	3477	5
					25,65zł	2015-11-10	13026	

Source: Own work

*58 trading days in the period January 1, 2016 to March 31, 2016

5. CONCLUSIONS

The WSE may play a more prominent role in supporting the development of innovative companies in the biotechnological, pharmaceutical, and medical industries. The first step towards solving any problem is its identification. Based on the analysis presented above, the following conclusions may be formulated:

1. Companies which do not exhibit stock liquidity above a certain threshold, such as 50,000 or 100,000 EUR daily should consider withdrawing from the WSE. That would improve the average liquidity of the companies listed on the WSE, thus helping to attract new domestic and international investors.
2. If individual and institutional investors become convinced as to the potential of small innovative companies and increase their liquidity, those companies are also likely to draw the attention of foreign investors.
3. If the company's stock is not sufficiently liquid, technical analysis does not make much sense.
4. When developing their strategies of financing through the capital market, Polish innovative companies in the medical sector must take into account the consequences of capital market consolidation in Europe[31].
5. Venture capital funds offer an alternative to the WSE.
6. Investors, including foreign ones, using the DeGiro platform, cannot access NewConnect. This means that access to the shares of Innogen and Milestone Medical, listed on that stock exchange, is limited as compared to Selvita and Mabion, which are listed on the WSE.
7. The government should encourage individual and institutional investors to participate and finance the Polish capital market by appropriate regulations[32] and tax exemptions.

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GIEŁDA PAPIERÓW WARTOŚCIOWYCH, JAKO ŹRÓDŁO FINANSOWANIA MAŁYCH FIRM INNOWACYJNYCH Z BRANŻY MEDYCZNEJ

Celem artykułu jest przedstawienie możliwości finansowania rozwoju firm z branży farmaceutycznej, biotechnologicznej i medycznej za pomocą rynku kapitałowego. Przedstawiono notowania wybranych firm na polskich rynkach kapitałowych – New Connect oraz GPW. Analizowano rozwój GPW w okresie 2007 – 2015 r. w celu przedstawienia ewolucji polskiego rynku kapitałowego. Szczególną uwagę poświęcono wolumenom oraz najwyższym i najniższym wartościom kursu akcji wybranych firm biotechnologicznych i medycz-

[33] Rozporządzenie Ministra Finansów z dnia 19 października 2005 r. w sprawie informacji stanowiących rekomendacje dotyczące instrumentów finansowych, ich emitentów lub wystawców. Online: http://isap.sejm.gov.pl/DetailsServlet?id=WDU20052061715. Accessed, 20.03.2016.

nych w okresie styczeń 2015 – kwiecień 2016. Za pomocą oprogramowania DbNotowania firmy Statica, wybrane firmy analizowano wizualnie w celu zidentyfikowania dużych wahań cenowych. Dane uzyskano z serwisu at-skaner.pl, znormalizowano i zaimportowano do programu Microsoft Access dla bardziej szczegółowej analizy. Firmy innowacyjne z branży medycznej, biotechnologicznej i farmaceutycznej z uwagi na prowadzoną działalność – opracowywanie nowych leków często w fazie przedklinicznej lub przed rejestracją, komercjalizacja nowych rozwiązań medycznych mają problem z pozyskiwaniem kapitału. Stwierdzono, że GPW może odgrywać bardziej znaczącą rolę w rozwoju innowacyjnych biotechnologicznych, farmaceutycznych i medycznych firm, jeżeli zostaną zrealizowane zmiany zaproponowane w niniejszym opracowaniu. W warunkach tendencji do konsolidacji rynków kapitałowych logiczne jest, że po debiucie na mniej płynnych rynkach firmy będą się starały stopniowo przychodzić na bardziej płynne. Dobrze jest, aby małe firmy innowacyjne znalazły się w polu uwagi takich serwisów wydających rekomendacje jak Edison Investment Research. Rząd powinien zachęcić inwestorów indywidualnych oraz instytucjonalnych do uczestnictwa i finansowania polskiego rynku kapitałowego poprzez odpowiednie regulacje oraz ulgi podatkowe.

Słowa kluczowe: biotechnologiczne firmy, rynek kapitałowy, finansowanie rozwoju biotechnologicznych firm, giełda papierów wartościowych, inwestowanie na giełdzie

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DEVELOPING FRAMEWORK FOR SUSTAINABILITY INDICATORS SYSTEM (SIS) FOR THE REMANUFACTURING COMPANIES FROM AUTOMOTIVE INDUSTRY- RESEARCH RESULTS

The aim of this paper is to provide results of research on the development of Sustainability Indicators System (SIS) for sustainability assessment in remanufacturing companies from automotive industry. Research was carried out within the project "*Sustainability in Remanufacturing Operations*" (hereafter: SIRO), representing cooperation between Poland and German for sustainable development accomplishment at the Faculty of Engineering Management at the Poznan University of Technology in 2012-2014. Sustainable development (hereafter: SD) is a concept based on three pillars including: Economy, Environment and Society, which remain in the trade-off relationship to each other. This implies difficulties in implementing the SD concept. Another equally important issue is the difficulty of the activities' assessment of compatibility with the basis of the concept. Authors state that, in order to realize the SD concept at the company level, the development of the measurement system is required. In the first place, it provides the assessment of the actual state, with simultaneous determining the course of future actions. To address this challenge, authors in the result of conducted research propose SIS consisted of 15 indicators suitable for integrated SD assessment. It was assumed that there is lack of appropriate indicators set capable to address integrated SD assessment at the remanufacturing company level. Previous studies present the opportunity to evaluate the different SD pillars, however, the disadvantage of these solutions is the multiplicity and unclarity of the proposed methodology. Therefore, as part of the study, the authors propose a clear methodology of sustainability assessment for remanufacturing companies.

Keywords: sustainable development, sustainability assessment, sustainability indicator system

1. INTRODUCTION

„Sustainable development" is recent issue, which according to Tan et al. is "*a hot issue for nations, companies and individuals*" [Tan et al. 2015, p. 132].

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SD has its roots in ideas about sustainable forest management which were developed in Europe nineteenth century. The essential issue was to manage the process of tree cutting considering the possibility of reforestation, providing the ability to restore the forest [Pittel 2004, p. 537].

It took some time and the concept was introduced to the worldwide debate - in the early 1970s, drawing attention to man's over-exploitation of the environment, with the focus on economic development. In the result, SD was incorporated into many research areas including: economy, philosophy, politics, engineering, etc., what led to many different definitions of the problematic issue [Wodzikowski 2009, p. 84].

Based on inventory of different definitions of SD[4], it was stated, that there is lack of clear and common for each research area, designation of SD, what would be convincing for everyone [Möller, 2013. p. 69]. That issue becomes the cause of SD critics, which was described by Kudłak [Kudłak 2008, p. 19]. The paper included one of the most widely recognized definitions of SD following the Brundtland Report: "*Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs*" [WCED, 1987].

In order to make the SD more specific, there was made a literature review of chosen definitions resulting in the list of SD concept features, including [Bartkowiak 2010, Piontek 2002, pp. 16-27; Kistowski 2003, pp. 31-34, Diefenbacher 2001, p. 65]:

- Type of development: social-economic (developed by human),
- Exposure time: long time horizon including future generations (the focus on long-term nature),
- The principle of intergenerational justice,
- Process characteristics: SD is an integrated process of human activities in various activities,
- Objective: balancing the three pillars[5]: people, environment, economy.

Considering the SD concept, it is required to refer to three sustainability pillars, including economy, environment and people.

Pillar „*ECONOMY*" is an economic component, expressing the classic striving to achieve prosperity in material approach. As a result, it becomes necessary to carry out economic development, resulting in an actual increase of wealth [Śleszyński 2007, p. 100]. This pillar is associated with the enlargement of capital, both financial and physical.

Pillar „*PEOPLE*" it is related to the provision of equal opportunities of development and meeting the needs of the people (mostly elementary needs such as health, access to water, education, shelter, etc.) [Śleszyński 2007, p. 100]. From a social point of view, it plays an important role to ensure security

Pillar „*ENVIRONMENT*" is focused on maintaining the „*environmental infrastructure*" as well as long-term „*ecologic productivity*". Śleszyński claims that, on the environmental resources should be used to avoid the disorganization of the relationship between the elements of the environment, and on the other hand, not to reduce their contri-

[4] In Polish literature Jeżowski pointed out 100 different SD definitions [Jeżowski 2007, p. 11], Piontek distinguished 44 SD explainations [Piontek 2002, pp. 16-26].

[5] Some of the research stated that „three pillars" concept is out-of-date. For instance Siemiński distinguished the following aspects of SD: socio-cultural, economic, environmental, spatial, technical-technological and ethical [Siemiński 2008, p.178], while Borys added to traditional configuration two dimensions: spatial and institutional [Borys 2005, p. 48]. In the paper there was used a traditional „three pillars" concept.

bution to the creation of human wellbeing [Śleszyński 2007, p. 100]. The quality of natural resources should not be worse, what is a result of the intergenerational justice (access to a variety of resources for different generations).

The key point in the meaning of the SD concept is to provide a balance between development of each sustainability pillar that the development of one of them did not cause adverse changes in the other dimensions. Mikłaszewski noted that this feature becomes a source of mistakes in the SD concept understanding. It results in the following way of thinking: "*the same percentage increase in spending on industrial development and environmental protection*" [Mikłaszewski 2000, p. 39].

In the field of sustainable development, there are many major challenges to be addressed. One of the major problematic issue is a trade-off relationships between elements making up the SD system. A '*trade-off*' is defined as an exchange of one thing in return for another one.

Enterprises undertaking technology investments related to the reduction of emissions (environmental aspect) or related to the improvement of Employees working conditions (social aspect) expend founds which become profit for owners (economic aspect). This leads to reduction of the profit of the owner, of which the economic aspect of the business activity is assessed. Thus, the economic aspect is often considered as a priority one, while the other pillars of SD are used as a servant in relation to him. There were many papers about the trade-off relations including: [Brent & Labuschagne, 2006], [Assefa & Frostell, 2007], [McKenzie, 2004].

Simultaneously to the trade-off relationship, there are different positions, that undermine these conflicts. According to Famielec, there is no conflict between economic and social objectives. [Famielec 2005], as the commitment to the social objectives may result in the achievement of economic goals (eg. Improvement of working conditions for employees can help to improve their effectiveness). The second conflict in the system: economy-environment is also a stereotype, which was observed in 1991 by Porter, arguing that there is a positive relationship between the growth of the environmental requirements and improving the competitiveness of enterprises [Porter 1991 p.168]. It may be confirmed by the installation of low-energy and low-waste technology, which in the long time horizon will be translated into lower costs.

The paper intends to present the comprehensive and practical indicator framework for sustainability assessment for car remanufacturing companies in Poland.

The remaining part of this paper is structured in the following way: Section 2 presents an overview of sustainability concept introduction at the company level. There were presented premises for incorporating sustainability into company strategy and the meaningful of sustainable enterprise. Section 3 introduces sustainability assessment as an essential part of SD. In section 4 indicators for assessing a SD at the company level were described. In section 5, the SIS framework is presented. Finally, there is included summary of the paper.

2. SUSTAINABILITY AT THE COMPANY LEVEL

Sustainability is an essential goal for governments, industry, companies, farms, etc. Authors focused in the paper on the company level. Researchers presented research results related to the evaluation of sustainability indicators for companies processing End of Life

vehicles, which are car remanufacturing companies. It was assumed that the study branch is performing the SD concept.

The introduction SD at the company level is an object of scientific discussion, which devotes more attention[6]. The realization of SD at the company level was popularized by the foundation of the World Business Council for Sustainable Development (WBCSD) and the International Institute for Sustainable Development (IISD) [Hejduk, Grudzewski 2014]. Assumptions about the concept at the enterprise-level, concern [Hejduk, Grudzewski 2014]:

- Ecoeffectiveness – production of goods /services that meet customer needs and improve their quality of life,
- Innovation and technology,
- Corporate social responsibility with regard to ecosystems, the health and safety of employees and customers of goods / services.

The company which follows pointed assumptions (is sustainable) is running a business in different manner than traditional one, what was presented in the Table 1.

Table 1. Comparison between traditional and sustainable enterprise

Comparison feature	**Traditional enterprise**	**Sustainable enterprise**
Objective	Profit maximization	Growth and sustainable development, care for the welfare of stakeholders and the environment
Approach to the Environment	Source of raw materials, which should be used (overexploitation)	Resource source, including non-renewable, which should be saved. Taking action in harmony with nature
Future vision	Limited to the planning horizon	Long-term, with taking under consideration needs of future generations
Values	Material, rational	Immaterial, socio-ecological
Priority of meeting needs	Company owner	Integration in meeting the needs of all stakeholders

Source: own elaboration based on [Raftowicz-Filipkiewicz 2013, p. 52]

Taking into account presented comparison of the traditional and sustainable company it was noticed, that modern enterprise that follow the implementation of SD is not aimed to maximize profits, which is characteristic for the traditional approach [Friedman 1970]. Currently we recognize the growing importance of intangible assets, respect for nature and creating good conditions for work and life of the people, at the expense of tangible assets (mostly financial). Moreover instead of focus on owner's needs, the company is oriented on integrating the needs of all company's stakeholders.

The authors indicated that simultaneously to the evolution of the approach to the role of the company, the attitude to the practical implementation of the principles of sustainable development in business activities was changing.

[6] The issue is discussed in international journals including: „Journal of Sustainability and Green Business", „Journal of Social Business" [Dobrzański and Szymańska, 2013]. There was observed domination of English publication, although there were some attempts on Polish market to reference the SD concept of business enterprises, such as the works of the following authors: Przychodzień or Jabłoński [Dobrzański and Szymańska, 2013].

Originally, the company implementing the assumptions of SD took actions related to the protection of the environment[7]. This involved carrying out activities aimed to reduce emissions of pollutants into the environment, waste reduction or resource efficiency. Currently, environmental issues are included into strategy of companies in the framework of environmental management systems such as ISO 14001 or EMAS, which have a wide range of influence [Ogrodnik 2011, p. 181]. Social issues however are carried out within the framework of CSR strategy[8]. The catalogue of currently undertaken actions in the framework of sustainable development includes as following [Szadziewska 2010]:

- rational use of natural resources,
- prevention of negative effects on the environment by the use of new environmentally friendly technologies and equipment reducing the amount of pollutants,
- undertaking initiatives to support local communities;
- attention to product quality,
- investments in environmental protection projects,
- ethic in relations with stakeholders of the company.

The concept of SD is often included in the strategy of the company. The basic reason is that it is seen as the basis for building competitive advantage.

The correlation between the implementation of SD strategies, and competitiveness increase is point of contention in the scientific community. According Wasiak and Dobrzański companies more frequently take the initiative related to the implementation of sustainable development, by introducing solutions that make it possible to meet the social and environmental demands in advance [Wasiak and Dobrzański 2005, p. 10], before there appear legal requirements. Przychodzień proved in his research on companies listed on the Warsaw Stock Exchange, that investment in sustainable development bring the expected benefits in terms of improved competitiveness [Przychodzień 2013]. Similar conclusions can be drawn based on the research carried out by Kudłak [Kudłak 2008]. Taking into account all presented information, it was assumed that there is a positive correlation between the implementation of sustainable development at business activity of the company and their competitiveness.

Apart from the internal SD aspiration, there are other premises for including SD concept into business activity. The basic sustainability drivers arise from economic confirmation and they are related to the environment protection.

First significant factor, become legal requirements. Sustainable development policy implemented at the country and organization level strengthens the favorable market trends and corrects the phenomena that are unfavorable. Lack of compliance with the law requirements is burdened with legal sanctions in the form of fines. In accordance to the law, there are also fees for air emissions or landfill, what stimulates less harmful company activities for the [Bernaciak and Gaczek, 2002, p. 276]. It resulted in carrying out proenvironmental actions, although the grounds lies in law compulsion. What is more, those actions are not always the result of deliberate actions in this direction, but may result from other causes, such as the desire to improve product quality and lower production costs

[7] Kozłowski believed that the implementation of SD in practice is equal to reducing dependence on non-renewable sources of energy, reducing emissions of harmful substances into the atmosphere and reducing emissions of toxic pollutants into water and soil [Kozłowski 1992].

[8] This strategy is sometimes mistakenly considered by some scientists equivalent to SD, despite the distinct theoretical foundations [Przychodzień, Przychodzień 2011, p. 59].

[Bernaciak and Gaczek, 2002, p.276]. However, in the face of increasing environmental pollution, all actions in this area are important, regardless of the accompanying genesis.

Another SD driver is increasing awareness of customers, who are looking for environmentally friendly products, manufactured under suitable conditions [Bernaciak and Gaczek, 2002, p. 276].

This argues that in the near future, the concept of sustainable development will be present and required in each company.

To sum up this chapter, authors cited Nidumolu et al. "*There is no alternative for SD*" [Nidumolu et al., 2009].

3. SUSTAINABILITY ASSESSMENT – ESSENTIAL PART OF SD

According to Ness et al. "The purpose of sustainability assessment is to provide decision-makers with an evaluation of global to local integrated nature-society systems in short and long term perspectives in order to assist them to determine which actions should or should not be taken in attempt to make society sustainable" [Ness et al., 2007, p. 499]. To sum up, it is necessary to improve sustainability, what requires knowledge of the actual "sustainability situation", what is equal to measurement requirement.

Sustainability assessment is something natural in the authors opinion. Taking into consideration the statement that "SD is the leading value" , there are required for decision makers at different levels of sustainability realization (global, country, company, etc.) information about the current "*SD state*", in order to focus efforts on actions aimed at improving the social, economic and environmental aspect. SD measurement allows to monitor the progress of its implementation on the improvement road towards a better future for the next generations. Sustainability assessment is a rapidly growing area in the literature, what may be confirmed by the data in Table 2.

Table 2 Distribution of papers related to the SD assessment in selected scientific bases

Keywords	PL – Polish	EN – English	Number of results[9]		
			SCOPUS[10]	Google scholar[11]	BazTech
„Sustainability assessment"		X	708	3000	6
	X		-	8	2
„Sustianability measurement"		X	63	82	0
	X		-	5	0
„Sustainability indicators"		X	395	1170	2
	X		-	33	2

Source: own elaboration

There were reviewed papers from journals and sources by searching Title with the keywords presented in the Table 2 (in English and Polish). Authors selected two international well-known databases (SCOPUS and Google Scholar) as well as one Polish (BazTech). It should be noticed that there is a research gap in Polish studies which are mainly theoretical consideration of the SD application at the country or region level asso-

[9] Searching results for the date: 08.04.2016

[10] Searching limitations: Social Sciences & Humanities

[11] Lack of searching limitations

ciated with the transportation, agriculture, tourism and public administration topics. There are much more papers in English.

Authors are focused on the sustainability assessment with the use of indicators, which are an example of the techniques and tools for SD assessment [Ness et al. 2007]. In accordance to the Agenda 21[12] requirements, there should be established indicators for sustainability measuring: "*Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems*" [US, 1992, chapter 40.4]

That was the most relevant factor for sustainability indicators system development.

Authors were focused on assessing sustainability at the company level. As Moldavska and Welo highlighted "if we cannot measure the level of the sustainability on the company level, we do not know if we do the right things and are heading in the right direction with our improvement initiatives" [Moldavska & Welo, 2015]. Concluding, there is a demand on sustainability indicators system for SD measurement at the company level.

4. SUSTAINABILITY INDICATOR

In the management, controlling is one of core activities. During the control, there is made verification of the degree of the goals realization, what requires measuring performance [Griffin, 2010, p. 662]. It is possible with the use of indicators.

The measurement requirement was expressed by the principle: "*If something cannot be measured, it cannot by managed*" [Cooper & Edgett 2008 Ehrenfeld 2008]. Authors assumed that SD was managed, what required measurement. In order to measure SD, there should be established the sustainability indicators system.

Indicators are useful and relevant tool to track progress over time and identify problems with improvements potential [Tan et al. 2015, p. 132].

Authors defined indicators as "the operational representation of an attribute (quality, characteristic, property) of a given system, by a quantitative or qualitative variable (for example numbers, graphics, colors, symbols) (or function of variables), including its value, related to a reference value" [Waas et al. 2014, p. 5520]. The cited definition is not only useful theoretically, but also practically [Tom Waas i inni, 2014. s. 5520].

Most of the objects /phenomena that are measured are systems. From a technical perspective, an indicator is a variable or an aggregation/function of variables, related to a reference value [Gallopin 1997]. As it was pointed out by Lancker et al. "*[…] a given indicator doesn't say anything about sustainability, unless a reference value […] is given to it*" [Lancker and Nijkamp, 2000]. The reference value could be a goal, a target, a norm, a standard or a benchmark [Gallopin 1997].

The importance of indicators is the best described by Abraham Lincoln who stated that: if we could first know where we are, and whither we are tending, we could better judge what to do, and how to do it" [Meadows 1998, p.1].

Indicators are source of information used to understand the world, plan actions and make some decisions [Meadows, 1998], what makes them important in management. Authors believed that the success of the company is no longer measured by financial and

[12] The action plan of the United Nations with regard to SD

economic indicators, but by more holistic measurement which includes social, economic and environmental aspects – sustainability indicators.

A literature review shows that several efforts have been made to develop SIS for the application at the company level (for instance: [Tan et al., 2015], [Azapagic, 2004], [Singh et al., 2016]). However identifying a suitable sustainability indicator system is a major challenge. There are many examples of indicators systems which are dedicated for selected business sector, type of the company (including the company size), etc.

Previous studies showed the following list of challenges related to the SIS establishment, including [Moldavska & Welo, 2015, pp. 621-623; Tan et al. 2015, pp.132-133; Azapagic 2004]:

- C1 - Addressing three sustainability pillars equally;
- C2 - Create the system balanced in terms level of generality, complexity, and practical dimension of the measurement;
- C3 -To provide useful information for internal decision- makers;
- C4 - Cost of SIS implementation;
- C5 - Mixing types of indicators (including qualitative and quantitative);
- C6 - Time of the assessment (resource consumption problem);
- C7 - Lack of linkage between sustainability assessment tool and sustainability practice

In the authors opinion, the most important thing is to create the dedicated site-specific SIS capable to address company needs while considering the company as a system and allow the holistic assessment with all sustainability pillars.

5. SUSTAINABILITY INDICATORS SYSTEM FOR REMANUFACTURING COMPANIES

This part of paper will discuss: criteria for indicators selection, indicator selection method, elements of indicators and finally, description of SIS for remanufacturing companies.

5.1 Criteria for “good indicator”

In the literature there are considered criteria which indicators should comply with in given conditions (called by authors as "*good indicator features*").

Previous studies provided many guidelines in that area, which were commonly expressed in the form of acronyms including - SMART [Lawler & Bilson, 2013 s.84-85], SPICED [Roche 1999] or CREAM [Schiavo Campo & 1999]. In authors opinion that attributes of good indicator should take into account the specific features of the measured system.

In the result of conducted research, there was proposed catalogue of guidelines for the good sustainability indicator at the company level. It was called in the form of acronym ACRUS, created by the first letters of selected features, including [Kosacka, 2014]:

- **A** – Availability of data: there should be used easy available data, do not create additional demand for data (it is particularly important for small and medium size companies), to ensure short time for the indicators evaluation;

- **C** – Comparability: policy makers need to be able to compare the results of indicator both – over the time (to identify trends) and to compare with others (benchmarking);
- **R** – **R**eliability/Relevance: indicator should provide reliable information required for the implementation of sustainable development policies. It should be directly relevant to continuous sustainability improvement.
- **U** – **U**sefulness: indicator should present the current, complete picture of the situation in the company in a given area. It should be free from excessive data and it should be necessary from the perspective of making further management decisions. It should be applicable to assess industry.
- **S** – **S**implicity: indicator should be simple and logical, both in the construction and interpretation, enabling non-expert understanding and interpreting it in order to make future decisions.

For authors each requirement is equally important.

5.2 Indicators' selection method

Authors have developed the method of indicators selection, presented in the Figure 1.

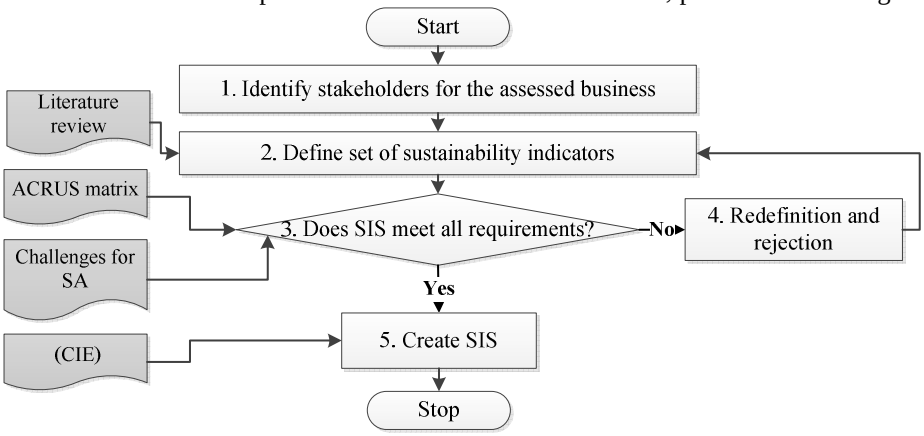

Fig.1 SIS selection method

Source: own elaboration based on [Kosacka, 2014]

The first step is to define stakeholders of the assessed system (company). For the remanufacturing companies, objects which are affected by or on which they have influence on, were: suppliers, customers; employees, competitors, local community and government.

At the step 2, with the information about stakeholders, there is defined a set of indicators divided into the following sub-categories: economic, ecologic, social in order to achieve the holistic view of sustainability in the assessment. This step should involve stakeholders which become experts. At this stage are also included data obtained from the literature review.

Step 3 includes verification of the proposed SIS in accordance to the ACRUS requirements (ACRUS matrix presented in the Table 3) and taking into account pointed out earlier list of challenges for sustainability assessment (in chapter 4).

Moreover the number of indicators in SIS should be as little as possible to present all required dimensions of SD at the company level. Authors have proposed a system consisted of 15 indicators.

Table 3. ACRUS matrix

ACRUS feature	I_1[13]	I_2	…	I_n
A				
C				
R				
U				
S				
Number of features (max 5)	/5	/5	/5	/5

Source: own elaboration

The next step is to redefine all indicators which do not fulfill the requirements in accordance to the results obtained of the ACRUS matrix. Indicators which do not comply with presented criteria are rejected. Indicators which meet all requirements (with the total maximum number of features) are selected to SIS.

In the last step, indicators are described according to the *Catalogue of the indicator's elements* (Hereafter: CIE), presented in the Table 4:

Table 4 Catalogue of the indicator's elements

Indicator's element	What does it includes?
Title	Short description of the indicator
Definition	Detailed, clear description of the indicator
Measurement	Formula or assessment base
Unit	Unit of indicator's value
Reference value	Desired value (improvement goal)

Source: own elaboration

There could be added also information about required data to provide the assessment and the frequency of measurement.

5.3 Sustainability indicators system for remanufacturing companies

Authors, as a result of conducted literature studies, indicates that there is a research gap related to the sustainability assessment in recycling companies.

In accordance to the presented procedure in the Fig. 1 there was prepared SIS for recycling companies, consisting of 15 indicators, what was presented in the Table 5:

[13] where $\mathbf{I_n}$ stand as n-th indicator **(I)**

Table 5 Sustainability indicators system for remanufacturing companies in Poland

No	Indicator	Description	Formula/assessment base	Unit	Reference value
	Economic performance				
1	OEE	Overall Equipment Effectiveness	$Availability\ rate \times Quality\ rate \times Performance\ rate$	%	100%
2	RPF	Remanufacturing process flow	*Quantitative assessment - expert's questionnaire*	1-5	5
3	Planning adequacy	Adequacy of reman process planning	$\frac{Planned\ batch\ remanufacturing\ lead\ time}{Real\ batch\ remanufacturing\ lead\ time} \times 100\%$	%	100%
4	AMT	Availability of machines and tools	*Quantitative assessment - expert's questionnaire*	1-5	5
5	Service level	Level of executed orders	$\frac{Number\ of\ executed\ orders\ in\ period\ t}{Total\ number\ of\ planned\ orders\ in\ period\ t} \times 100\%$	%	100%
6	OOS	Availability of materials (overall out of stock)	*Quantitative assessment - expert's questionnaire*	1-5	5
	Environmental performance				
7	Energy consumption level	Energy consumption per core	*Quantitative assessment - expert's questionnaire*	1-5	1
8	Waste generation level	Amount of generated waste	$\frac{Amount\ of\ waste\ in\ period\ t}{Amount\ of\ material\ used\ for\ production\ in\ period\ t} \times 100\%$	%	0%
9	MRR	Material recovery rate	$\frac{Number\ of\ recovered\ cores\ in\ period\ t}{Number\ of\ cores\ entered\ to\ process\ in\ period\ t} \times 100\%$	%	100%
10	Generated Emissions level	Amount of emissions (CO_2, water, sewage) per one regenerated core (product)	$\frac{Amount\ of\ emissions\ in\ period\ t}{(Amount\ of\ cores\ remanufactured \times weight\ of\ core)\ in\ period\ t} \times 100\%$	%	0%
	Social performance				
11	Employment	Change in the level of employment in the period	$\frac{Number\ of\ executed\ orders\ in\ period\ t}{Total\ number\ of\ planned\ orders\ in\ period\ t} \times 100\%$	%	>100%

No	Indicator	Description	Formula/assessment base	Unit	Reference value
12	Staff Training	Percentage of employees who participated in additional training	$\frac{Number\ of\ employees\ in\ training\ in\ period\ t}{Total\ number\ of\ employees\ in\ period\ t} \times 100\%$	%	100%
13	Harmfulness of the remanufacturing process	Refers to the consequences that are associated with threat to safe and health of workers in the remanufacturing process	$W = \sum_{i=1}^{N} (300D + 10S + M) \times L_i$ Grading scale for W, where: W< 10 - grade : 1, 100>W>=10 - grade:2, 300>W>=100- grade: 3, 1500>W >=300- grade: 4, W >= 1500 - grade: 5	1-5	1
14	Average level of comfort at work	Identification of waste (muda) of time of workers due to inefficient workplace design	$(1 - \frac{Number\ of\ identified\ muda\ in\ compaany}{Total\ number\ of\ potential\ muda\ in\ RPA}) \times 100\%$	%	100%
15	Innovation level	The number of implemented innovations in the enterprise proposed by employees	$\frac{Number\ of\ accepted\ innovation\ per\ period\ t}{Total\ number\ of\ proposed\ innovation\ in\ period\ t} \times 100\%$	%	100%

Source: [Golińska et al. 2015, Kosacka 2014]

Each indicator was defined according to the Catalogue of the indicator's elements.

Taking into consideration that the data for the calculation of the indicators should be readily available in the company and if the data are not available in the form of numerical values, the indicator can be calculated based on the expert knowledge of decision-makers, the SIS consisted of quantitative and qualitative indicators (I_2, I_4, I_6, I_7). The questionnaires to measure levels of qualitative indicators were described in details in work of Golińska et al.[2015]

The presented SIS is a dedicated solution for sustainability assessment which was practically used in remanufacturing business in Poland.

6. SUMMARY

There is observed the growing concern on sustainability, including the SD concept introduction at the company level. The SD is not an option but it is a requirement of the competiveness, what results in managing the SD. To manage a company including social, economic and ecologic aspects there is a challenge of assessing sustainability performance.

Authors have described an indicators based assessment method, which is appropriate for assessing current sustainability state. Previous studies show that there are different approaches towards the development of sustainability assessment tools, but there was no example of SIS dedicated for the remanufacturing companies which process ELVs.

The process of SIS establishment was time-consuming and required overcoming many difficulties involved in complying with the guidelines of a good indicator (ACRUS) as well as challenges related to SIS (from C1 till C7).

In authors opinion the proposed set of indicators is a useful tool for measuring the three dimensions of sustainable development, which is adapted to the business specific of company remanufacturing car parts , in the context of support for future decisions aimed at improving the sustainability.

SIS should be verified in practice, which is a prerequisite to undertake further research in this area.

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SYSTEM WSKAŹNIKÓW ZRÓWNOWAŻONEGO ROZWOJU (SIS) DLA PRZEDSIĘBIORSTW REMANUFACTURINGOWYCH Z BRANŻY MOTORYZACYJNEJ – WYNIKI BADAŃ

Celem artykułu jest prezentacja wyników badań nad opracowaniem Systemu Wskaźników Zrównoważonego Rozwoju (Sustainable Development Indicators System - SDIS) dla oceny przedsiębiorstw zajmujących się remanufacturingiem części samochodowych. Badania przeprowadzane były w ramach projektu SIRO „Zrównoważony rozwój w procesie wtórnego wytwarzania" (ang. Sustainability in Remanufacturing Operations) stanowiącego przykład polsko – niemieckiej współpracy na rzecz zrównoważonego rozwoju realizowanego na Wydziale Inżynierii Zarządzania Politechniki Poznańskiej w latach 2012-2014. Zrównoważony rozwój to koncepcja oparta na 3 filarach: społecznym, środowiskowym i ekonomicznym, które pozostają ze sobą w relacji trade – off. Implikuje to trudności w realizacji koncepcji. Innym problemem w realizacji zasad zrównoważonego rozwoju jest trudność w ocenie zgodności podejmowanych działań z założeniami koncepcji. W opinii autorów, aby przedsiębiorstwa mogły realizować koncepcję zrównoważonego rozwoju, koniecznym jest zbudowanie systemu umożliwiającego jego pomiar. Służyć ma to,

z jednej strony ocenie stanu obecnego, a z drugiej wyznaczaniu kierunków działań podejmowanych w przyszłości. Autorzy artykuły w ramach przeprowadzonych badań, zaproponowali system 15 wskaźników pozwalający na ocenę każdego z 3 filarów zrównoważonego rozwoju. Autorzy, wnioskując na podstawie przeprowadzonych badań literaturowych, postawili tezę wskazującą na brak kompleksowego systemu oceny zrównoważonego rozwoju. Dotychczasowe badania prezentują możliwość oceny poszczególnych filarów zrównoważonego rozwoju, jednak wadą tych rozwiązań jest mnogość i niejednoznaczność proponowanych metodyk. W związku z powyższym w ramach przeprowadzonych badań, autorzy zaproponowali jednoznaczną metodykę pozwalającą dokonać oceny zrównoważonego rozwoju dla przedsiębiorstw przetwarzających pojazdy wycofane z eksploatacji.

Słowa kluczowe: zrównoważony rozwój, ocena zrównoważonego rozwoju ocena wskaźnikowa zrównoważonego rozwoju

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Josef KRAUSE[1]

VOLUNTARY INSTRUMENTS OF ENVIRONMENTAL CARE AS A GLOBAL TREND – EXAMPLE OF THE SITAUTION IN THE CZECH REPUBLIC

The presented paper discusses the importance of voluntary environmental activities to business activity. In recent decades, a number of trends have been underway that have increased the importance of a friendly approach to the environment for the successful functioning of enterprises. A certain level of environmental care is given by the legislative requirements of the country. At the same time, enterprises can develop activities beyond those mandatory obligations. The aim of the presented article is to provide a list of the basic voluntary instruments that businesses use to take a friendly approach to the environment and, using selected instruments, describe their use in the Czech Republic. A further aim is to briefly map the opinions of the inhabitants of the Czech Republic concerning the status and protection of the environment in the Czech Republic. Businesses can use several voluntary environmental tools. EMAS and ecolabelling are considered the main voluntary environmental instruments. The potential benefits of both tools include possible cost savings as well as a possible increase in revenues. In the Czech Republic, both voluntary instruments mentioned above are used. Research focused on the impact of voluntary environmental tools on business performance has shown that their use mostly increases environmental performance. Greater economic performance is not always achieved. A survey conducted among the citizens of the Czech Republic indicated that they are quite satisfied with the state of the environment. Furthermore, it is possible to identify potential demand for environmentally friendly products.

Keywords: environmental strategy; ecolabelling; EMAS; voluntary instruments.

1. INTRODUCTION

Global trends and changes in the business environment are very important considerations for business strategy[2]. Reflections on these issues can bring enterprises various benefits, including the opportunity to obtain a competitive advantage.

There are many global trends in the area of the environment. For example, Done[3] specifies twelve trends: repercussions of the crisis, geopolitical power shifts, technological challenges, climate change, water and food, education, demographic changes, war, terrorism and social unrest, energy, ecosystems and biodiversity, health, and natural disasters. At least half of these trends (climate change, water and food, demographic

[1] Ing. et Ing. Josef Krause, Ph.D. Department of Strategy, Faculty of Business Administration, University of Economics, Prague, W. Churchill Sq. 1938/4, 130 67 Prague 3, Czech Republic.

[2] G. Johnson, K. Scholes, R. Whittington, *Exploring corporate strategy: Text and cases*, 8th ed., Prentice Hall, Harlow 2008; R.M. Grant, *Contemporary strategy analysis: Text and cases*, 9th ed., Chicester: John Wiley & Sons Inc. 2016. M.E. Porter, *Competitive strategy: Techniques for analyzing industries and competitors*, 8th ed., Harlow: Prentice Hall, Harlow 2004; B. de Wit, R. Meyer, *Strategy synthesis: Managing strategy paradoxes to create competitive advantage*, 4th ed., Andover: Cengage Learning 2014.

[3] A. Done, *Global trends: Facing up to a changing world*, 1st ed., Palgrave Macmillan, Basingstoke 2012.

changes, energy, ecosystems and biodiversity, natural disasters) can be considered questions of sustainability. The importance of trends in the area of sustainability has also been confirmed by other authors. Examples of functional trends are "environment and energy", according to Dabelko[4] and "economics and energy", according to Gates[5]. Climate change is mentioned as one of the most important trends by Soucek[6].

Care for the environment is also a part of the concept of corporate social responsibility. It is traditionally based on three pillars: economic, social, and environmental. The environmental pillar, according to Srpová et al. (2012), includes the following elements: protection of natural resources, reduction of negative impacts on the environment, recycling, use of environmentally friendly products, use of alternative energy sources, and compliance with standards ISO 140 and EMAS.

The aim of the presented article is to provide a list of the basic voluntary instruments that businesses use to take a friendly approach to the environment and, using selected instruments, describe their use in the Czech Republic. A further aim is to briefly map the opinions of the inhabitants of the Czech Republic on the status and protection of the environment in the Czech Republic.

2. POSITIVE IMPACT OF ENVRIONMENTAL PERFORMANCE

Many authors argue that environmental issues are important ingredients of a business strategy. Russo et al.[7] analysed 243 such issues and confirmed that economic performance and environmental performance are positively linked. They also discovered a positive relationship between this link and the growth of industry.

Young et al.[8] state that sustainability can increase profitability and competitiveness. These authors specify ten reasons why the question of sustainability is important for companies. These reasons are volatile energy prices, increases in the cost of raw materials, increases in waste and disposal costs, changes in waste legislation, strengthening of environmental laws, changes in customer demands and expectations, competitive advantages, transparency issues, acquisition, retention, and motivation of astute employees, and the cost of procrastination.

In addition, Hitchcock et al.[9] cite many potential benefits of pursuing sustainability. These benefits are reducing energy, waste and costs, differentiating companies, meeting future regulations, developing new product or processes innovations, opening new markets, attracting the best employees, improving the image among shareholders, legal risk, reducing insurance costs, higher quality of life.

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[4] G.D. Dabelko, *Environment and energy*. In ed. Arnas, N.: Fighting chance: Global trends and shocks in the national security environment, 1st ed., Center for Technology and National Security Policy, Washington 2009.

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[7] M.V. Russo, P.A. Fouts, *A resource-based perspective on corporate environmental performance and profitability*, "Academy of Management Journal" 1997/3, p. 534–559.

[8] S.T. Young, K.K. Dhanda, *Sustainability: Essentials for business*. Sage, Los Angeles 2013, 416 pp.

[9] D. Hitchcock, M. Willard, *Marsha. The business guide to sustainability: Practical strategies and tools for organizations*, 2nd ed., London 2009.

Li et al.[10] examined 256 Chinese-based high-tech firms. The authors confirmed that green product design and green supply-chain processes play an important role in the environmental and financial performance of the companies. Wu et al.[11] confirmed that green marketing strategies have a positive impact on the business performance of organic farms in Taiwan.

Research by Eiadat et al.[12] examined an environmental innovation strategy and its link to business performance. The research was based on Jordanian firms in the chemical industry. This research also found an association between an environmental innovation strategy and better business performance.

UEAPME[13] mentions environmental management systems (EMAS) and ecolabelling (EUAPME, 2016) as voluntary environmental instruments. According to Hadrabova[14], environmental management systems involve the EMAS and ISO 14000 standards. The European Commission further adds green procurement[15].

2.1. Consumer views on environmental protection in the Czech Republic[16]

68% of the population are satisfied (very satisfied or rather satisfied) with the state of the environment in the Czech Republic. Certain differences can be found in different areas of the environment. Most of the population is satisfied with the quality of drinking water (84%), availability of wilderness areas (83%), purity of the surrounding countryside (77%), clean air (64%), noise level (61%), purity of surface waters (59%), and traffic density (41%). Satisfaction with various aspects of the environment is higher (except for satisfaction with the purity of drinking water) in small villages in comparison with large cities. It is interesting to note the answer to the question of whether respondents are interested in information concerning the environment in the Czech Republic. 57% of the respondents answered that they are interested in such information. At the same time, only

[10] S.R. Li, V. Jayaraman, A. Paulraj, K.C. Shang, *Proactive environmental strategies and performance: Role of green supply chain processes and green product design in the Chinese high-tech industry*, "International Journal of Production Research" 2016, 54/7.

[11] S.I. Wu, S.R. Lin, *The effect of a green marketing strategy on business performance: A study of organic farms in Taiwan.* Total Quality Management and Business Excellence" 2016. 27/2, pp. 141–156.

[12] Y. Eiadat, A. Kelly, F. Roche, H. Eyadat, *Green and competitive? An empirical test of the mediating role of environmental innovation strategy*. "Journal of World Business" 2008, 43/2, pp. 131–145.

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[14] A. Hadrabova, *Environmentální aspekty podnikání*. Oeconomica, Prague 2010.

[15] EC, *EU voluntary environmental protection instruments.* European Commission. Available on-line: http://europa.eu/rapid/press-release_MEMO-06-6_en.htm; 12 August 2016.

[16] The research cited in this part of the article was carried out by the Public Opinion Research Center (part of the Institute of Sociology of the Czech Academy of Sciences). The research is based on quota sampling. Quotas are according to region (NUTS 3), size of residence, gender, age and education. The representativeness is related to residents of the Czech Republic who are 15 years of age or older. The size of the sample was 1015 respondents. The method used for the research was an interview with the respondents according to a standardized questionnaire (SOU AV CR. Hodnocení stavu životního prostředí – květen 2016. Centrum pro výzkum veřejného mínění. Sociologický ústav AVČR, v.v.i. Available online: http://cvvm.soc.cas.cz/en/media/com_form2content/documents/c1/a7335/f3/oe160615.pdf; 1 October 2016; SOU AV CR, Hodnocení ochrany životního prostředí – květen 2016. Centrum pro výzkum veřejného mínění. Sociologický ústav AVČR, v.v.i. Available online: http://cvvm.soc.cas.cz/media/com_form2content/ documents/c1/a7568/f3/oe 160613.pdf; 1 October 2016; SOU AV CR, Postoje k ochraně životního prostředí a jejímu financování – květen 2016. Centrum pro výzkum veřejného mínění. Sociologický ústav AVČR, v.v.i. Available online: http://cvvm.soc.cas.cz/media/com_form2content/documents/c1/a7570/f3/oe160621.pdf; 1 October 2016.).

43% of the respondents answered that there is enough information about the environment in the Czech Republic[17].

According to the opinion of 59% of the respondents, the Czech Republic cares about the environment appropriately, while 35% of the respondents feel this is done poorly. In terms of evaluating the environmental protection activities of various institutions, municipal authorities were evaluated as the best. 64% of the respondents view their work positively. 55% of the respondents mentioned the good work of environmental organizations, 47% mentioned the Ministry of the Environment, 41% the regional offices, 36% the government, 32% the European Union, and only 23% of the respondents mentioned the parliament. In terms of assessing the situation in individual areas of environmental performance, according to the respondents the situation is good in the economy of consumption of raw materials and energy by citizens (44%), impact of agricultural activities on the environment (42%), renewable energy (38%), citizen behaviour toward the environment (34%), the rigor of laws on environmental protection (30%), economics of the consumption of raw materials and energy in our production (30%), impact of logging on the environment (26%), being friendly to natural areas during construction (22%), behaviour of enterprises toward the environment (21%), prosecution of those who damage the environment (19%), impact of mineral extraction on the environment (17%), and impact of road transport on the environment (16%)[18].

According to consumer research conducted in the Czech Republic, the prevailing view is that it is right to do something for the environment, even if it costs more money or demands more time. 82% of the respondents strongly agreed or agreed with this statement. At the same time, another survey suggests that consumers are not as optimistic about their ability as individuals to affect things in the environment. 51% of the respondents said they strongly agree or agree with the assertion that it is difficult for them to do something more for the environment as individuals. And 35% of the respondents agreed with the statement that their activity in the environmental field will not be relevant unless other people are active as well. At the same time, 38% of the respondents agreed (strongly agreed or agreed) with the statement that there are more important things in life than concern for the environment. In the field of environmental protection, 74% of the respondents agreed with the statement that the problem of environmental pollution must be resolved without spending money. Only 31% of the respondents would be willing to give part of their revenue for environmental protection, and 27% of the respondents approved of raising taxes if these resources were to be spent on environmental protection[19].

2.2. Ecolabelling

Along with new trends (globalization, climate change) also come new needs of customers. Ecolabelling is one of the ways to satisfy these needs. The main arguments and benefits of the voluntary tools for customers are: strict criteria for granting certification by independent bodies, products which have less impact on the environment, products which

[17] SOU AV CR, Hodnocení stavu životního prostředí – květen 2016. Centrum pro výzkum veřejného mínění. Sociologický ústav AVČR, v.v.i. Available on-line: http://cvvm.soc.cas.cz/en/media/com_form2content/ documents/ c1/a7335/f3/oe160615.pdf; 1 October 2016.

[18] SOU AV CR, Hodnocení ochrany životního prostředí – květen 2016.

[19] EC, *Search engine for EMAS registrations.* European Commission. Available on-line: http://ec.europa.eu/environment/emas/register/search/search.do; 5 July 2016

are better for consumer health, contribution to sustainable development, and a certification backed by the European Commission[20].

The main objectives of the criteria for awarding ecolabels are formulated as follows, according to EC[21]: "The EU Ecolabel seeks to minimize the various environmental impacts at each stage of a product's life. The criteria are set at levels that promote products which have a lower overall environmental impact".

In the Czech Republic, products holding the designation "environmentally friendly product" are classified into the following areas: dry cleaning, household and office, house, garden, workshop, service, construction and reconstruction, heating, and other. 60 manufacturers hold this designation. The structure of licensing by individual groups is indicated in the table.

Chart 1. Structure of product groups holding an ecolabel in the Czech Republic

Absorbents	1.06%
Wood-burning boilers	1.06%
Metal furniture	1.06%
Lubricants	1.06%
Mulch material from recycled paper	1.06%
Absorbents	1.06%
Spreading materials	1.06%
Hard floor coverings	1.06%
Textile products	2.13%
Adhesives and sealants, water-soluble	2.13%
Printed paper	3.19%
Products from molded pulp	1.06%
Detergents	3.19%
Products from a "tissue" paper	3.19%
Gas boilers	4.26%
Cardboard, paperboard and articles thereof	6.38%
Accommodation services for tourists	8.51%
Pipes of polyolefin	10.64%
Paints containing water	20.21%
Furniture	27.66%
Total	100.00%

Source: Cenia. *Produkty s ekoznačkou Ekologicky šetrný výrobek/služba a Ekoznačkou EU udělenou v ČR.* The Czech environmental information agency. Available on-line: http://www1.cenia.cz/www/ekoznaceni/seznam-esv; 6 July 2016.

These figures show that more than half (57%) of all licenses are awarded in three product groups: furniture, paints containing water, and pipes of polyolefin. The groups "accommodation services" and "cardboard, paperboard and articles thereof" have at least a 5% representation (but less than 10%). Other groups have less than 5 %.

[20] EC, *Marketing guide for EU Ecolabel companies: How to make the EU flower visible in your marketing.* European Commission. 2007. Available on-line: http://ec.europa.eu/environment/ecolabel/documents/ marketing_guide_en.pdf; 20 August 2016.

[21] EC, *EU Ecolabel paints and varnishes user manual.* European Commission. Available on-line: http://ec.europa.eu/environment/ecolabel/documents/User_Manual_paints_varnishes.pdf; 1 August 2016.

Research on the benefits of ecolabelling

Karlsson et al.[22] examined the impact of the ecolabelling of tourism services and the demand for them. The authors observed that ecolabelling is not very important for the wider tourism segment. However, the research confirmed the existence of a niche market that is interested in providers with this type of certification. Delmas et al.[23] examined the impact of ecolabelling and the certification of environmental practices. The authors observed that eco-certification brought a premium price, but an ecolabel did not bring this premium price.

2.3. EMAS

EMAS is an environmental management system. The potential benefits of this system are[24]:

Reduced operating costs. EMAS can help to reduce the cost of raw materials, energy, and charges for environmental pollution;

- Reduced risk of accidents;
- Reduced cost of fines for environmental pollution;
- Improvement of access to licenses, certificates, etc.;
- Better access to capital (grants, loans, public procurement);
- Improved business organization, clarified organizational structure, clearly defined business plan.

In addition, a document from the European Commission specifies similar benefits of EMAS: resource efficiency, climate protection, corporate social responsibility, legal compliance, supply chain management and green public procurement, credible information, performance measurement, employee engagement, and stakeholder involvement[25].

In recent years, the number of certified operators has been around 25. The maximum number of certified organizations was achieved in 2009. It is expected that the decline after 2009 was associated with the financial crisis and the financial demands of this certification.

Chart 2. Number of EMAS holders in the Czech Republic

geo\time	2008	2009	2010	2011	2012	2013	2014	2015
Czech Republic	28	34	26	25	24	24	25	24

Source: Eurostat, *Organisations and sites with eco-management and audit scheme (EMAS) registration*. Available online: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdpc410; 3 August 2016.

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[24] MECR, *Aktualizovaný program EMAS (Základní dokumenty)*. Ministry of Environment of the Czech Republic, 2002.

[25] EC (2012). *3×3 Good Reasons for EMAS: Improve your environmental performance with the premium standard in environmental management*. European Commission. Luxembourg: Publications Office of the European Union. Available on-line: http://ec.europa.eu/environment/emas/pdf/other/Brochure_3x3_Good_reasons_for_EMAS.pdf; (dostęp: 1.08.2016 r.).

The structure of enterprises by sector having an EMAS certification in the Czech Republic (EMAS register of the European Commission, EC[26]):

- Manufacturing industry – 40%.
- Production and distribution of electricity, gas, steam and air conditioning – 10%.
- Construction – 25%.
- Public administration and defence; compulsory social security – 15%.
- Health and social care – 5%.

Research on EMAS benefits

Merli et al.[27] examined the benefits of EMAS holders in Italy. The authors examined the strategic, environmental, and economic benefits of certification. The most important strategic benefits are improvement of legislative compliance and improvement of image. The least important factors are improvement in relations with staff and improvement of access to public funds and tenders. The most important environmental benefits are a reduction in waste generation and in the use of resources, raw materials, and energy. The least important benefits of an EMAS certification are reductions in the use of soil, in soil contamination, and in effects on biodiversity. The most important economic benefits are energy savings and savings in the use of raw materials. The least important economic benefits are savings on insurance premiums and an increase in turnover. The research was further aimed at detecting difficulties with the EMAS certification. The most important difficulties are lack of staff time and difficulties related to the initial environmental review.

Martin-Pena et al.[28] also examined the benefits and difficulties associated with EMAS certification. The research was focused on the automotive industry in Spain. The main benefits detected were improvements in market position, environmental performance, relations with stakeholders, and access to environmentally friendly technologies. The most important difficulties were connected with the organisational structure, staff, and environmental information.

Iraldo et al.[29] examined the impact of EMAS certification on environmental and competitive performance. The impact on environmental performance was confirmed. The effects on competitive performance were not strongly confirmed.

3. CONCLUSION

Voluntary business instruments in environmental care can bring enterprises a number of benefits. The main benefits include a reduction in operating costs and risk of accidents, lower costs associated with environmental pollution, improvement of the transparency of processes within the organization, and greater attractiveness to customers and other interest groups. According to numerous studies dealing with an evaluation of the impact

[26] EC (2016). *Search engine for EMAS registrations.* European Commission. Available on-line: http://ec.europa.eu/environment/emas/register/search/search.do; 5 July 2016.

[27] R. Merli, M. Preziosi, Ch. Ippolito, *Promoting sustainability through EMS application: A survey examining the critical factors about EMAS registration in Italian organizations,* "Sustainability" 2016. 8/3

[28] M.L. Martin-Pena, E. Diaz-Garrido, J.M. Sanchez-Lopez, *Analysis of benefits and difficulties associated with firms' Environmental Management Systems: The case of the Spanish automotive industry,* "Journal of Cleaner Production" 2014, 70.

[29] F. Iraldo, F. Testa, *Is an environmental management system able to influence environmental and competitive performance? The case of the eco-management and audit scheme (EMAS) in the European Union,* 2009, 17/16.

of selected tools on enterprises, it is evident that these benefits are not always realized in practice. Further research should therefore focus on the conditions under which businesses can reap all the potential benefits of these tools. The inhabitants of the Czech Republic are rather satisfied with the environment, and they agree that it should be protected. This attitude can be identified as an opportunity for firms. Ecolabelling and the EMAS certification are used in the Czech Republic, but their use is not widespread.

Acknowledgements

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DOBROWOLNE INSTRUMENTY OCHRONY ŚRODOWISKA NATURALNEGO JAKO JEDEN Z TRENDÓW GLOBALNYCH – PRZYKŁAD SYTUACJI W CZECHACH

Niniejszy artykuł analizuje znaczenie dobrowolnych działań środowiskowych dla funkcjonowania firmy. W ostatnich dziesięcioleciach pojawiło się wiele trendów, które podwyższają znaczenie przyjaznego podejścia do środowiska naturalnego z perspektywy udanych działań przedsiębiorstw. Określony poziom ochrony środowiska naturalnego jest wyznaczany za pośrednictwem wymogów prawnych danego kraju. Obecnie przedsiębiorstwa mogą w tej dziedzinie rozwijać inne działania wychodzące ponad poziom

wymogów obowiązkowych. Celem artykułu jest dokonanie przeglądu podstawowych dobrowolnych instrumentów w zakresie poszanowania środowiska naturalnego, a w przypadku wybranych instrumentów opis ich wykorzystania w Republice Czeskiej. Kolejnym celem jest zwięzłe przedstawienie opinii mieszkańców Republiki Czeskiej na temat stanu i ochrony środowiska w Republice Czeskiej. Przedsiębiorstwa mogą korzystać z kilku dobrowolnych instrumentów. Za główne dobrowolne instrumenty są uważane: EMAS i oznakowanie ekologiczne. Za potencjalne korzyści obu typów narzędzi wskazuje się możliwe oszczędności oraz zwiększenie przychodów.W Czechach wykorzystywane są oba typy dobrowolnych instrumentów. Ich zastosowanie nie jest jednak zbyt powszechne. W Czechach przyznano mniej niż 100 licencji „produkt przyjazny dla środowiska" a certyfikację EMAS posiada mniej niż 30 organizacji. Badania dotyczące wpływu dobrowolnych instrumentów środowiskowych na efektywność przedsiębiorstw pokazują, że ich wydajność środowiskowa się zazwyczaj podwyższa, choć nie jest zawsze osiągana. Badania przeprowadzone wśród czeskich konsumentów pokazują, że są oni raczej zadowoleni ze stanu środowiska naturalnego. Większość mieszkańców zgadza się z działaniami i inwestycjami mającymi na celu ochronę środowiska naturalnego. Z owych badań można również wnioskować, że na terenie Czech istnieje potencjalny popyt na produkty przyjazne środowisku.

Słowa kluczowe: strategie zarządzania środowiskowego, oznakowanie ekologiczne, EMAS, dobrowolne instrumenty.

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INNOVATION STRATEGIES IN SMEs. SOME EVIDENCE FROM THE CASE OF PODKARPACKIE, POLAND

The aim of this paper is to provide a detailed account of the strategy for growth through innovation of the SME's sector in Podkarpackie Voivodship in Poland. In analyzing this case, we raise the following two questions: (1) what are the types, structure, and quality of innovation strategies of SMEs in Podkarpackie?; (2) what are the key factors and dynamics leading and limiting to innovation activity, as well as to the growth of this innovation strategy?

Generally, there are three theoretical types of innovation strategies: a. creation, b. interaction and c. reaction. In the first case innovation is a natural and internal type of thinking about company development. Interaction describes innovation as strategic resource of the company. The 'reaction' type is for these companies that treat innovation as external compulsion. The type of innovation strategy is determined by quantity and quality of innovations implemented: numerous and original innovations indicate the strategy we call "creation" while the opposite results in quantity and quality are more likely typical for "reaction" type.

The empirical bases for the analyses are derived from various sources: historical documents, statistical data, and in-depth interviews with key individuals in SME's. The analysis presented in this article is the result of CATI carried out among 419 out of 820 enterprises researched in the project.

Keywords: innovation, innovation strategies, SMEs, entrepreneurship, Podkarpackie Voivodship

1. INTRODUCTION

Innovations are considered to be one of the most progressive determinants of socio-economic growth, also in the territorial, regional and local perspective[3,4,5,6,7]. The high level of innovation has a positive impact on productivity at the firm level [business per-

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formance[8]] and consequently also on the economic results at regional or national level [economic performance[9]].

The aim of this paper is to contribute to a greater understanding of the research on strategy for growth through innovation in peripheral regions by providing a detailed account of the case of the SME's sector in Podkarpackie Voivodship in Poland. In analyzing this case, we raise the following two questions: (1) what are the types, structure, and quality of innovation strategies of SMEs in Podkarpackie?; (2) what are the key factors and dynamics leading and limiting to innovation activity, as well as to the growth of this innovation strategy?

2. LITERATURE REVIEW

There are different perspectives on what is and what is not an *innovative activity* and how *innovativeness* can be stimulated (what are a *determinants of innovation*)[10,11].

According to GUS (Central Statistical Office in Poland), and according to international statistics – innovation is: "introducing into the market a new or better product, as well as introducing a new process or updated process of production, with the product or process new from the perspective of enterprise that implements it"[12].

A modern way to perceive innovation moves away from perceiving it as the only one event, but a complex of events or phenomenon that make new patterns, goods or technologies in the area of production and services. Innovations are made in the specified expanse with a system of linkages[13], that is called *innovation system.* It contains production and scientific sub-systems, institutional solutions and interdependent relationships among them[14]. They are characterized by the level of innovativeness of the particular region[15].

In a broad sense, innovation is positive change, which is effective from the point of view of economic and financial accounts, and as a result - the competitiveness of enterprises.

Investment in innovation cannot be easily defined. It is impossible to say that investment in innovation is, for example, the purchase of technology or a new device. So as to form an innovation, it is necessary first of all to implement or contribute to the implemen-

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tation of the production of a particular investment. Because the implementation is carried out after the purchase of the investment, it is not possible in advance to name investment - investment in innovation. Thus some investments could potentially be investing in innovation and after implementation - investments are becoming investment in innovation. Investment in innovation is an investment that creates the basis for being innovative, and then it is implemented or contributes to the implementation of new products, processes or organizational solutions.

According to the OECD definition, a competitive advantage is made, among others, by improving the company's ability to be innovative (by increasing the ability to develop new products or processes, or increase and the creation of new knowledge)[16].

Over the past few years we have seen an increase of press releases directly aimed at innovation polices in Poland, this indicates its growing popularity. Empirical research on factors that determine innovation are however still very scarce. We follow the footsteps of Acs and Audretsch[17], Hansen[18] as we link innovation with the size, range of activities, and dynamics of development in an enterprise. According to Hansen[19], company's size should be responsible for innovation. A brief glance on the dataset and questionnaire suggested that 'innovative investments' have been related to production, process, organizational or marketing innovation, the same as in Vaona and Pianta[20] research.

There aren't many empirical studies examining the relationship between the companies' dynamics of growth and their self-assessed economic situation and innovation. The hypothesis that there is a positive relationship between the growth, the economic situation of the enterprise and innovation has been tested in literature with wavering findings. Baldwin and Johnson[21] suggest that faster-growing entrants are more innovative than slower-growing ones.

Some authors look value added on the network or cooperation with other entities such as R&D centers, in terms of access to complementary resources (knowledge, information, finance, and other various resources), joint projects, risk sharing, and synergies of resource sharing[22]. According to Heunks[23] innovation depends on cooperation with other firms and on the availability of external capital, but this regards mainly marketing innovation. In other words, firms cooperating with other firms and using external capital tend to

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innovate their commercial systems more than others. Lewandowska and Stopa[24] in other study have observed an interesting correlation. This is the dominant approach to innovation, characterized as 'pragmatic'. Cooperation with companies constituting the competition arises after the implementation of innovation in the company, which is in fact the strengthening of market position. Then follows the need for specialization and a wider cooperation so that the innovation makes sense – so that the innovation at least breaks even and certainly to be profitable. The sole administrator of the innovation is only the company that has implemented it.

A group of reasons, which stresses the productivity advantages of clustering or generally cooperation with other entities, include better and/or cheaper access to such inputs as components, machinery, business services or personnel, better and/or cheaper access to information, and knowledge[25]. He finds that SMEs may rely more heavily on external knowledge networks as an input to innovation than do large firms. For example, Audretsch and Vivarelli[26] finds out that small firms – those with less than 100 employees – appeared to benefit more from external research than large firms. Other researcher Cornett[27] stressed the one way to enforce a sustainable growth (firms and region) is to stimulate the linkages between the knowledge sector and the business sector. This is similar conclusions in Kaufmann and Tödtling[28]: "firms cooperating with science increase their ability to realize more radical innovations and to introduce products which are new to the market". According to they each form of cooperating (e.g. universities and firms, profit-oriented contract research institutions) is basically viable, important is the well-working inter-systemic exchange.

3. INNOVATION STRATEGIES

Starting point of our understanding of "innovation strategy" is an ideal type of enterprise that constructs its functioning on innovativeness[29]. As it was mentioned above, innovation is a process and this process may become the core of functioning of the firm, that is interested in constant original innovations, based on internal R&D and/or tight cooperation with external R&D institutions, with the full use of external support of institutional system. Such innovations create new interactions within widely understood enterprise's environment. The enterprise's products or services do not follow customers' needs – they rather create the needs, ahead of demand. Of course, such innovations do not have to be breakthrough, but in their number and quality they are foundations of new and changing

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relations with customers and cooperatives, as well as with institutional surrounding. We called such approach "creation," assuming internal consistent structure of this strategy.

At the other extreme there is strategy for surviving – reacting on changes in the environment: innovations are external and a kind of "forced," usually by the closest competitors or customers. In this type of approach innovations are not the consequence of systematic reflection. They are rather a reaction to new situation, therefore much more random. As the opposite ideal type, there is no originality in innovation – the novelty of products/services/processes applies only to enterprise's level. The cooperation with R&D institutions is from case to case, usually as the argument for additional public financial support. The quantity and quality of innovations are secondary characteristics, depending on market demands and possible external support, therefore we call this type of approach a "reaction."

Between these two extremes there is the strategy of "interaction," where the innovation is not the main paradigm for the enterprise but is important enough to be developed and supported by occasional cooperation with external R&D institutions and the utilitarian approach towards public financing of the innovation.

It is crucial to know and understand the approach(es) towards innovations among enterprises, because it determines regional level innovativeness and describes the effectiveness of institutional support system.

4. METHODOLOGY

A computer-assisted telephone interview survey was conducted in 2014 within research project titled "The Study of the Impact of Investments in Innovation on the Competitiveness of the SME sector in Podkarpackie Voivodship." Two random samples were constructed, taking into account the fact whether the enterprise introduced at least one innovation between 2004-2011 (419 companies) or did not (401 companies). Actually, the questionnaire consisted of seven parts: SH: innovation introduction (filtering companies into two main groups), A: innovative products, B: innovative technological processes and organizational innovation, C: research activity, investment and spending, D: the effects of investment in period 2008-2012, E: sources of financing the investment, F: obstacles in innovation, and X: independent data. The questionnaire included 232 variables (mostly on nominal and ordinal scale), but next 25 variables were constructed for analysis presented in this paper (by recoding and indexing).

The sample itself had random characteristics, though due to the structure of the SMEs' sector in Poland (micro-sized enterprises represent the vast majority) and due to the topic of the research two stratums had to be identified: the size of the enterprise and the sector of its activity. Therefore, the research was conducted on a stratified sample. Finally, 820 companies were covered by the study, that gives 3% of maximum error (at confidence level α=0.95 and 0.50 fraction – main characteristic divided the researched companies into two equal groups). However, the paper presents the results of analysis of the data only for these enterprises that introduced at least one innovation in period 2004-2011. Therefore, the maximum error for interpretations and conclusions is 5% (still at confidence level 0.95 and 0.50 fraction – unknown distribution of characteristics).

As for the statistical analysis of the data, the main statistical test for relationships and dependencies was the chi-square independence test. To arbitrate whether there were statistically significant differences between averages in innovation quantity and quality scale

due to different factors among enterprises, analysis for variance (H Kruskal-Wallis' test for k independent samples) procedure was implemented.

5. THE QUANTITY SCALE OF INNOVATION

The companies' representatives who declared that between 2004-2011 any kind of innovation had been implemented were asked about 26 different actions within innovation: development (of new products, technologies, patents, utility models, computer software, technical know-how), purchases (of technologies, automatic and computerized production lines, ICT technologies, licenses, computer software), modernization (of ICT technologies, production line) and involvement (in employees' training, marketing actions, projecting and new organizational solutions). In each case, respondents could choose either "yes" (1) or "no" (0) answer. Next step was to index all 26 answers for each respondent to receive the quantity scale of innovation in 2004-2011 period. Theoretical distribution is between 1 and 26, but empirical data show that maximum for researched companies was 15 (for 396 respondents out of 419) – the distribution is chi-square like (Fig. 1).

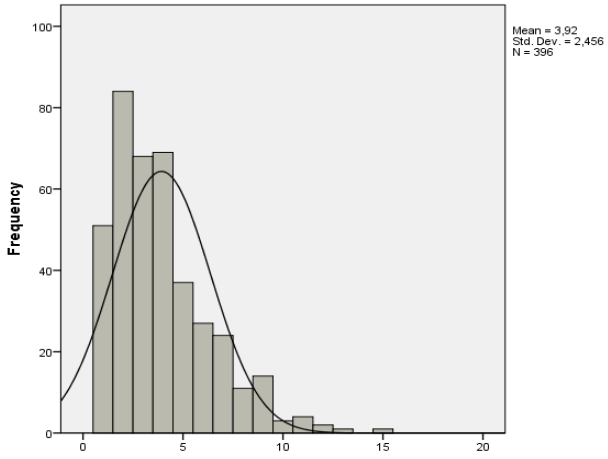

Figure 1. The distribution of the quantity scale of innovation (N=396)

Source: *Own studies.*

The final result in the quantity scale of innovation could depend on the size of the enterprise, it's scale of activities (local vs global) and, of course, the amount of money invested. These factors might be called "hard". On the other hand, enterprise's interest in research and development, cooperation with external R&D or other subjects of environment (customers, suppliers, consulting firms, NGOs etc.) and institutional support (financial, consulting or information) might influence the quantity scale result for each enterprise. Such factors could be called "soft", because they depend on enterprise's involvement in innovation (additional actions, extra sections etc.).

The independent factors consisted of three variables from X section of the questionnaire: the range/scale of activities (local/regional within country, local/regional across borders – up to 50 km, within country and international), the value of investment in

2011/2012 (from 0 up to 5 million and more zlotys) and the number of employees in 2011/2012 (in intervals: 0-9, 10-49, 50-249). These variables described the condition of each enterprise in the research.

The dependent factors consisted of three variables form C section of the questionnaire: engagement in research and development (only internal, internal with external, only external, none), cooperation index (as number of parties in research and development cooperation – for 32 enterprises that declared such cooperation) and institutional support index (as the number of institutions supporting innovation in researched enterprises). These variables described the readiness for innovation of each enterprise in the research.

Due to the chi-square distribution of the quantity scale of innovation, H Kruskal-Wallis' test for k independent samples was implemented to test if there was statistically significant differences in the quantity scale of innovation resulting from "independent" and "dependent" factors' influence. The table 1. presents the p value of the test for every factor indicated above.

Table 1. P-value of H Kruskal-Wallis' test for k independent samples

Hard factors	p value	Soft factors	p value
range/scale of activities	.000	engagement in R&D	.203
value of investment in 2011/2012	.000	cooperation index	.154
number of employees in 2011/2012	.000	institutional support index	.065

Source: *Own studies*

The score of the quantity scale innovation depended on "objective" factors and this relation had linear character, meaning that the more international range of enterprise's activities, the bigger scale of investment and the bigger enterprise itself, the more activities within innovation were implemented in 2004-2011 period. These dependencies were not surprising at all, because innovation is an expensive process that only enterprises in good economic condition may afford. However, what could concern was that environmental support, cooperation and even own research and development unit did not differ the quantity of innovations. In other words, in case of Podkarpackie Voivodship and it's SMEs, differences due to the market condition were not mitigated by institutional support. This had to result in petrification of differences between strong and weak companies.

The lack of influence of the institutional support also showed the weaknesses of the actual innovation support system. At least in quantity dimension. Of course, there is still question on quality of innovation – answered in next section of the paper.

6. THE QUALITY SCALE OF INNOVATION

Within the quality of innovation three different aspects were included (questions from section A and B of the questionnaire): whether the innovation (new/improved product/service or new/improved process) was original or not; if the innovation was not original – who inspired it (local, regional, national and abroad enterprises); and who was responsible for final implementation of the innovation (enterprise itself, enterprise in cooperation with other companies, enterprise in cooperation with R&D institutions, mainly other companies).

The questions on originality of the innovation were on nominal scale – dichotomous ("yes/no"). Therefore, potential soft factors: "engagement in R&D," "cooperation index" and "institutional support index" were to be recoded into dichotomies, too. If there was at least one point in the index, it received value "yes", if "0" - value "no." Thanks to such solution, it was possible to use chi-square independence test and phi correlation factor. In case of "hard" variables: "range/scale of activity," "value of investment in 2011/2012" and "number of employees in 2011/2012" chi-square independence test and Kendall's tau-c factor were used.

Once again the tables 2-3 present the p-value of the test for every factor indicated above for originality of new/improved products/services and processes.

Table 2. P-value of chi-square independence test for originality of new/improved product/services

Hard factors	p value	Soft factors	p value
range/scale of activities	.009	engagement in R&D	.040
value of investment in 2011/2012	.244	cooperation index	.090
number of employees in 2011/2012	.096	institutional support index	.879

Source: *own studies*

Table 3. P-value of chi-square independence test for originality of new/improved processes

Hard factors	p value	Soft factors	p value
range/scale of activities	.388	engagement in R&D	.155
value of investment in 2011/2012	.348	cooperation index	.454
number of employees in 2011/2012	.814	institutional support index	.867

Source: *Own studies*

Originality of product/service innovation depended on the engagement in R&D and the range/scale of activities. In other words, enterprises that did have their own R&D section or cooperated with external R&D institutions and operated on wider level than local or regional, more often introduced original product/service innovation. Actually, these two factors were the only ones that correlated significantly. What is more, process innovations did not depend on any of indicated factors. It is worth to add, that 65 (N=419) representatives declared that their enterprise had implemented completely new product or service (unknown to other companies) and 42 completely new processes (also unknown to other companies).

The majority of surveyed representatives of SMEs that introduced any innovation in 2004-2011 period declared that these innovations had been implemented in other companies before (57% for new or improved products/services, with 24% of "don't know" answers; and 50% for new or improved processes, but with 30% of "don't know" answers). These competitive enterprises that introduced the same innovations earlier were mostly from the region (from 59% for products and services to 64% for processes – according to declarations). These results proved that innovative SMEs in Podkarpackie Voivodship were clearly local in their perspective of everyday functioning and competing and that the innovations were forced by changing of that local environment – trying to catch up with

the pace rather than setting the pace itself. What was more, the less cooperation with R&D institutional system declared, the more local was innovation inspiration – in both cases (products/services: p-value .040: Kendall's tau-b = -.140 and processes: p-value .013: Kendall's tau-b = -.212).

7. CONCLUSIONS

On the basis of conducted analysis, it could be assumed that socio-economic growth of the regions, and Podkarpackie Voivodship is highly subjected to the factors connected to innovations and the level of innovativeness. Simultaneously, the development strategy in the SME's is gradually directed towards strengthening the regional innovativeness. The innovation strategies in SMEs are quite differentiated. Generally, there are three theoretical types of innovation strategies: a. creation, b. interaction and c. reaction. In the first case innovation is natural and internal type of thinking about company's development. Interaction describes innovation as strategic resource of the company. The 'reaction' type is for these companies that treat innovation as external compulsion.

The type of innovation strategy is determined by quantity and quality of innovations implemented: numerous and original innovations indicate the strategy we call "creation" while the opposite results in quantity and quality are more likely typical for "reaction" type. Of course, factors such as own R&D or at least cooperation with external R&D institutions as well as the use of public support also indicate more systematic approach towards innovation.

The research results showed that the more international range of enterprise's activities, the bigger scale of investment and the bigger enterprise itself, the more activities within innovation were implemented in 2004-2011 period. Originality of product/service innovation depended on the engagement in R&D and the range/scale of activities: enterprises that did have their own R&D section or cooperated with external R&D institutions and operated on wider level than local or regional, more often introduced original product/service innovation. But such enterprises were very few. Most of so called innovative enterprises represented rather "reaction" strategy – trying to catch up with the pace rather than setting the pace itself.

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STRATEGIE INNOWACYJNOŚCI PRZEDSIĘBIORSTW SEKTORA MSP W WOJEWÓDZTWIE PODKARPACKIM

Celem pracy jest prezentacja strategii rozwoju firm poprzez innowacje sektora MSP w województwie podkarpackim w Polsce. Analizując ten przypadek, możemy podnieść następujące dwa pytania: (1) Jakie są rodzaje, struktura i jakość strategii innowacji MŚP na Podkarpaciu?; (2) Jakie są kluczowe czynniki i dynamika prowadzenia i ograniczenia aktywności innowacyjnej, a także do wzrostu tej strategii innowacji?

Na przykładzie kilkuset przedsiębiorstw pokazano określone sposoby podejścia do innowacyjności. Dzięki czemu przy uwzględnieniu specyfiki szerszego kontekstu, tj. warunków społeczno-ekonomicznych województwa podkarpackiego, możliwe jest lepsze zrozumienie czynników wpływających na jakość innowacyjności i potencjalnych barier dalszego stosowania strategii nastawionej na wdrażanie innowacji w przedsiębiorstwach.

Ogólnie rzecz biorąc, istnieją trzy teoretyczne typy strategii innowacji: tworzenie, b. interakcja i c. reakcja. W pierwszym przypadku innowacja jest naturalna i wewnętrzny typ myślenia o rozwoju firmy. Interakcję opisuje innowacja jako strategiczny zasób przedsiębiorstwa. Typ "reakcja" jest dla tych firm, które traktują innowacje jako zewnętrzny przymus. Typ strategii innowacji zależy od ilości i jakości realizowanej innowacji: liczne i oryginalne innowacje wskazują na strategię nazwaną "tworzenie", podczas gdy przeciwstawne wyniki co do ilości i jakości są bardziej prawdopodobne i typowe dla typu strategii "reakcja".

Podstawą dla analiz empirycznych są różne źródła: dokumenty historyczne, dane statystyczne oraz wywiady pogłębione z kluczowymi osobami w MŚP. Analiza prezentowana w artykule jest efektem badań CATI zrealizowanych wśród 419 spośród 800 podkarpackich firm objętych badaniem.

Słowa kluczowe: innowacje, strategie innowacji, MSP, przedsiębiorczość, woj. podkarpackie

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POSSIBILITIES AND LIMITATIONS OF THE ECO-INNOVATION IMPLEMENTATION IN SMALL ENTERPRISES

An analysis of the levels of innovation leads to the conclusion that, still, a big problem, especially for small businesses, is the cost of their implementation. This statement is reflected in the results of quantitative and qualitative research that was presented in the article. Poor financial situation of enterprises, especially small and medium-sized, fragmented financing projects in the field of environmental protection, unstable financial conditions, lack of marketing skills and the fear and reluctance to bear the risks associated with taking innovative projects are fundamental barriers to the introduction of eco-innovation. Among the institutional barriers the following are observed: substantive and systemic weaknesses in the effective use of aid funds, and insufficient knowledge about patents, copyright, etc. It should be emphasized that small companies, introducing new solutions, depend to a large extent on the attitude of the entrepreneur. It is the entrepreneur who bears the burden of creating ideas, stimulating the employees to be active and preparing the company to implement innovative solutions.

The analysis of the literature indicates that in order to overcome barriers to the implementation of eco-innovation, action should be taken primarily in terms of raising the awareness of the need for eco-innovation. Proper environmental management also requires new instruments and procedures to improve the introduction of the environmentally friendly solutions by entrepreneurs.

Keywords: innovation, small businesses, barriers, environmental management, pro-ecological actions.

1. INTRODUCTION

Economic development is closely related to the higher and higher influence of enterprises on the natural environment. The growing number of companies often interfering with environment requires the implementation of additional pro-ecological actions. Modern companies should be managed strategically, economically and innovatively. In

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order to make their products competitive on markets, they have to take care of their quality which, in turn, requires openness to changes.

Vast implementation of ecological solutions may help in the restriction of many key issues related to the environmental protection, such as detrimental climate changes, decreasing natural resources, environment pollution or the loss of biological diversity.

Therefore, the introduction and use of the environment protecting regulations is so important. Their scope in different countries is regulated by adequate acts of law.

Entrepreneurs may introduce additional actions diminishing their companies' negative influence on the environment. Such actions may be realised in the field of products' manufacture, applied processes and technologies, as well as, organisation. However, research studies emphasise the hindrances of their implementation and the lack of awareness among the entrepreneurs, especially those of small and medium-size companies, and of the extent to which their company interferes with the environment. Therefore, quite often, environmental issues in companies are marginalised.

Taking the above into consideration, it seems obvious that the implementation of the environment protection solutions is indispensable.

In small and medium-size Polish companies, low level of the innovations' implementation is observed, which is a worrying phenomenon, as their activities are of priority in the local development planning. It should be emphasized that the Polish small and medium-size enterprises (SME) account for about 47–48% of the country's GDP, in this way concentrating the basic part of the production process[5].

The aim of the article is to signalise the importance of the eco-innovation implementation as indispensable for the realisation of the environment protection requirements and for the development of companies' competitiveness. The article identifies the benefits and obstacles of the eco-innovation implementation. It also analyses the factors influencing the restrictions of new solutions' implementation, in particular, in small Polish companies.

2. THE NOTION OF ECO-INNOVATION

The notion of eco-innovation first appeared in 1990s in relation to the growth of ecological problems, environmental dangers and appreciation of the importance of innovative solutions for the competitiveness and economic development. Research studies and implementation of eco-innovation being the combination of innovative solutions with the care of the natural environment became indispensable for the appropriate development of the contemporary economy. The term "eco-innovation" refers to various forms of innovation which create opportunities for companies and bring benefits to the environment, mainly thanks to the prevention or restriction of their negative impact on the environment.

The notion of ecological innovation is relatively new. In Poland, only in 2009, the Central Statistical Office of Poland (GUS), comprehensively and for the first time, defined the term of eco-innovation and, simultaneously, introduced the relevant research results.

And thus, quoting after GUS, "an innovation bringing benefits to the environment (eco-innovation) is a new or improved product (a manufacture or service), process, organisational or marketing method, which brings benefits to the environment as

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compared to the alternative solutions." One of the first definitions of eco-innovation was suggested by Fussler and James (1996), who described it as such innovations which bring benefits to both the entrepreneur and the consumer with the simultaneous limitation of the detrimental impact of economy on the environment[6]. In a broad sense, eco-innovation is perceived as any innovation which improves the effectiveness of the natural resources usage in economy and minimizes the negative influence of economic processes on the natural environment[7]. According to Reid and Miedziński (2008), a pro-ecological innovation is any innovation realized according to the current laws and regulations in force, which bring benefits to the natural environment – especially as the minimised use of natural resources per unit of manufactured product or minimising the flow of dangerous substances into the environment in the process of the product manufacture, during and after its usage[8]. Eco-innovations may be created in the fields of new, eco-friendly services, products and processes, as well as, modern management methods diminishing the negative impact of companies on the environment.

The definitions explicitly indicate that apart from the limitations of the detrimental effect of the economic processes on the environment, what is also crucial is the productive use of natural environment resources. Therefore, beside the ecological dimension, the economical factor must be emphasised, too, e.g. the cost reduction and the safety issues, like diminishing the dependence on the resources deliveries. The main function of the innovative solutions is alleviating the anthropogenic effects of the environmental changes, for instance, the effects of climatic changes and the necessity of restrictions.

3. PURPOSE AND BENEFITS OF ECO-INNOVATION IMPLEMENTATION

Eco-innovations are strictly related to the ways of the natural resources use, to the production technologies and management methods. Nowadays, eco-innovations should be an important element of ecological policy being crucial as the environment protection prerequisites and in order to build economic competitiveness. They favour the process of production the companies' transition from traditional to modern production methods and give them competitive advantage. The introduction of eco-innovation in economic practice means the implementation of new or improved product, service or process, as well as, the implementation of a new marketing or organisation method concerning the organisation of work or relations with the environment.

Numerous authors underline that the implementation of eco-innovations contributes to the[9]:

- creation of the companies' positive image,
- protection of the natural environment,
- competitiveness and economy acceleration,
- financial benefits for entrepreneurships,
- improvement of the products' and services' quality.

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An innovation usage should result in the cost reduction and increase of sales, or the improvement of services and meeting more and more restrictive legal requirements concerning environment protection. The activities limiting companies' negative impact on environment may be carried out in the field of products manufacturing, used processes and technologies and within the scope of the organisation.

The examples of the most crucial actions regarding products, processes and technologies comprise the following:

- designing technological processes and products as regards the energy and material consumption restrictions,
- implementation of technologies and products limiting water consumption,
- implementation of renewable energy sources,
- implementation of optimal waste management methods with the assumption of the pollutant emission restriction.

Among the examples of particular solutions contributing to gradual reduction of environmental burdens there are[10] :

- implementation of solar panels for water and room heating,
- improvement of material supply planning in order to reduce excess supply,
- elimination of the need of air conditioning through adequate room design,
- reduction of energy use by means of automatic solutions regulating the optimal energy use,
- organisation of various waste collection and packaging, and their delivery to recycling companies,
- optimisation of manufacture and processes design, limiting their energy and material consumption to necessary minimum,
- introduction of additional installations allowing for water cleaning (with the aim of its reuse).

Companies organisation may require[11] :

- management systems, based on ISO 14001 or EMAS norms, which concern voluntary participation in European system of pro-environmental actions (audits, balances, verifications, adherence to the law, governmental support of the actions, etc.),
- implementation of intelligent systems of measurement, which bring consumer benefits such as less frequent electrical energy prices rises.

Considering the benefits for the environment, it has to be emphasised that they have to be the main objective of innovations or the effect of the undertaken actions for the realisation of other plans. They may be generated in the process of product or service manufacture or at the time of the product or service use by the consumer.

The most important benefits at the level of product or service generation are:

- lowering the material consumption per product unit,
- decrease of companies' detrimental emissions,
- the use of less pollutant or less dangerous resources for the environment,
- reduction of soil, water and air pollution,

[10] Grudzewski M.W., Hajduk I.K., Technology Management. Advanced Technologies and their Commercialisation, Difin, Warszawa 2008.

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- reuse of wastes, water or materials.

Therefore, after the implementation of such innovations, an enterprise may obtain savings stemming from lower water and energy use, from the decrease of waste amounts produced, from the amelioration of the effective use of resources, lowering of bills for the economic use of the environment, etc.

On the other hand, the group of benefits of a product or service use include:

- lower amounts of energy used during the exploitation period,
- lower air, water and soil pollution or noise levels,
- improvement of re-usage possibilities for particular products after the usage period.

As a result, the eco-innovations may help as solutions within the field of environment protection in numerous key issues, such as[12],[13]:

- negative climate changes,
- diminishing of natural resources,
- loss of biological diversity,
- air pollution,
- waste and sewage management, recycling,
- high CO_2 levels.

Taking the above benefits into consideration, companies should be managed strategically, innovatively and with the market in mind. For their products to be competitive, the companies have to take care of the quality of products, and this, in turn, demands changes. Numerous authors emphasise that the necessary condition for innovations implementation must always be the entrepreneurs who are open to non-standard environmental solutions.[14],[15]

4. FACTORS INFLUENCING THE ECO-INNOVATION DEVELOPMENT IN ENTERPRISES

As mentioned above, eco-innovations in enterprises may be realised in various fields. They may be directed at new products, processes, technologies or new management methods.

A detailed eco-innovation typology, referring to the division of the European system of innovations analysis, is suggested by the authors of the report on the *MEI Project*. It includes the following[16] :

- **environmental technologies (*environmental technologies*)** – comprising technologies used for limitation and control of the emitted pollution and technologies restricting the use of resources and materials in production,

[12] Arimura, T.H., Hibiki A., Johnstone N., Anempirical analysis of environmental R&D: what encourages facilities be environmentally innovative? [in:] N. Johnstone (red.) "Environmental Policy and CorporateBehaviour", Edward Elgar, Cheltenham 2007.

[13] Mickwitz P., Hyvättinen H., KivimaaP., The role of policy instruments in the innovation and diffusion of environmentally friendlier technologies: popular claims versus case study experiences, "Journal of Cleaner Production" 2007, Vol.16.

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[15] Szpor A., ŚniegockiA., Ecoinnovations in Poland. Current situation, developmental barriers, possibilities of support, IBS Warszawa 2012.

[16] Kemp R., Volpi M., The diffusion of clean technologies: a review with suggestions for future diffusion analysis, "Journal of Cleaner Production" 2008, vol. 16 (1).

- **organisational innovations (*organisational innovations*)** – new environment management (e.g. according to ISO 14001 norm, EMAS), management based on the life cycle assessment concept (LCA) and cooperation between enterprises.
- **product and service innovations** – comprising changes at the stage of design and product or service generation,
- **"green" system innovations** – alternative production and consumption systems, friendlier to the environment than the ones used so far, e.g. implementation of renewable energy sources.

Of course, the field or fields for innovation creation depends on the enterprise specificity. Innovation implementation is a complex process dependent on many diverse factors, internal and external in relation to the enterprise. An innovation process is a repetitive cycle of many activities[17] :

- finding ideas,
- testing and implementation of a selected project,
- promotion and launching a product into the market,
- creation of new uses on the basis of the innovations used earlier.

Table 1. Stages of innovation implementation in a company

I	defining the problem
II	searching for possible solutions
III	designing, testing
IV	implementation
V	monitoring, correcting
VI	entering the market, selling

Source: Sztucki M. Stages of innovation implementation in a company (http://www.nauka-igospodarka.pl/index.php?option=com_content&view=article&id=156:etapy-procesu-innowacyjnego-w-przedsibiorstwie&catid=39:artykuly&Itemid=78& lan g= pl)

Also, what is important is the issue of knowledge and the transformation of particular ideas into innovative products or services. Two models of innovative process are the most frequently mentioned in the field: supply governed innovations and innovations stimulated by the market needs.

As far as the former group is concerned, the innovations are created in the areas of science, and then introduced to economy. Certainly, enterprises must be prepared organisationally and technically for the new systems implementation.

In the later group, new solutions are determined by the needs. In this case, as opposed to the above-mentioned, it is the market which decides about the creation of new innovations. The eco-innovation factor is the consumer's demand. Awareness and knowledge of the society, e.g. as regards clean technologies, determines the innovations implementation[18] .

[17] Gaczek W.M., Komorowski J.W., Human and social resources of the region as a factor of economy development based on knowledge, [in:] "Innovations in the Region Development", W.M. Gaczek (ed.), Research Papers of the University of Economics in Poznan, No. 57, The University of Economics in Poznan Publisher, Poznan 2005.

[18] Urbaniak W., Innovations in Waste Management, Materials of the 18th International Environmental Protection Congress ENVICON 13-14 October 2014 in Poznan, ABRYS LLC Publishing House, Poznan 2014

Apart from the above-mentioned factors, another group of important factors are external ones, related to public institutions and their development policy. Environment protection or tax policy may have great impact on companies' eco-innovativeness[19] .

In order for an enterprise to dynamically develop ecological activity, the following conditions have to be met:

- achievement of adequate level of knowledge and staff awareness about the necessities and possibilities of pro-ecological activities,
- making entrepreneurs aware of the benefits and necessity of pro-ecological activities,
- shaping an adequate organizational and technological infrastructure to support the process of transformation of ideas into eco-innovations,
- training for entrepreneurships on the possibilities of financial aids from funds for innovations related to environment protection,
- training, directing and motivating staff to engage more in the environment protection activities.

5. BARRIERS RESTRICTING DEVELOPMENT OF ECO-INNOVATIONS

At particular stages of development and implementation of eco-innovations, various difficulties may occur, e.g. organisational, economical, informational or motivational. Generally, eco-innovations meet the same barriers as any other innovations, however, often they are intensified by the markets' failures within the field of environment protection[20,21] (Figs. 1-2).

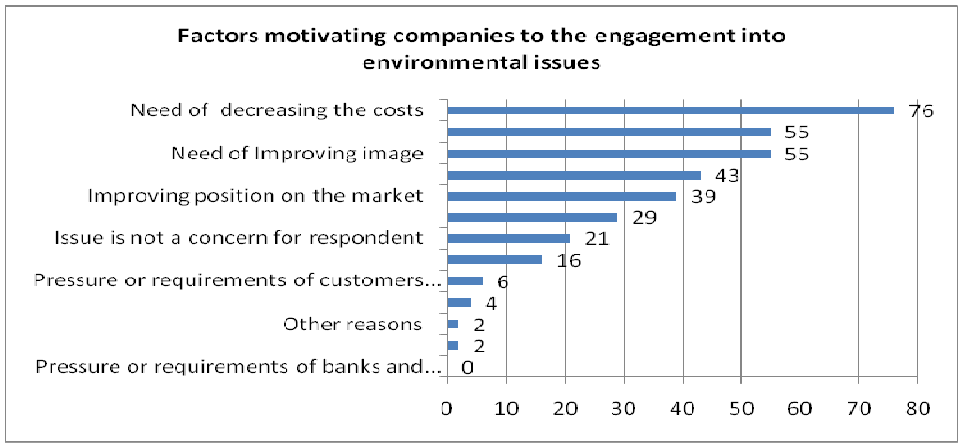

Fig 1. 2 Factors influencing the choice and hindering the implementation of eco-innovation in Poland,

Source: Foundation Partnership for the Environment (2010)

[19] Horbach J., Indicator systems for sustainable innovation, Physic, Heidelberg 2005

[20] Jaffe A.B., Newell R.G. Stavins R.N., A tale of two market failures: Technology and environmental policy, "Ecological Economics" 2005. 54 (2-3).

[21] Johnson K.N. Lybecker K.M., Innovating for an uncertain market: A literature view of the constraints on environmental innovation, Colorado College Working Paper 2009-06, Department of Economics and Business, Colorado College 2009

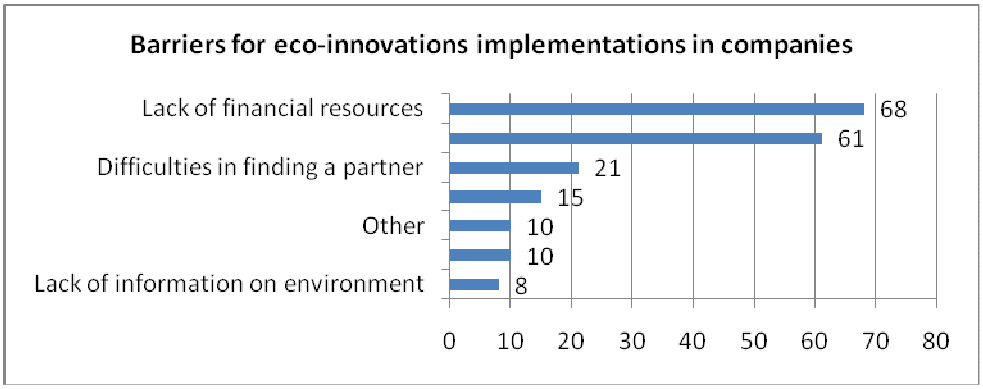

Fig 2. Barriers for eco-innovation implementations in companies

Source: Foundation Partnership for the Environment (2010)

The most important barriers hindering the eco-innovations implementation in companies are the following factors:

- economical – lack of company's own financial means, lack of external financing, high interest rates of loans for innovations, financial risk related to uncertainty of refund of invested funds, let alone obtaining economical benefits, etc.,
- legal – frequent changes of legislation causing market's uncertainty and discouraging from investment, unclear, changeable laws and regulations concerning environment protection, etc.,
- marketing – lack of market needs identification, uncertainty of sale of new, innovative products, etc.,
- technological – inadequate research and developmental base, lack of flow of information about possible technologies or products, limited accessibility of technologies, lack of sufficient support from the research centers,
- staffing – problems with management competences, lack of adequate skills for eco-innovation processes management, lack of prepared, appropriately educated and experienced staff, lack of conviction and
- discouragement for risk taking in the field of eco-innovation.

Moreover, a group of entrepreneurs are not aware of all the effects of a company's interference with the natural environment, and therefore, they do not notice the need of environment protection solutions being implemented. A research study conducted by the Partnership for the Environment Foundation in 2008 on the influence of SME on the environment, with the main aim of determining the degree of ecological awareness in the researched companies and their readiness to undertake steps for environment protection, showed that 68% of respondents considers the influence of their activities on the environment as minimal.

For comparison, the research results obtained by the same organisation in 2004 on the reasons for undertaking pro-ecological activities by SME in Poland showed that over ¾ of the researched companies considers that the influence of their activities on the environment is either small or very small. It proves that ecological awareness among entrepreneurs raises minimally. There is, however, a small group of entrepreneurs (7% of respondents) convinced that their activity does not influence the environment in any

way.[22],[23] Often, even, the management staff do not have adequate knowledge concerning the duties stemming from legal regulations concerning the environment protection. It results from the complicated, unclear and often changing regulations or lack of adequate education and staff trainings. It must be emphasised, however, that entrepreneurs not always notice the benefits of pro-ecological solutions, e.g. savings from the improvements of the natural resources use or from the implementation of pro-ecological products to markets. For many companies, eco-innovation projects are too uncertain and their implementation too expensive and time-consuming[24] .

The facts that innovations give the possibility of a company's functioning cost reduction, as well as more effective use of its supplies, were most often indicated by the respondents of the research studies carried out by T.B. Kalinowski. They were noticed by nearly 46% and 50% of the respondents respectively. Nevertheless, every third respondent indicated the limited financial sources as the basic barrier for innovation implementation.[25]

Moreover, research studies show that entrepreneurs running small businesses, often are not competent and do not have enough time for data collection and analysis necessary for the implementation of the innovative solutions.

All the above barriers are the most noticeable in the case of EMS which dispose of small funds and have even smaller possibilities of obtaining useful knowledge and experience in comparison to big companies.

6. SUMMARY

The analysis of the extent to which innovations are implemented allows to observe that still, the greatest issue faced especially by small and medium-sized Polish enterprises is the cost of the implementation.

It must be underlined that in Poland such enterprises are the greatest group and their development is of priority in the programme of local development. SME play an important role in every market economy, as they provide job vacancies and generate significant part of GDP. Unfortunately, a weak financial condition of SME, inconsistent financing system for the environment protection activities, unstable financial conditions, lack of marketing skills, concerns and unwillingness to take risk related to innovations – are the basic barriers against eco-innovations implementation. Institutional hindrances comprise content and systemic weaknesses in the effective use of financial aid or unsatisfactory knowledge of patents and copyrights, etc. Another reason of low innovativeness mentioned by entrepreneurs is, among others, the great number of legal regulations and their frequent changes, which discourage small enterprises from undertaking additional actions. It must be emphasised that in small enterprises, the

[22] Kornecki J., Michaliszyn B., Krupanek J., Ratman-Kłosińska I., Banasiak M., Pochroń A., Kondrat P., Jagusztyn–Krynicki T., Czyż P., Wolińska I., Pylak K., SME Potential in the Field of New Innovative Products Creation – Pro-ecological Solutions, Order finalised from the EU Funds of Regional Development, 2008.

[23] Łunarski J., Eco-innovativeness in the Production Processes Reorganisation, [in:] Woźniak L., Strojny J., Wojnicka E. (ed.) "Eco-innovations in the Practice of SME Functioning", Polish Agency for Enterprise, Warsaw.2010.

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implementation of new solutions depends, to a large extent, on the entrepreneur him- or herself. It is them who is responsible for the creativity and ideas generation, for staff stimulation for activity and for the company's preparation for innovations.

A great part of SME managers believes that eco-innovation implementation is risky and too expensive, which may be particularly significant both in the innovation creation and in the commercialisation processes. The most serious barrier for entrepreneurs is the uncertainty of the eco-innovation investment cost return and long time needed for it[26,27,28]. Some remedy for this lack of resources and risk reluctance attitude is offered by actions within EU funded programs that are oriented on direct support of SMEs[29,30].The literature data indicates that, besides the financial support, in order to overcome the eco-innovation implementation restrictions, actions should be undertaken in order to raise awareness of the necessity of eco-innovations. Substantial for this are the processes of learning and gaining knowledge on the necessity of natural environment protection.

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MOŻLIWOŚCI I OGRANICZENIA WPROWADZANIA EKOINNOWACJI W MAŁYCH PRZEDSIĘBIORSTWACH

Analiza poziomu wprowadzania innowacji pozwala stwierdzić, że nadal dużym problemem szczególnie dla małych przedsiębiorstw są koszty ich wprowadzenia. Stwierdzenie to znajduje odzwierciedlenie w wynikach badań jakościowych oraz ilościowych, które przedstawiono w artykule. Słaba kondycja finansowa przedsiębiorstw, szczególnie małych i średnich, niespójny system finansowania przedsięwzięć z zakresu ochrony środowiska, niestabilne warunki finansowe, brak umiejętności marketingowych oraz obawa i niechęć do ponoszenia ryzyka związanego z podejmowaniem przedsięwzięć innowacyjnych są podstawowymi barierami wprowadzania ekoinnowacji. Wśród barier instytucjonalnych wymieniane są słabości merytoryczne i systemowe w efektywnym wykorzystaniu pomocowych funduszy czy niedostateczna wiedza o patentach, prawach autorskich itp. Koleją z przyczyn niskiej innowacyjności wymienianych przez przedsiębiorców jest m.in. duża ilość przepisów prawnych częste ich zmiany co zniechęca małe przedsiębiorstwa do podejmowania dodatkowych działań. Należy podkreślić, że w

małych przedsiębiorstwach wprowadzanie nowych rozwiązań uzależnione jest w dużym stopniu od postawy samego przedsiębiorcy. To on przede wszystkim ponosi ciężar kreowania pomysłów, pobudzania pracowników do aktywności oraz przygotowywania przedsiębiorstwa do wdrożenia innowacyjnych rozwiązań.

Analiza danych literaturowych wskazuje, że w celu pokonania barier ograniczających wdrażanie ekoinnowacji powinny być podjęte działania przede wszystkim w zakresie zwiększenia świadomości potrzeby wprowadzenia ekoinnowacji. Fundamentalne znaczenie mają procesy uczenia się, zdobywania wiedzy na temat konieczności ochrony środowiska naturalnego. Prawidłowe zarządzanie środowiskowe wymaga również uruchamiania nowych instrumentów i udoskonalania procedur pozwalających na wprowadzanie przez przedsiębiorców przyjaznych środowisku rozwiązań.

Słowa kluczowe: innowacje, małe przedsiębiorstwa, bariery, zarządzanie środowiskowe, proekologiczne działania.

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COMPREHENSIVENESS OF A STRATEGY EXECUTION MEASUREMENT SYSTEM

The article describes the issue of strategy execution measurement taking into consideration two variables – the level of its comprehensiveness and the effectiveness of activities performed. The comprehensiveness was defined by means of three areas: the use of measurement tools, processes and regularity of the measurement work conducted. Whereas the effectiveness of strategy implementation was expressed through the level to which intended strategic objectives are achieved and income dynamics. The research sample included managers of 200 companies that have been operating for at least 5 years and are listed among the 500 largest Polish companies in the ranking of "Polityka" magazine and in the "Forbes Diamonds 2013" ranking. The study was conducted the PAPI (Paper and Pencil Interview) technique. The questions in the questionnaire were of nominal value (the respondents declared the existence of specific obstacles) and or ordinal variable nature (the respondents indicated the strength of their impact on a 5-point scale). In order to test the hypotheses, Pearson's correlation coefficient was calculated. The research has shown the existence of a positive correlation between these, indicating that the greatest role is played by appropriately designed measurement processes. Concurrently, it is important to take into consideration mutual interactions between the elements of the measurement system, in order to adopt a holistic perspective and design it using the comprehensive approach.

Keywords: strategy execution, measurement system, strategic goals, strategic management, control

1. INTRODUCTION

The literature review showed that there is a lack of a consistent definition of the measurement system, concerning also the strategy execution measurement system. Researchers present different statements regarding its components and measures used. This is, however, one of the key aspects of the strategy implementation process as it influences the opportunity for necessary correction and is a tool for diagnosing crucial elements determining the achievement of objectives. It is, thus a relevant and important research area, in particular due to the high percentage of implementation failure[2] and low efficiency of existing systems for measurement of results achieved, as well as the low degree of usefulness and applicability of information acquired[3]. The key problem is the choice of proper measures from the wide variety of options available, the establishment of the regularity of

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activities conducted and the design of the appropriate processes. This is connected with the character of the organisation and field in which it operates[4].

The objective of this work is an examination of the relationships between a comprehensive strategy execution measurement system and the results of activities conducted. Also the organization size was considered.

2. LITERATURE REVIEW AND HYPOTHESES

A general definition of a measurement system describes it as a balanced and dynamic system supporting the process by which decisions (including those of a strategic nature) are taken, through the collection, compilation and analysis of information[5]. However, it is essential to ensure simultaneously organisational adaptation – each system should consider such variables as strategy being executed, objectives, structures, culture and technology[6]. It can therefore be stated that this is an integral element of the strategic development process[7], and a lack of coherence between measurement system and strategy being executed may cause significant difficulties in achieving the results intended[8].

A broader notion is the measurement of results from activity conducted, which is composed of procedures utilised to graduate measures reflecting best the degree of strategy execution at the organisation[9]. This integrates two functions – communication among all participants concerning setting and measuring the objectives as well as providing the information on results achieved, the course of processes and profitability of products or business entities[10]. This is thus information necessary for assessment of the relevance and content of the strategy devised[11]. Its main role, however, though not the only, is the consideration of implementation progress[12] by integrating the financial, strategic and operational indicators[13]. As a result, it is a tool supporting the processes of planning, measurement and control of results achieved as well as ensuring the conformity of the work of particular departments with the strategy[14]. The outcome of a properly functioning strategy execution measurement system is the opportunity to define effectiveness as a measure of

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ability to achieve planned effects of activities undertaken and efficiency, as a measure of ability to execute set goals with certain limitations[15]. In the literature relating to the measurement and controlling system, a great deal of attention is devoted to ensuring the integration and coherence of these two variables with the strategy being executed[16]. As research results indicate, for many organisations the measurement of strategy implementation results is becoming almost an obsession, chiefly due to the need for proper allocation of available resources[17].

The control and measurement of implementation progress are also a part of the risk management process. These are constituents of its proper course, although it is essential to ensure the completeness, precision, relevance and integrity of the entire process by which decisions are taken, including those of a strategic nature[18]. This demands cohesion and transparency of both strategic goals and the communication of the course of activities being executed as well as current and scrupulous reporting of the level of execution of key indicators. Crucial, therefore, is the synchronisation of strategy, the risk management system and operational activities[19].

A system to measure the effectiveness of activities is useful in both the issue of the implementation of strategy and the methods for its modification[20]. These aspects are mutually bound and it is essential to ensure their integrity. This is proven by some research results indicating that as many as 80% of entities surveyed had introduced changes in their measurement system within the last three years as a result of the correction of the development concept[21].

In the literature there is a lack of an explicit recommendation regarding the choice of measures best reflecting the progress of strategy implementation. On the one hand, it is implied that focusing too much on some indicators (such as EPS) does not bring the intended effects due to an excessive concentration on financial results without ensuring coherence with other aspects of the strategy[22]. On the other hand, it is pointed out that measures of a financial nature (profit or income) best illustrate level of strategy execution[23]. Particular attention is drawn to the usefulness of ROI as a measure indicating the achievement of the intended benefits of strategic changes introduced[24]. Some researchers

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[15] K. Choong, *Understanding the features of performance measurement system: a literature review*, "Measuring Business Excellence" 17(4)/(2013), p. 114.

[16] P. Perego, F. Hartmann, *Aligning Performance Measurement Systems With Strategy: The Case of Environmental Strategy*, "Abacus – A Journal of Accounting Finance and Business Studies" 45(4)/(2009), p. 428 – 432.

[17] S. Brignall, J. Ballantine, *Strategic Enterprise Management Systems: new directions for research*, "Management Accounting Research" 15(2004), p. 225.

[18] F. Hoque, *Shaping Your Business Strategy*, "Baseline" September/(2008), p. 49.

[19] F. Hoque, *Turning Ideas Into Action*, "Baseline" April/(2008), p. 61.

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[21] M. Frigo, J. Litman, *Strategy, Business Execution, and Performance Measures*, "Strategic Finance" May/(2002), p. 6-8.

[22] M. Frigo, *Strategy or Execution?*, "Strategic Finance", March/(2003), p. 9.

[23] J. Morgan, *Strategy Execution. A Four-Step Process*, "American Management Association "MWorld" Winter/(2010-11), p.16.

[24] C. Hanley, *The Execution Challenge: Translating Strategy into Action*, "Bank Accounting & Finance" October-November/(2007), p. 19.

postulate, however, a greater use of non-financial measures as those more closely connected with the development concept and constituting the basis for a determination of financial goals[25]. By contrast, some research indicates that although companies use non-financial measures in operational activities[26], few of these are formally and directly linked with the strategy and the measurement of its effectiveness[27]. It seems, however, that better results are obtained by monitoring effects of activities conducted with the use of measures related to the nature of the strategy being executed, taking into consideration also the organisational structure and specifics of a given enterprise[28].

The measurement issue is important in particular in the case of small and medium-sized companies, for which there is a lack of comprehensive models and systems taking into consideration their specifics, which often results in fragmentary implementation of existing solutions. Moreover, modifications (also unintended) are made by the elimination of some elements, which then leads to the execution of systems that are incomplete and unadjusted to the needs characteristic of this group of businesses[29]. In particular small entities are more focused on operational and financial results[30]. This is why their approach to the measurement system is more informal and undetermined and not based on a previously devised schema, but has the nature rather of spontaneous and temporary solutions. It is not, therefore, an effect of a long-term plan and anticipation, which in consequence leads to a lack of coherence between the strategy and its measures[31]. This is particularly significant in the context of a low level of strategy formalisation, by which small organisations are most commonly characterised. A well-thought-out, coherent measurement system could, for this reason, support both a more detailed definition of development concept as well as separation of strategic and operational issues[32]. As some research results indicate, large enterprises conduct more regular measurements and do so more frequently[33]. On the other hand, results obtained are more difficult to interpret[34].

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[25] M. Frigo, *Nonfinancial Performance Measures and Strategy Execution*, "Strategic Finance" August/(2002), p. 6-8.

[26] J. Burns, R. Scapens, S. Turley, *The crunch for numbers*, "Accountancy" 119(1245)/(1997), p. 86.

[27] C. Gomes, M. Yasin, J. Lisboa, *A literature review of manufacturing performance measures and measurement in an organizational context: a framework and direction for future research*, "Journal of Manufacturing Technology Management" 15(6)/(2004), p. 522 - 524

[28] F. Fishman, *Strategy Execution for Enduring Performance*, "Baseline" April/(2009), p. 40.

[29] J. Tenhunen, H. Rantanen, J. Ukko, *SME-oriented implementation of a performance Measurement system*, Department of Industrial Engineering and Management, Lappeenranta University of Technology, Finland, 2001.

[30] H-H. Hvolby, A. Thorstenson, *Performance Measurement in Small and Medium-Sized Enterprises*, "3rd International Conference on Stimulating Manufacturing Excellence in SMEs (Proceedings)", Coventry University, 2000, p. 324-332.

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[32] M. Hudson, M. Bourne, J. Lean, P. Smart, *Only Just Managing – No Time to Measure*, "Performance Measurement – Past, Present and Future (Conference Proceedings)", Cranfield University, Cranfield, 2000, p. 243-250.

[33] W. Van Dooren, *What Makes Organisations Measure? Hypotheses on the Causes and Conditions for Performance Measurement*, "Financial Accountability & AMP Management" July/(2005), p. 362 – 383.

[34] A. Jääskeläinen, *Productivity Measurement and Management in Large Public Service Organizations*, Publication 927, Tampere University of Technology, Tampere, 2010.

The results of presented research indicate that there are recommendations regarding the characteristics which should represent an effective and comprehensive measurement system. Nonetheless, there is a lack of guidance as to its components. This deficit is of particular significance in the case of strategy implementation and measurement of the effectiveness of this process. It is accepted in this study that strategy implementation measurement should integrate the strategy, the tools for its implementation and measurement frequency[35] [Kaplan, Norton, 2008]. A comprehensive strategy execution measurement system should therefore take into consideration three areas:

- the use of measurement tools – including typical strategy implementation tools (Balanced Scorecard, budgeting and planning, projects and strategic programs, strategic controlling) (C1);
- the processes – assignment to strategic objectives measures and indicators of their execution, design of an incentive system in which employee remuneration level is dependent on the degree to which strategic objectives are achieved and creation of a system monitoring the environment of the firm (C2);
- regularity of the measurement work conducted (C3).

Effectiveness of strategy execution was defined by:

- the level to which intended strategic objectives are achieved – as an indicator showing the efficacy of activities conducted (E1);
- income dynamics – as an indicator showing effects of activities conducted (E2);
- in addition, the organisation size was taken into consideration.

The following research hypothesis was formulated:

- *H:* There *is a positive interdependency between a comprehensive system for the measurement of strategy execution and the effectiveness of this process.*
- additional hypotheses were also devised. The first was used to verify whether aspect of the processes in a strategy execution measurement system has an influence on results achieved; *H1: Proper design of processes constituting the measurement system affects growth in effectiveness of strategy execution.*
- the second, however, was intended to verify the influence of measurement system comprehensiveness on one of the aspects of effectiveness; *H2: Design of a comprehensive strategy execution measurement system affects growth in the level of execution of strategic goals assumed.*

3. SAMPLE AND DATA COLLECTION, RESEARCH TOOLS

The group of respondents included managers of 200 companies that have been operating for at least five years and are listed among the 500 largest polish companies in the ranking of "Polityka" magazine (101 entities) and in the "Forbes Diamonds 2013" ranking (99 companies). The first ranking takes account of sales revenues, the total revenues of the companies, the gross and net profit, as well as the number of staff. The "Diamonds" list included the companies showing the fastest increase in value. The study was conducted the PAPI (Paper and Pencil Interview) technique. In order to ensure the highest possible representativeness, the sample was selected using the stratified random sampling method. The questions in the questionnaire were of nominal value (the respondents declared the

[35] R. Kaplan R., D. Norton, *The Execution Premium: Linking Strategy to Operations for Competitive Advantage*, "Harvard Business Press", Boston, 2008, p. 15.

existence of specific obstacles) and or ordinal variable nature (the respondents indicated the strength of their impact on a 5-point scale). In order to test the hypotheses, Pearson's correlation coefficient was calculated.

4. RESEARCH RESULTS AND DISCUSSION

The first stage of the research was calculation of average responses for those areas presented above describing the degree of measurement system comprehensiveness and the degree of effectiveness of strategies executed for each entity surveyed.

Subsequently Pearson's correlation coefficient (level) for the entire examined sample was calculated. The following table 1. indicates the results of the research.

Table 1. Research results. Correlation between the comprehensiveness of the measurement system and the effectiveness of strategy execution

	Result
Pearson correlation	,469
Dual significance	,001
N	196

Source: Own research.

As the results obtained show, there is an average positive correlation between the comprehensiveness of the measurement of strategy execution and the effectiveness of this process. This means that ensuring the comprehensive functioning of a strategy implementation measurement system, and thus taking into consideration both tools supporting strategy implementation and proper design of implementation processes, as well as determination of the regularity of measurement work, increases the chance of an effective development concept realisation. Although a measurement system is no guarantee that the results desired will be achieved, an organisation which considers in its activities the need for multidimensional design and a complex strategy execution measurement system has a greater chance of the accomplishment of the goals intended, thereby achieving a higher effectiveness of activities performed, expressed in an increase in income dynamics. The main hypothesis can therefore be accepted. In order to accomplish the goal of this work, further research concerned the existence of the correlation described at organisations of different sizes, defined by number of employees. The results are presented table 2.

Table 2. Correlation between the comprehensiveness of the measurement system and the effectiveness of strategy execution at organisations of different sizes

	0-49	**50-249**	**250<**
Pearson correlation	,172	,398	,413
Dual significance	,009	,004	,012
N	68	63	65

Source: Own research.

As the results obtained present, the level of correlation is lowest in the case of small organisations. This certainly results from a low level of strategy formalization and consequently the least formal system for measurement of its execution and a low regularity of measurement work. The level of correlation for medium-sized and large enterprises is similar and may be defined as medium. No significant differences were observed in the case of these two groups, which differs slightly from the research results mentioned earli-

er, most of which indicate a higher formality and regularity of measurement work performed at large organisations. In the research discussed, however, no significant differences in level of correlation were indicated, which may mean that executives at both medium-sized and large organisations possess a strategic awareness concerning the need to ensure comprehensiveness in measurement systems designed. Further analysis of results indicated some differences in interdependencies between particular aspects of variables investigated (table 3).

Table 3. Correlations between the elements of measurement system comprehensiveness and the effectiveness of strategy execution

	C1	**C2**	**C3**
Pearson correlation	,292	,456	,411
Dual significance	,015	,002	,018
N	196	196	196

Source: Own research.

An analysis of the results indicates that the highest level of correlation (0.456) was achieved for the processes constituting the measurement system. This is, therefore, the element affecting most the effectiveness of the strategy executed. The hypothesis H1 may thus be accepted. The lowest level of correlation was average, obtained for the tools used to measure strategy implementation progress. Accordingly, it may be concluded that for the appropriateness and effectiveness of the measurement system it is of key importance to design, in a well-thought-out manner, processes which will provide useful feedback and allow for necessary corrections of observed deviations from the desired level of realisation of particular strategy aspects. Implementation tools play therefore a supporting function and influence the effectiveness of development concept implementation to a lesser degree. It is also important to mention the medium level of correlation for measurement system regularity, which, as research indicates, should be regarded as a significant factor influencing the achievement of the strategic goals intended. Periodicity and regularity of measurement work is a guarantee of the proper functioning of the entire system. Further interdependencies between two elements of strategy execution effectiveness and the measurement system were investigated. The results are presented in the table 4.

Table 4. Correlation between the elements of the effectiveness of strategy execution and measurement system comprehensiveness.

	E1	**E2**
Pearson correlation	,583	,201
Dual significance	0,022	0,11
N	196	196

Source: Own research.

A considerable difference between the results obtained is visible. The level of assumed strategic goal achievement, as an indicator showing the effectiveness of activities performed, demonstrates a strong, positive correlation with measurement system comprehensiveness. Considering in the measurement system elements belonging to all three specified aspects and their interrelations provides a greater guarantee of assumed goal achievement, and, importantly, their realisation may be regarded as effective. Substantially lower correlation was observed in the case of the second element investigated (E2), which is income

dynamics. Although this is positive, the result obtained (0.201) should be considered low. Income dynamics as an indicator showing the effects of activities performed is considerably less correlated with a comprehensive measurement system and it is therefore difficult to state unequivocally that its design such affects growth in income achieved. This result is unsurprising as income dynamics are dependent on many variables, including those of an external nature. The results presented allow for acceptance of the H2 hypothesis.

5. CONCLUSION

The issue of strategy execution measurement is a complex and multidimensional problem. On the one hand, it is necessary to consider those measures best adjusted to the specifics of the given organisation which most accurately reflect the level of achievement of the goals assumed. On the other hand, however, it seems essential to take into consideration also other elements which form a measurement system allowing for the effectiveness of activities undertaken to be raised. The research results presented confirm the existence of a relationship between the comprehensiveness of this system and the effectiveness of strategy execution. It has been shown that the greatest role in this regard is played by appropriately designed processes. It should be mentioned also that further analysis of the results obtained proved that individual constituents of the strategy implementation measurement system have a lesser influence on the effectiveness of this process than the combination of them. For this reason it seems imperative to take a holistic perspective and design this system considering the need to achieve the highest possible level of comprehensiveness. It is necessary therefore to ensure the correct functioning of the processes, the use of proper implementation tools and the provision of a defined order and regularity of works performed. Simultaneous collaboration and mutual interaction of the elements mentioned above allow an increase in the effectiveness of strategy execution. It is also worth mentioning that results obtained allow it to be claimed that the comprehensiveness of a measurement system shows a significantly higher correlation with level of strategic goal achievement than with income dynamics.

The main constraint of the research conducted is the declarative nature of some variables, particularly the level of assumed strategic goal achievement. However, it has been recognised as reasonable to use this aspect as a measure connected with the nature of the strategy executed. This is why financial indicators have intentionally not been taken into consideration, since according to the suggestions of some researchers it has been assumed that their analysis does not allow for such precise monitoring of the effects of activities undertaken as the level of strategic goal achievement better reflects the connection with the development concept and the specifics of the given organisation.

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KOMPLEKSOWOŚĆ SYSTEMU POMIARU REALIZACJI STRATEGII

Artykuł opisuje zagadnienie pomiaru realizacji strategii z uwzględnieniem dwóch zmiennych – poziomu jego kompleksowości oraz efektywności prowadzonych działań. Kompleksowość została zdefiniowana w ramach trzech obszarów: wykorzystania narzędzi służących pomiarowi stopnia realizacji strategii, przebieg procesów oraz pomiar postępów wdrożeniowych. Natomiast efektywność implementacji strategii została wyrażona poprzez poziom realizacji celów strategicznych oraz dynamikę przychodów. Próba badawcza obejmowała 200 przedsiębiorstw działających od minimum 5 lat i wyszczególnionych w rankingu „Polityki" oraz „Diamentów Forbesa 2013". Wykorzystana została technika PAPI (Paper and Pencil Interview), a pytania miały charakter nominalny (deklarowane było występowanie określonych barier implementacyjnych) oraz zmiennych porządkowych (określano ich oddziaływanie na 5 punktowej skali). W celu weryfikacji postawionych hipotez, obliczona została korelacja Pearsona. Przeprowadzone badania wykazały istnienie dodatniej korelacji pomiędzy nimi, przy czym wskazano, iż największą rolę odgrywają odpowiednio zaprojektowane procesy pomiaru. Jednocześnie istotne jest uwzględnienie wzajemnych interakcji pomiędzy składowymi systemu pomiaru, a więc przyjęcie perspektywy holistycznej i projektowanie go w oparciu o zasadę kompleksowości. Równoległe współdziałanie i wzajemna interakcja wymienionych elementów pozwalają na wzrost efektywności realizacji strategii. Przekłada się to bowiem na osiągane wyniki, zarówno w zakresie dynamiki przychodów, jak i stopnia realizacji celów strategicznych. Warto także wspomnieć, że otrzymane wyniki pozwalają stwierdzić, iż kompleksowość systemu pomiaru wykazuje znacznie większą zależność z poziomem osiągnięcia celów strategicznych, aniżeli z dynamiką przychodów.

Słowa kluczowe: implementacja strategii, system pomiaru, cele strategiczne, zarządzanie strategiczne, kontrola.

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IDENTIFYING THE POTENTIAL OF GREATER POLAND TO DEVELOP COOPERATION NETWORKS

Foresight, a tool for creating common future (visions), relies on monitoring significant developments and formulating strategic objectives for enterprises, sectors or regions. The article presents a comparative analysis of the findings of identity studies carried out in 2010 and 2016 in the Region of Greater Poland (also referred to by its Polish name of Wielkopolska) as part of a foresight project that relied on business networks to foster innovation. Region's identity translates into its potential and propensity to change, as it is interpreted as the synergy of key skills and common values, The discussion below identifies trends in building the region's identity and shows whether such an identity will support the development of cooperation networks.

The above research has shown an identity as being a factor in the assessment of coexisting formal structures and relationship networks, which constitutes a significant potential of a region. While noting the incorporation of regional identity into foresight research, the authors emphasize the need for regular studies. Knowledge on regional identity helps formulate measures that support a sense of community and reveal the opportunities which the decision-makers involved in building Innovative Wielkopolska can use to make a difference. The study findings show that significance of identity components changes along with transformations in public expectations.

Keywords: foresight, region's identity, shaping of networks, potential, Wielkopolska (region in Poland)

1. INTRODUCTION

A study carried out at the Poznań University of Technology between 2009 and 2011 within the framework of the project "Foresight – Wielkopolska Business Networks – knowledge transformation scenarios in support of innovative economy" has suggested that Wielkopolska's developmental transition should begin with defining the Region's strategic identity (i.e., specifically, the shared values and key competencies that define it), systemic measures aimed at promoting entrepreneurship and network initiatives, preparing and coordinating programs to foster research and development cooperation, helping disseminate knowledge via business support institutions and among businesses and stimulating the development of social capital[3]. By identifying such potential, that is

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[3] M.K. Wyrwicka, *Wstęp* [in:] M.K.Wyrwicka, *Foresight „Sieci gospodarcze Wielopolski" scenariusze transformacji wiedzy wspierające innowacyjną gospodarkę. Raport końcowy.*, Wydawnictwo Politechniki Poznańskiej, Poznań, 2011, pp. 5-12.

locally available capacities and tangible as well as intangible resources, a launching pad will be formed for realistic development scenarios.

Defined as learning organizations, whose knowledge is transferred among individual actors, regions aspire, as their key purpose, to seek to disseminate their knowledge and have it used for experimentation (in the pursuit of innovation). Knowledge is a resource that grows along with increases in the number of its applications. This is because practical applications of knowledge help better understand the underlying causes and principles. As knowledge is disseminated (diffused) via networks, new skills and competencies are acquired and critical issues are identified. As a consequence, knowledge is built and disseminated across a shared value network through human interactions which allow information to be transferred across organization structures[4]. One's identification with a specific location or institution and one's dedication to pursue structural improvements and modifications can well be identified by reference to identity. The article relies on a method developed by K. Ragin-Skorecka[5] and applied to assess the identity of the Wielkopolska Region in 2010 and 2016 studies.

The resulting comparative material outlines the transitions witnessed in the Wielkopolska Region helping one to reassess the existing potential for implementing the concept of Innovative Wielkopolska which the Region has pursued for a number of years.

2. METHODOLOGY FOR INVESTIGATING THE POTENTIAL OF THE WIELKOPOLSKA REGION

2.1. The use of foresight to prepare for the future

The term "foresight" was coined by J.F. Coates, who defined it as "a process by which one comes to a fuller understanding of the forces shaping the long-term future which should be taken into account in policy formulation, planning and decision-making"[6]. K. Safin sees foresight as a process that enables one to "preempt various possible variants of the future and prepare responses to the most likely events"[7]. Foresight is a process that encompasses recurring periods of reflection followed by the construction of networks which incorporate diverse social groups. It relies on social consultation and debates among various stakeholders. In its multiple scenarios, foresight research follows the stages of:

1) analysis (quantitative as well as qualitative),
2) model development (relationship networks, process modeling),
3) verification by way of social consultations,
4) development of deployment precepts (scenarios).

The procedure leads to building a shared multi-faceted outlook while ensuring widespread identification with the adopted strategy. Foresight is employed to explore

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long-term potentials resulting from the impact of science and innovation on the general public. The perceptions of the future, commonly represented in foresight surveys as individual scenarios, rely on diagnoses of the status quo, assessments of the development potential, the identification of trends and attempts to identify mechanisms triggered by the decisions of various interest groups. An actively created vision of the future combines the items monitored, trends and impacts on the future seen vis-à-vis the development trends desired by decision-makers. Therefore, foresight research begins with attempts to identify and analyze the status quo in the recognition that the future results from past and present actions.

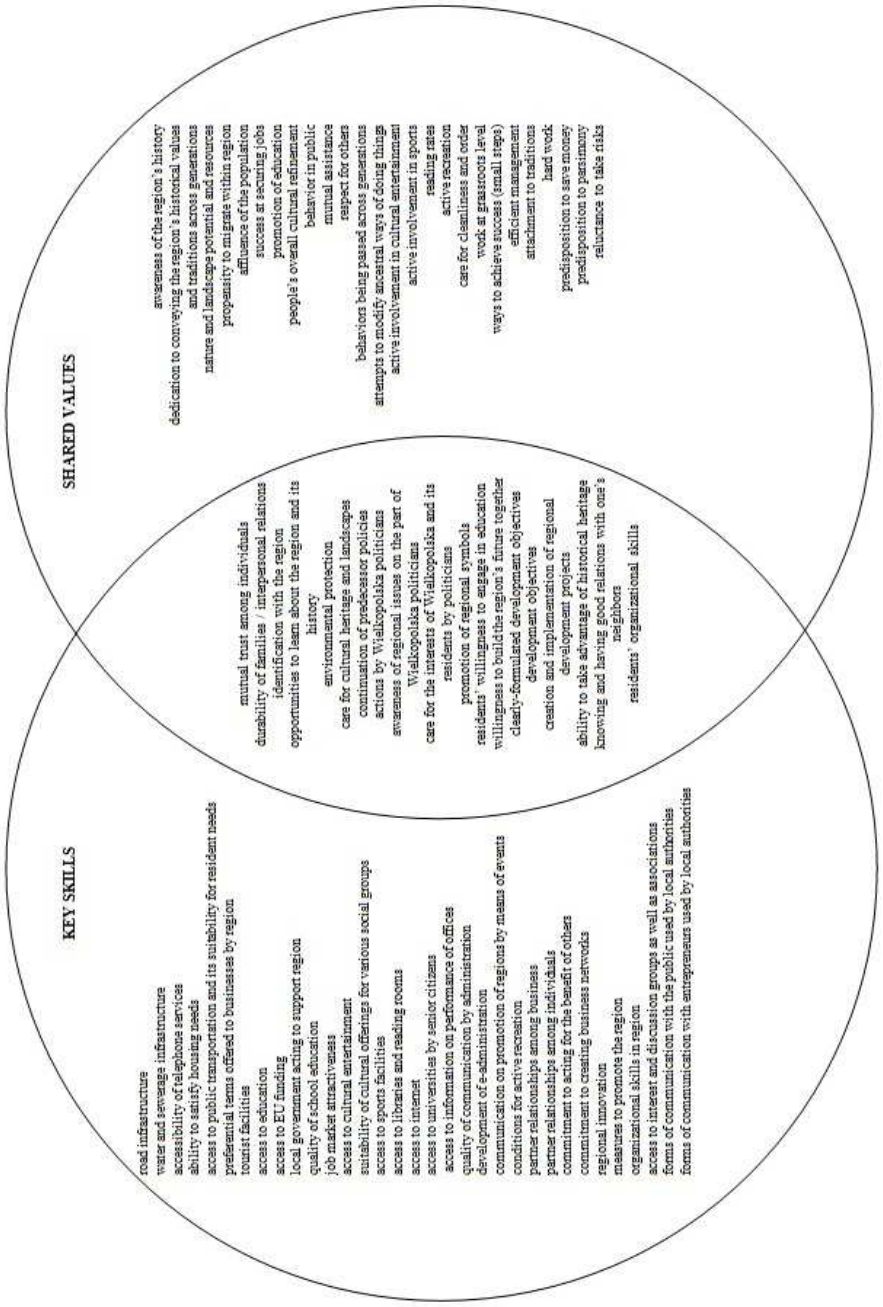
With respect to the Region of Greater Poland, the foresight research has focused on networking, the diffusion of innovative ideas and institutions which support businesses and regional identity, all of which helped assess the current potential.

2.2. Procedure for assessing growth opportunities

Regional development relies on the accumulated resources to create growth poles and differentiate structures by polarizing the economy. Such growth poles emerge, evolve and fade away through the spread of innovation and the impact of development incentives. Discrepancies in regional development arise over time through the operation of cause-and-effect mechanisms within the existing structures. Such feedback mechanisms generate positive or negative reinforcement (respectively triggering either growth or recessions). By recognizing significant resources and relationships as well as measures and incentives that stimulate or impede growth or recessions, decision-makers and local authorities formulate their regional policies and intervene in the process. Therefore, relevant research and assessments are focused on networks. In a network, borderlines between individual network components become blurred. This is because less attention is being paid to formal limitations while priority is given to relationships across and within the individual components. A network's cohesion is achieved by ensuring that its components are sufficiently diverse so as to secure and guide the initiatives of individual entities. A key to assessing the development potential of a given region is to identify the characteristics of its network. Note that the view that networks are multifaceted, commonplace and beyond one's grasp preempt debates on whether network mechanisms operate properly. Networks, which have become ubiquitous, are often seen as backgrounds to formal organizations. Researchers commonly forego attempts to identify the differences between structures and networks. As a consequence, they resort to the term "network organization" which implies unpredictability. This approach is justified with the growing complexity, environmental pressures, orientation issues, uncertainty and data overload.

If organizations and networks are recognized as suited to face different challenges, one will naturally expect that different research methods and approaches to their description be used for their assessment. Nevertheless, operating realities and pragmatics make it necessary to assess circumstances in which networks and structures coexist. For that reason, the authors assume that a key to synthetically assessing the status quo is to define the identity of an organization.

Fig. 1. Characteristics of regional identity



Source: (Ragin-Skorecka, 2010a, p. 20)

2.3. Regional identity

Scholars vary in the definitions of organizational identity they adopt depending on their research perspectives[8]. Zarębska[9] defines organizational identity as an ethos that expresses the aims and values of significance for an organization and that presents the rationale for individuality that helps distinguish oneself in a competitive market". Identity helps present organizations to target groups – they are a planned self-presentation which relies on a specified strategy. Pacholski and Wyrwicka[10] compare organizational identity to "a genetic code which determines the predispositions and traits manifested by a given organism, which may either be improved during its lifetime or left unexpressed and unutilized". To ensure terminological consistency, organizational identity has been defined as "a system of mutually complementary features of an organization which distinguish it individually, ensure its stability and consistency and contribute to its internal and external reputation". Identity has been assumed to manifest itself through an organization's reputation, reputation being a notion broader than image and affording deeper insights into the complexities of identity[11].

Regions (voivodships) are the highest-level units of administrative subdivision in Poland as well as the highest echelon of local governments[12]. Being highly autonomous entities, regions resemble organizations. Having recognized this, one may proceed to a discussion on regional identity and a region's stakeholders.

The identity of a Voivodship is a system of the region's complementary features which distinguish it from others and which contribute to its stability, cohesion as well as internal and external reputation. The features that make up a region's identity are defined with emphasis on the good intentions that underpin them and how they are evaluated.

The variables that make up a region's identity can be divided into the three categories (Fig. 1) of shared values, key skills and the overlap between the two. Key skills provide the region with an advantage helping it stand out from among other regions. These features are susceptible to change – they can be fashioned to ensure the achievement of the specific objectives of a region and its residents. Shared values are a blend of cultural transformations, stereotypes and local traditions. They are acquired and evade control as many of them do not become absorbed into the collective awareness of the region's local community. The overlap between the two is an area of a region's own values which are

[8] S. Albert, D.A. Whetten, *Organizational identity: Organizational identity*, New York. Oxford University Press, 2004; J.M.T. Balmer, *Corporate identity: the power and paradox*, Design Management Journal, Winter, 1995; J. Dutton, J. Dukerich, *Keeping an eye on the mirror: the role of image and identity in organizational adaptation*, Academy of Management Journal, vol. 34, 1991; Hong-Wei He, J.M.T. Balmer, *Identity studies: multiple perspectives and implications for corporate-level marketing*, European Journal of Marketing, vol. 41, no. 7/8, 1997; Strategor, *Zarządzanie firmą*, Polskie Wydawnictwo Ekonomiczne, Warszawa, 1996; C.B.M. van Riel, J.M.T. Balmer, *Corporate identity: the concept, its measurement and management*, European Journal of Management, vol. 31 no. 5, 1997.

[9] A. Zarębska, *Identyfikacja tożsamości organizacyjnej w zarządzaniu przedsiębiorstwem*, Warszawa, Wydawnictwo Difin, 2009.

[10] L.M. Pacholski, M.K. Wyrwicka, *Tożsamość przedsiębiorstwa*, Zeszyty Naukowe Politechniki Poznańskiej, no. 49, Poznań, 2007.

[11] K. Ragin-Skorecka, *Corporate identity*, Wydawnictwo Politechniki Poznańskiej, Seria Monografie Poznań, 2010.

[12] A. Adamus-Matuszyńska, *Wizerunek jak opoka*, Marketing w Praktyce, no. 10, 2003.

also key skills and which, under proper conditions (or circumstances) become controllable[13].

3. SELECTED RESEARCH OUTCOMES

3.1. Study outline

The study's objective was to assess the identity of the region and identify its key properties that translate into the regional identity. The findings additionally helped identify the region's features and the ways changes were attempted to improve the region's perception.

The study relied on a survey questionnaire comprised of 78 questions referring to the tree of the region's identity features. Responses to these closed-ended questions could be selected on a seven-point scale ranging from the lowest score (weight) of 1 to the highest score of 7. The identity scores were used to evaluate two aspects. One was the respondent's assessment of the present state of a given regional identity component. The other indicated the significance of the component in developing the region's identity. The respondents' input helped define the region's identity broken down by respondent groups as well as identify the key elements of the region's identity and rank them by importance.

The first such surveys were conducted in 2010 as part of the research project "Foresight – Wielkopolska Business Networks – knowledge transformation scenarios in support of an innovative economy". Carried out in Wielkopolska, the survey involved a representative sample of five respondent groups. The responses were contributed by 800 residents, 200 local government officials, 50 representatives of the news media, 50 business managers, and 100 research scholars. The sample and its weighing was designed to ensure representativeness across the individual subregions of Wielkopolska (the subregions of Poznań, Kalisz, Leszno, Piła and Konin).

The survey was repeated in 2016, this time covering 50 respondents as it was not possible to include a larger population. Due to the small size of the sample, the interpretation of the outcomes will not be broken down by subregions but rather generalized over the entire region of Wielkopolska.

The region's identity was assessed and the key identity components that require change to improve its perception identified by means of an own tool relying on fuzzy logic and factor analysis[14].

3.2. The identity of Wielkopolska

The majority of the region's identity components are soft factors which escape assessment by hard criteria. As the evaluations were expressed in a natural language, it was necessary to employ the tool of Fuzzy Identity Indicator. The interpretation focused on a triangular fuzzy number which is diffused and consequently translated into an understand-

[13] K. Ragin-Skorecka, *Diagnoza tożsamości Wielkopolski*, [in:] M.K. Wyrwicka, *Tendencje rozwojowe Wielkopolski w kontekście transformacji wiedzy w sieciach gospodarczych*, Wydawnictwo Politechniki Poznańskiej, Poznań, 2010, pp. 15-58.

[14] K. Ragin-Skorecka, *Management of Internal Corporate Identity*, Wydawnictwo Politechniki Poznańskiej, Poznań, 2010.

able description of a region's identity. The tool and its underlying algorithm are presented in[15].

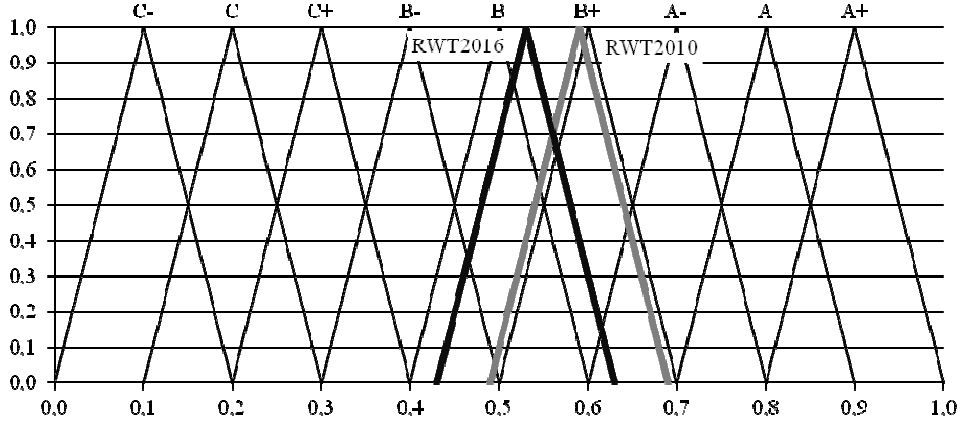


Fig. 2. Fuzzy Identity Indicators for Wielkopolska in 2010 and 2016

Source: Own research

An analysis of the outcomes received from the entire study population showed that the identity of Wielkopolska deteriorated in 2016 approximating model level B. This means that the region's identity is made up of a neutral reputation and a neutral image. In 2010, the region's identity was close to level B+ (Fig. 2). The outcome and its comparison with the previous findings suggest the upsetting conclusion that Wielkopolska's identity is in decline.

3.3. Key identity variables

The Fuzzy Identity Indicator can be used to identify areas that are key to developing a strong regional identity. Changes in these variables should be recognized as a top priority. Fig. 3 shows the regional identity components whose Fuzzy Identity Indicators were the highest in 2016 and 2010. Respondents in 2016 pointed to 7 and those in 2010 to 8 variables that are key to the entire population whose Fuzzy Identity Indicators ranked high.

A comparison of the 2016 and 2010 results shows improvements in the regional identity components for the components of continuation of predecessor policies, propensity to migrate within the region, attempts to modify ancestral ways of doing things, predisposition to parsimony and reluctance to take risk. Such findings are interesting as the characteristics fall into the area of own values which can hardly be controlled at the level of the organization, i.e. e.g. the level of regional authorities or entities operating in the region.

No improvements were seen in the areas of access to universities by senior citizens, access to interest and discussion groups and partner relationships among businesses. All of the above are controllable variables set out in the category of key competencies. Particular attention at the regional level should be paid to the variable of partner relationships among businesses as a critical success factor in Wielkopolska.

[15] K. Ragin-Skorecka, *Diagnoza tożsamości Wielkopolski*, [in:] M.K. Wyrwicka, *Tendencje rozwojowe Wielkopolski w kontekście transformacji wiedzy w sieciach gospodarczych*, Wydawnictwo Politechniki Poznańskiej, Poznań, 2010, pp. 15-58.

2016
L2 – water and sewerage infrastructure (KS)
L16 – access to libraries and reading rooms (KS)
L18 – access to universities by senior citizens (KS)
L19 – access to interest and discussion groups (KS)
L27 – partner relationships among businesses (KS)
L32 – commitment to creating business networks (KS)
L33 – development objectives (KS+SV)

2010
L18 – access to universities by senior citizens (KS)
L19 – access to interest and discussion groups (KS)
L27 – partner relationships among businesses (KS)
L40 – continuation of predecessor policies (KS+SV)
L53 – propensity to migrate within the region (SV)
L63 – attempts to modify ancestral strategies (SV)
L76 – predisposition to parsimony (SV)
L77 – reluctance to take risks (SV)

Fig. 3. Regional identity components whose Fuzzy Identity Indicators ranked high in 2010 and 2016

Source: Own research

The year 2016 saw the arrival of new areas in need of improvement, i.e. water and sewerage infrastructure, access to libraries and reading rooms, commitment to creating business networks and development objectives. All of these variables fall into the key skills category. Particularly disquieting is the addition of the two final key factors as it suggest difficulties in Wielkopolska's development.

Factor analysis proved helpful in reducing the homogenous set of input variables by replacing it with a single new variable. Such analysis shed light on the internal relationships among factors tackled in multidimensional observations and helped identify key factors and rule out information that was of little significance for the matter at hand, i.e. for the region's identity. The variables that help define the significance of the selected identity components are the importance of each highlighted identity characteristic.

The results subjected to interpretation by factor analysis are the rotated factor loading score matrix and a factor loading score plot. Figure 4 presents the regional identity components given the highest factor loading scores (above 0.62) in 2016 and 2010. 20 variables were selected in 2016 and 14 in 2010 that were significant for the entire population.

No improvements were seen in the areas of development objectives, continuation of predecessor policies and actions taken by Wielkopolska politicians. These are controllable variables set aside as key skills that refer to regional policy.

A number of new areas of key significance for improving regional identity emerged in 2016. The majority of them fell into the key skills category.

2016
L4 – ability to satisfy housing needs (KS)
L8 – access to education (KS)
L13 – access to cultural entertainment (KS)
L14 – suitability of cultural offerings for various social groups (KS)
L16 – access to libraries and reading rooms (KS)
L24 – communication on promotion of regions by means of events (KS)
L26 – availability of active leisure pursuits (KS)
L28 – partner relationships among individuals (KS)
L29 – mutual trust among individuals (KS+SV)
L32 – commitment to creating business networks (KS)
L33 – development objectives (KS+SV)
L34 – level of regional innovation (KS)
L37 – opportunities to learn about the region and its history (KS+SV)
L39 – care for cultural heritage and landscapes (KS+SV)
L40 – continuation of predecessor policies (KS+SV)
L41 – actions taken by Wielkopolska politicians (KS+SV)
L51 – ability to take advantage of historical heritage (KS+SV)
L59 – behavior in public (SV)
L60 – mutual assistance (SV)
L61 – respect for others (SV)

2010
L25 – forms of communication with businesses used by local governments (KS)
L33 – development objectives (KS+SV)
L40 – continuation of predecessor policies (KS+SV)
L41 – actions taken by Wielkopolska politicians (KS+SV)
L42 – awareness of regional issues among Wielkopolska politicians (KS+SV)
L43 – politicians' care for the interests of Wielkopolska and its residents (KS+SV)
L46 – clearly-formulated development objectives (KS)
L47 – development and implementation of regional development projects (KS+SV)
L68 – care for cleanliness and order (SV)
L70 – ways to achieve success (small steps) (SV)
L71 – cost efficiency (SV)
L72 – the region's organizational skills (KS)
L73 – attachment to traditions (SV)
L74 – dedication to hard working (SV)

Fig. 4. Regional identity components of high significance as identified in 2010 and 2016

Source: Own research

A comparative analysis of the Fuzzy Significance Indicator and factor analysis outcomes points to the key regional identity variables that require modification. In 2016, these were:

- access to libraries and reading rooms,
- commitment to creating business networks,
- development objectives.

The above characteristics fall into the key skills (KS) category, which makes them controllable variables. Of particular importance for Wielkopolska's economic development is the focus on selecting adequate development objectives and ensuring the support and engagement of public administrative authorities in the creation of economic networks.

4. CONCLUSIONS

The above research has shown identity as being a factor in the assessment of coexisting formal structures and relationship networks, which constitutes a significant potential of a region. While noting the incorporation of regional identity into foresight research, the authors emphasize the need for regular studies. Knowledge on regional identity helps formulate measures that support a sense of community and reveal the opportunities which the decision-makers involved in building Innovative Wielkopolska can use to make a difference. The study findings show that significance of identity components changes along with transformations in public expectations. However, one should note that a number of significant factors remain unaffected by economic and political developments. Such identity components should be taken under "particular care" and be used as a tool for integrating the local community.

Furthermore, by identifying variables that can be controlled by regional authorities, the study points to opportunities to take action and make a difference thus facilitating measures that promote growth and help achieve the desired aims.

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IDENTYFIKACJA POTENCJAŁU WIELKOPOLSKI W KSZTAŁTOWANIU SIECI WSPÓŁPRACY

Foresight, jako narzędzie kreowania wspólnej przyszłości (wizji), zakłada monitorowanie istotnych zjawisk i wytyczanie kierunków strategicznych dla przedsiębiorstw, branż lub regionów. Artykuł pokazuje analizę porównawczą wyników badań tożsamości Wielkopolski (przeprowadzone w roku 2010 i 2016), realizowaną w ramach foresightu dotyczącego proinnowacyjnego oddziaływania sieci gospodarczych. Tożsamość regionu, jako synergia umiejętności kluczowych i wartości wspólnych stanowi o potencjale regionu i gotowości do przeobrażeń. Prezentowana tu analiza pozwala dostrzec w jakim kierunku przeobraża się tożsamość regionu i czy będzie wspierać kształtowanie sieci współpracy.

Wyniki prezentowanych badań pokazują tożsamość jako parametr oceny współistnienia struktur formalnych i sieci powiązań, która stanowi istotny potencjał regionu. Zwracając uwagę na ulokowanie tożsamości regionu w badaniach foresight, autorki podkreślają potrzebę prowadzenia cyklicznych badań. Wiedza o tożsamości regionu wytycza kierunki działań wspierających poczucie wspólnoty i ujawnia możliwości sprawcze decydentów budujących Innowacyjną Wielkopolskę. Uzyskane rezultaty badań pokazują, że istotne elementy tożsamości zmieniają się, gdyż przemianom ulegają oczekiwania społeczności. Warto jednak dostrzec, że ważność niektórych czynników pozostaje niezmienna, nie podlega dynamice sytuacji gospodarczej i politycznej. Te składowe tożsamości powinny być „pod szczególną opieką" i być obiektem działań integrujących lokalna społeczność.

Prezentowane badanie pokazuje również możliwości sprawcze, identyfikując zmienne sterowalne z punktu widzenia władz regionu, co powinno ułatwiać wprowadzanie zmian prorozwojowych i ukierunkowanie funkcjonowania na pożądane cele.

Słowa kluczowe: foresight, tożsamość regionu, współpraca w sieci, potencjał, Wielkopolska

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IMPACT OF KAIZEN SOLUTIONS ON PRODUCTION EFFICIENCY

The aim of this article is to demonstrate the impact of creativity and employee involvement in improving their workplaces on productivity.

The article shows an example of the involvement of employees in the improvement actions on their work environment. Pattern, where employees are aware of their role in the production process and the impact on its realization are the basic principles of Kaizen. Thanks to this activity, it is possible to create employee motivation to improve their job according to their own needs and requirements. Choice of the topic results from the conviction that the proper motivation of production employees leads to an increase of their commitment to work and improving their production station translates into an increase in the efficiency of the whole production process. Proper use of employees ideas, brings positive results in better use of available resources of the company.

An article includes an example of using the employees suggestions system in the company from the metal industry. Performance analyse of the workstation was made before and after the implementation of kaizen along with the implemented improvement solutions. Authors through their research showed that the greater the involvement of employees in improving their workplace (which is a direct result of the suggestion system implemented in the company), than the greater performance of this position.

Keywords: Kaizen, Lean Manufacturing, improvement, employee involvement, employee suggestion system

1. INTRODUCTION

Kaizen is a philosophy for continuous improvement of the company and approach it to perfection. Kaizen refers to a small, gradual improvements incurred as a result of efforts. The aim of kaizen is to improve individual operations and processes by eliminating waste and improving value-added activities. The Kaizen philosophy has been implemented in organizations around the world as a way to improve production values while also improving employee morale and safety. The Kaizen philosophy may be applied to any workplace scenario due to its simple nature.The first scientific publication indexed in Scopus on the subject of kaizen is a conference paper "Towards Balanced appropriately factory automation" presented by a scien-

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tist from the University in Oakland at 8th International Conference on Production Research in Stuttgart in 1985. The number of scientific publications indexed in Scopus on the subject of kaizen in individual years is shown in Fig.1.

The issue of Kaizen is discussed in various scientific fields, but most often in scientific publications in the field of engineering sciences (54.7% of all publications), followed by management (28.6% of all publications) and computer science (12.7% of all publications). The growing interest in the concept of Kaizen among scientists is reflected also in enterprises. Companies are increasingly willing to start improving processes in their companies of implementing the Kaizen concept. The main advantage of Kaizen is the fact that all company's employees are involved in improving processes through the ability to report on the conclusions of kaizen ideas. The involvement of employees guarantees durability of the implemented solutions.

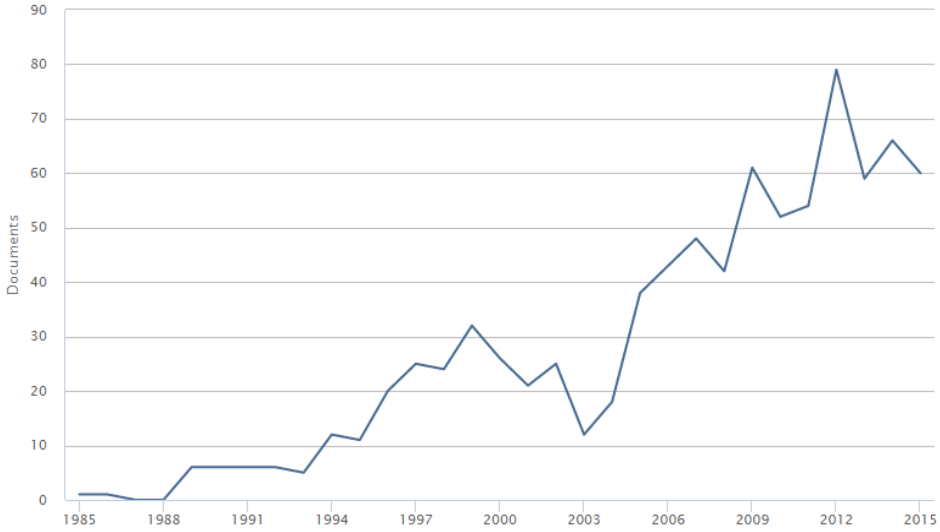

Fig. 1. The number of scientific publications on the subject of kaizen indexed in Scopus

Source: own.

2. LITERATURE REVIEW

The economic situation of the country and the position of manufacturing enterprises among the competitors forces the manufacturers to use methods of improving production processes that allow the reduce production costs and increase productivity. The concept, which allows the improvement of manufacturing processes, is Lean Manufacturing (LM). Primarily a LM assumes the elimination of all waste (jap. Muda) occurring on production[5]. This concept is derived from the production system TPS (Toyota Production System), whose creators were Japanese engineers: Sakichi Toyoda, Ki'ichirō Toyoda and Taiichi Ohno. It is they who in the early twentieth century revolutionized manufacturing

[5] J. K. Liker, D. P. Meier, *Droga Toyoty Fieldbook. Praktyczny przewodnik wdrażania 4P Toyoty*, Wyd. MT Biznes, Warszawa, 2011.

Toyota Group[6]. Taiichi Ohno[7] in his works devoted to the frugal production of listed seven types of waste: overproduction, errors and quality defects, waiting, over-processing, transport superfluous and movement superfluous. Currently, seven types of waste is enriched by yet another - untapped potential employee. In this context, it is meant ignoring or not using of ideas, competence, talent and time employee[8].

Manufacturing enterprises to eliminate waste, presented the use of one of the tools of Lean Manufacturing which is Kaizen. In Japan, Kaizen means continuous improvement[9] [10]. It is run slowly, increasing from time to time but continuously. Meanwhile, in America it is known as "Kaizen Blizt" or "Kaizen Event"[11]. According to Imai[12] Kaizen is a continuous improvement process involving every one, managers and workers. Cheser[13] explains that Kaizen means making small changes on a regular basis by reducing waste and continuously improving productivity, safety, and effectiveness. Suzaki[14] explains that Kaizen is a philosophy widely practiced in belief that, that there is no end to make a process better. Each small improvement consists of many levels of development, mainly used for improving manufacturing processes.

Application process of kaizen method basically consists of[15]:

- definition of the improvement area,
- analysis and selection of the key problem,
- identification of the cause of improvement,
- planning the remedial center measures,
- implementation of the improving project,
- measuring, analyzing and comparison of the results,
- standardization.

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The Kaizen is dedicated to the improvement of productivity, efficiency, quality and of business excellence[16].

3. COMPANY DESCRIPTION

The research was conducted in a large European manufacturing company which is an official supplier and technological partner of a vast majority of the vehicle producing companies from all over the world. The Company was set up in 1949 producing mechanical cables for the spare parts market. In that time, the automobile industry was nearly inexistent in Spain. Between the 50's and the 70's, several makers, such as Seat, Barreiros, Avia and Iomsa, Fasa Renault, Pegaso, Ford, Mercedes, Citroën, Peugeot and Motor Ibérica among others, decided to establish themselves in the country. The Company decided a change in strategy and focused it in becoming a supplier for these brands. Following this path, The Company grows and consolidates as the Spanish leader in its different lines of product, though benefited by the political environment and closed markets. On the one hand, the protectionist Spanish legislation of that time obliged the car builders which were established in the country to have Spanish main suppliers. On the other hand, the builders' decisions were decentralized at every country they operated, which helped The Company be near the customers and know first-hand their needs and habits. During this first stage, The Company begins its expansion abroad, deciding to establish itself in Oporto in Portugal in the beginning of the 70's. Nowadays The Company has production centers, engineering centers and commercial offices in 19 countries in Europe, North America, South America and Asia. The Company has a team of 8.661 professionals working all around the world, invests a 4% of its turnover in R&D every year and in 2012, the Group invoiced 953 million Euro.

In order to constantly improve the company decided to implement kaizen in the production system. Pilot implementation was made on the production line producing one of the handles.

The main goals that The Company intended to achieve through the implementation of kaizen were as follows:

- Increase the productivity,
- Reduce manufacturing cycle,
- Reduce manufacturing area,
- Reduce work in progress,
- Increase the quality,
- Flexible line according to the customer requirements,
- Improve ergonomics and security of work

It should be noted that, in according to management wishes, goals were set quite generally, without specifying numerical values. A common practice is to set specific numerical values to be pursued. The term numerical targets help to evaluate the efficiency and effectiveness of these actions.

At the first meeting the working team established a detailed work plan consisting of the stages as show in fig. 2.

[16] M. A. Titu, C. Operan, D. Grecu, *Applying the Kaizen Method and the 5S Technique in the Activity of Post-Sale Services in the Knowledge-Based Organization*, "Proceedings of the International MultiConference of Engineers and Computer Scientists" 2010, Vol. III, IMECS, Hong Kong, March 17-19.

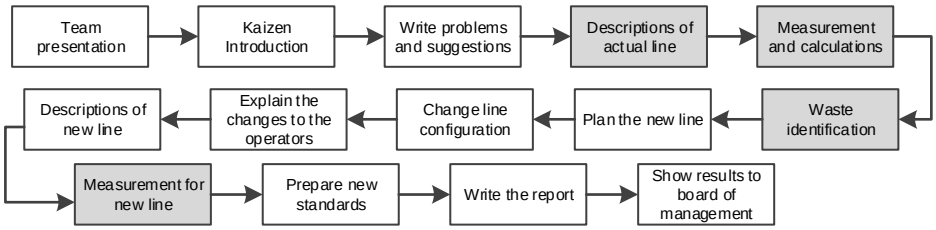

Fig. 2. Work plan

Source: own.

Due to the limited volume of the article in this publication selected steps of improvement are shown in Figure 2 in gray.

4. MEASUREMENT AND CALCULATIONS

Figure 3 shows lay out of the line before kaizen activities.

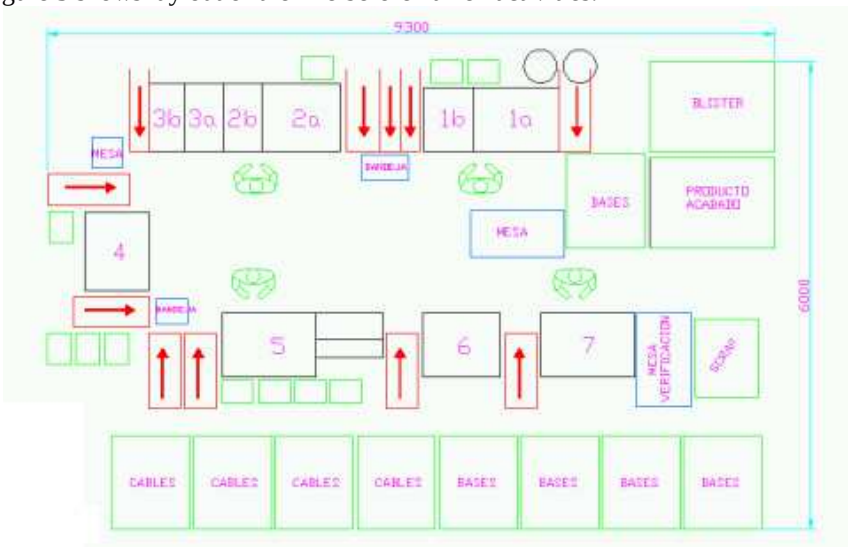

Fig.3. Initial layout of the line

Source: own.

Initial data of the process before Kaizen for one of the production line was as follow:

- Number of workers per turns – 7 operators,
- Volume of production per day (two turns) – 392 pieces,
- Productivity [units/hour/person] – 3,5,
- Area of the line – 9,3 x 6 = 55,8 m2,
- Work in progress – 30 handles.

Total work time of 8 hours (480 minutes) in a shift (gross time) less 15 minutes breakfast, 15 minutes for break, 10 minutes for cleaning and 20 minutes for changeover, then the net Available Time to Work = 480 - 15 - 15 - 10 - 20 = 420 minutes, which is 25200

seconds in turn, so 50400 seconds per day. Customer demand is 427 units a day, so tact time for this production line is 118 seconds.

In table 1-7, information's about measurement of time used by operator no.1-7 in each operation before Kaizen are shown.

Table 1. Time of the operation by operator no. 1

Operator no.1

Task 1: Take base and position in useful, press button, take Lever, Joint Socket and set in Lever, turn Joint Socket in the other side, place Lever in useful grease and grease, place Joint Socket in the correct position, set 1st Semisocket in Lever and set everything with the Base, take out Base from useful and check if Semisocket is in the right position, place again the Base in the useful and set the 2nd Semisocket. Take placket and set with Base, screw with 2 screws, check screwed pressing a button and take out the Base pressing the bimanual.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
53,1	*56,3*	*64,7*	*55,9*	*60,2*	*55,2*	*53,3*	*54,0*	*67,3*	*56,2*	*57,6*
Time [sec]										

Task 2: Move from place to place, take out cart and take out old Base and leave in a tray, position Base in nailed useful, to face up Sub. Bracket Guide Ball to Lever, press button and introduce the tray, press bimanual to nail Sub. Bracket Guide Ball and move from place to place.

No. of measure-ment	***Time [sec]***	**No. of measure-ment**	***Time [sec]***
1	*8,6*	6	*8,6*
2	*8,6*	7	*8,6*
3	*8,6*	8	*8,6*
4	*8,6*	9	*8,6*
5	*8,6*	10	*8,6*
Average time [sec]		***8,6***	

Total time in process for operator no.1

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
61,7	*64,9*	*73,3*	*64,5*	*68,8*	*63,8*	*61,9*	*62,6*	*75,9*	*64,8*	*66,2*
Time [sec]										

Source: own

Table 2. Time of the operation by operator no. 2

Operator no.2

Task 1: Take Base and position in useful, press bimanual to lock, take Selector and grease with the paintbrush, take Spring and Locker Badge and set in Selector, set everything in Base, take two Badges and set in Base, insert the tray and press bimanual, take out the last Base from place 2b and leave in 3a, come back to 2a, take out the Base and leave in 2b.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
33,0	*28,9*	*29,6*	*29,8*	*30,2*	*33,2*	*30,1*	*29,4*	*32,8*	*31,9*	*30,9*
Time [sec]										

Task 2: Put Base in 2b, take Shift Lock and Shaft Shift Lock and set in the Base, press Bimanual.

No. of measure-ment	***Time [sec]***	**No. of measure-ment**	***Time [sec]***
1	*10,0*	6	*10,0*
2	*10,0*	7	*10,0*
3	*10,0*	8	*10,0*
4	*10,0*	9	*10,0*
5	*10,0*	10	*10,0*
Average time [sec]		**10,0**	

Total time in process for operator no.2

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
43,0	*38,9*	*39,6*	*39,8*	*40,2*	*43,2*	*40,1*	*39,4*	*42,8*	*41,9*	*40,9*
Time [sec]										

Source: own.

Table 3. Time of the operation by operator no. 3

Operator no.3

Task 1: Take base and put in 3b, connect the circuit with the solenoid, set Circuit in the Base and point the solenoid to the Base, position Base in 3a, press bimanual, face up Solenoid in useful and lower the manual press, position Base in 3a, take screw and screw to fix the solenoid, take out and leave in next station.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
53,7	*54,2*	*56,5*	*48,7*	*56,3*	*62,2*	*48,5*	*51,9*	*60,5*	*56,2*	*54,9*
Time [sec]										

Total time in process for operator no.3

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
53,7	*54,2*	*56,5*	*48,7*	*56,3*	*62,2*	*48,5*	*51,9*	*60,5*	*56,2*	*54,9*
Time [sec]										

Source: own.

Table 4. Time of the operation by operator no. 4

Operator no.4

Task 1: Take Base and put pressing a button, take Detent grease “valleys and mountains” zone and set in Base, screw (x4) the Detent, check Lever movement, take and set superior joint and check screw approaching the tester and pressing bimanual, take out the tester and take out the lever.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
35,0	*50,4*	*50,8*	*48,0*	*48,3*	*50,1*	*51,9*	*60,7*	*56,9*	*53,9*	*50,6*
Time [sec]										

Total time in process for operator no.4

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
35,0	*50,4*	*50,8*	*48,0*	*48,3*	*50,1*	*51,9*	*60,7*	*56,9*	*53,9*	*50,6*
Time [sec]										

Source: own.

Table 5. Time of the operation by operator no. 5

Operator no.5

Task 1: Take a Lever and position in useful, take Lead and Back Foam and set in the Lever, take a cable and face up to the Base, TC Coco Vikingo visual checking, put Coco Vikingo in useful, move to the right side and join Kneecap Seat with Kneecap, take a Staple and put in Base, paint TF with felt tip pen and press bimanual and take out Lever + Cable.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
51,7	*56,8*	*64,2*	*62,0*	*57,1*	*62,8*	*59,0*	*58,6*	*64,0*	*63,5*	*60,0*
Time [sec]										

Total time in process for operator no.5

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
51,7	*56,8*	*64,2*	*62,0*	*57,1*	*62,8*	*59,0*	*58,6*	*64,0*	*63,5*	*60,0*
Time [sec]										

Source: own.

Table 6. Time of the operation by operator no. 6

Operator no.6

Task 1: Take a Lever + Cable and put in useful, set Lower Joint, set Lid and press bimanual, take out, check Lid join and set again Superior Joint.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
39,0	*41,7*	*40,5*	*39,1*	*41,0*	*40,7*	*40,7*	*40,1*	*39,5*	*37,7*	*40,0*
Time [sec]										

Total time in process for operator no.6

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
39,0	*41,7*	*40,5*	*39,1*	*41,0*	*40,7*	*40,7*	*40,1*	*39,5*	*37,7*	*40,0*
Time [sec]										

Source: own.

Table 7. Time of the operation by operator no. 7

Operator no.7

Task 1: Take Lever + Cable and put in useful for a final test, press bimanual.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
6,9	*5,7*	*7,0*	*6,8*	*4,8*	*6,0*	*7,0*	*6,9*	*6,9*	*6,7*	*6,5*
Time [sec]										

Task 2: Stick label in the front Lever, check feeling and leave in a container.

No. of measure-ment	***Time [sec]***	**No. of measure-ment**	***Time [sec]***
1	*35,0*	6	*33,3*
2	*27,4*	7	*32,3*
3	*30,0*	8	*28,6*
4	*37,3*	9	*30,6*
5	*39,0*	10	*32,9*
Average time [sec]		***32,6***	

Task 3: Register in Final Check List and take out Lever from useful from Final Test.

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
8,3	*13,2*	*12,8*	*11,2*	*8,9*	*10,0*	*12,0*	*14,0*	*13,3*	*7,7*	*11,1*
Time [sec]										

Total time in process for operator no.7

No. of measurement										**Average**
1	2	3	4	5	6	7	8	9	10	
50,2	*46,3*	*49,8*	*55,3*	*52,7*	*49,3*	*51,3*	*49,5*	*50,8*	*47,3*	*50,2*
Time [sec]										

Source: own.

Table 8. shows time that each worker spends in each step of his work and the total time spent in the whole process

Table 8. Time per operator – before Kaizen

Operator no.	1	2	3	4	5	6	7
Total time [sec]	66,2	40,9	54,9	50,6	60,0	40,0	50,2
The cycle time is 362,8 seconds.							

Source: own.

5. WASTE IDENTIFICATION

Very important step in improving production system was to identify all the waste, in lean manufacturing conception it is named Muda. Kaizen team defined seven kinds of waste are shown in table 9.

Table 9. Waste identified by Kaizen team

Kind of waste	Identified examples
Overproduction	- Accumulation of work in progress. - Objectives and achievements are not clear. - The quantity of pieces to manufacture is out of control.
Waiting	- Operators without work. - Low rhythm of the operators.
Transport	- Loading and unloading are very complicated. - A large number of means of transport.
Over processing	- Differences between the operators. - Differences between the standard and the activity. - A lot of activity which does not add any value from the point of view of the customer.
Inventory	- Stock of damaged material. - Stock in containers of current production. - Differentiated storage system.
Movements	- Not standardized workstation equipment. - Wrong spaced equipments. - Difficult access to the components.
Defects	- A lot of rejected parts. - Difficulties during assembly. - Long repair jobs. - Irregular operations.

Source: own.

Next step was to identify waste in regard to each operator and workplace. Tables 10 to 16 shows waste identify for each operator.

Table 10. Waste identify at first workstation

Kind of waste	Identified examples
Overproduction	- Accumulates 5 – 6 levers for next post.
Over processing	- Mounted cap on lever and turn it over to grease Lever and then put back well. - After place Lever at Base, take out Base of the useful to check the Semisocket Assembly. - Reset on each lever because the station does not work well (screwed Verifier).
Movement	- Container Bases are very deep. - Levers are near frame side and must look out for catching it.
Defects	- Although the program gives information to the verification of the bolted and placket, it does not lock the Lever and let follow the following process but the Lever oiler not oiling. - The alarms lights are activated when you press the bimanual in case of eject Lever.

Source: own.

Table 11. Waste identify at second workstation

Kind of waste	Identified examples
Overproduction	- Accumulates 5 – 6 levers for next post. - They have no place to leave the levers made and they are left on the bench in a disorderly way in the base of the next post.
Over processing	- Take the spring from the shelf and mounts, and then take the locking pin of the same shelf (2 movements of the arm). - Fit parts in Kanban boxes
Movement	- Moves from 2a to 2b to remove the lever, he goes back to the 2a to grab the lever and made moves to 2b to put in useful and press button, returns to 2a to mount and position lever in useful. - You must look out for catching them and parts back side structure.

Source: own.

Table 12. Waste identify at third workstation

Kind of waste	Identified examples
Overproduction	- Accumulates 5 – 6 levers for next post.
Over processing	- 3a difficulty in positioning lever in useful to attach solenoid. - 3a difficulty in placing Solenoid in basis. - 3a wrap the Solenoid cables giving 2 laps. - Fit parts in Kanban boxes.
Movement	- 3a turns to leave lever in next station. - 3a the following do not have to leave the levers and lose time searching for it. - 3a moves from 3a to 3b to mount Solenoid in database and returns to 3a for screw Solenoid. - Very high benches (place a pallet on the floor to gain height).

Source: own.

Table 13. Waste identify at fourth workstation

Kind of waste	Identified examples
Overproduction	- Accumulates 5 – 6 levers for next post.
Over processing	- Fit parts in Kanban boxes.
Movement	- Detent away behind the lateral structure and must look out for catching it. - He turns to leave the lever in the tray of the next station. - Superior joint very remote. - Very high benches (place a pallet on the floor to gain height).
Defects	- Checker Fails screwed. Reset on each lever.

Source: own.

Table 14. Waste identify at fifth workstation

Kind of waste	Identified examples
Overproduction	- Sometimes leave the levers on a shelf
Over processing	- Pink point mark in TF. - Check TC CocoVikingo and plastic TF. - Fit parts in Kanban boxes.
Movement	- Move to station 6, take out the lever and return to station 5, grab the lever and returns to station 6, placed in useful and drives bimanual. Returns to station 5.
Defects	- TC bad stapling. - TF with broken "chimney". - TF with broken tigger.

Source: own.

Table 15. Waste identify at sixth workstation

Kind of waste	Identified examples
Overproduction	- Accumulates in tray for next post
Over processing	- Joint glued bottom among them. The operator must come off with considerable difficulty. - Fit parts in Kanban boxes.
Movement	- Lower joint loose on the bench.
Defects	- Lower joint bent and torn material. - Cover badly wedged

Source: own.

Table 16. Waste identify at seventh workstation

Kind of waste	Identified examples
Overproduction	- Take out lever of the useful and leaves in control table. - Returns up to tray and grab handle to put in useful. - Fill out the Final Check List sheet. - Makes labels NOK product. - Fit parts in Kanban boxes.
Movement	- Very deep shipping container and has to lean. - Go to look for separators for shipping container.
Defects	- Mistakes in the final check list.

Source: own.

The reasons of occur waste are identified through the use of quality tools, such as cause-and-effect diagram, control chart, Pareto chart, flow chart and also 5 why and failure mode and effects analysis. Removal of individual cases of waste was made possible by organizational changes, change psyche of employees, and also by small investment. After analyzing the causes of waste and ways of eliminating was formulate new labor standards for operators, which resulted in a shortening of cycle time.

6. MEASUREMENT FOR THE NEW LINE

Actions taken in the context of improvement and involvement of employees contributed to a significant improvement on the analyzed production line. Figure 4 shows lay out of the line after kaizen activities.

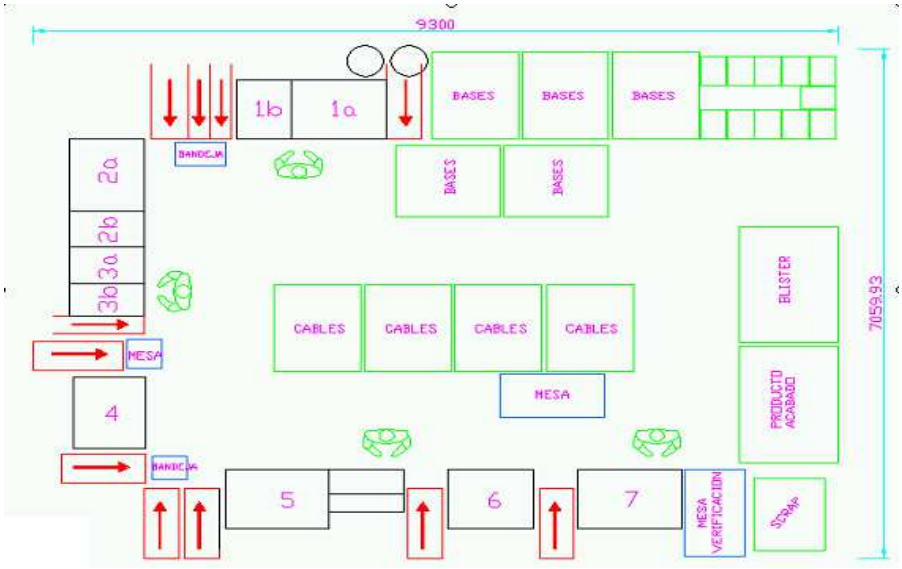

Fig.4. Layout of the line after kaizen activities

Source: own.

Table 17 shows new times that each operators need for each steps of his work after Kaizen.

Table 17.Time per operator – after Kaizen

Operator no.	1	2	3	4	5	6	7
Total time [sec]	62,9	34,9	48,9	47,6	52,1	34,0	50,2
The cycle time is 330,6 seconds.							

Source: own.

Number of employees after changes has been the same, but volume of production increase to 482 pieces per day, it mean that new productivity is 4,3 pieces per operator per hour. Better use of production space reduce the need for production area from 55,8m^2 to 49m^2. Also work in progress are now under control and it takes 15 handles.

7. CONCLUSIONS

After an application of Kaizen solution for the analyzed production line there is still the same number of workers, but increasing the productivity. Each operator produces now 6 units more per turn. Cycle time was reduced by 30 seconds. With the new layout production line was using 15,8 square meters less than before. The summary of all results are shown in table 18.

Table 18. Result of kaizen activity

Concept	*Before Kaizen*	*After Kaizen*	*Variation [%]*
Production [units]	392	482	23
Production [seconds/unit]	128,6	104,6	
Productivity [units/hour/person]	3,5	4,3	
Occupied surface [m^2]	55,8	49	14
Work in progress	30	15	50

Source: own.

Pilot implementation of the concept of kaizen on one of the production line was a success, so management decided to implement kaizen on other lines. Kazien goals for the next line have been quantified, and the company developed its own way of communicating with employees, reporting kaizen ideas and rewarding employees who contribute to the continuous improvement of the company.

Implementation of the project confirms that creativity and employee involvement in improving their workplaces has a huge impact on productivity.

8. ACKNOWLEDGMENT

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WPŁYW ZASTOSOWANIA ROZWIĄZAŃ KAIZEN NA WYDAJNOŚĆ PRODUKCJI

Celem artykułu jest wykazanie wpływu kreatywności i zaangażowania pracowników w doskonalenie własnych stanowisk roboczych na wydajność produkcji. Współczesne przedsiębiorstwa, chcąc sprostać dynamicznie zmieniającym się wymaganiom ze strony rynku, są zmuszone elastycznie reagować na potrzeby rynku pamiętając jednocześnie o zachowaniu odpowiedniego poziomu oferowanych produktów. W artykule przedstawiono przykład zaangażowania pracowników w działania doskonalące ich środowisko pracy. Model, w którym pracownicy są świadomi swojej pośredniej i bezpośredniej roli w procesie produkcyjnym i wpływie na jego realizację są podstawowymi założeniami Kaizen. Dzięki temu możliwe jest wykreowanie motywacji pracowników do udoskonalania swoich stanowisk pracy według własnych potrzeb i wymagań. Wybór tematu wynika z przekonania, że właściwa motywacja pracowników produkcyjnych przekłada się na wzrost ich zaangażowania w pracę, a doskonalenie własnego stanowiska produkcyjnego przekłada się na wzrost wydajności całego procesu. Właściwe wykorzystanie pomysłów pracowników, przynosi pozytywne efekty w postaci lepszego wykorzystania dostępnych zasobów przedsiębiorstwa. Artykuł zawiera przykład wykorzystania systemu sugestii pracowników w przedsiębiorstwie branży metalowej. Została dokonana analiza wydajności stanowiska roboczego przed i po wdrożeniu kaizen wraz z wdrożonymi rozwiązaniami doskonalącymi. Autorzy dzięki swoim badaniom wykazali, że im większe jest zaangażowanie ze strony pracowników w doskonalenie swojego miejsca pracy (które wynika bezpośrednio z systemu sugestii wdrożonego w danym przedsiębiorstwie), tym większa jest wydajność tego stanowiska.

Słowa kluczowe: Kaizen, Lean Manufacturing, doskonalenie, zaangażowanie pracownika, system sugestii pracownika

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BUSINESS MODELS BASED ON SUSTAINABILITY. PRACTICAL EXAMPLES

Modern companies which look for sources of competitive advantage are more and more often taking into consideration concepts that allow them to assess their business activities in wider perspective than only of financial or marketing nature. The concept of sustainable development has become an important element in the public debate on the role and place of business in the modern society. Business organizations are expected to behave in socially responsible way including economic, ecological and social aspects of their operations. Sustainability, next to the other concepts, helps to understand complex relationships and improves ways of gaining common goals in a win-win strategy.

Companies that are searching for a competitive advantage by using sustainable development adapt its principles to their strategies and business models. At the core issues of sustainable business models lie multiply value creation and strategic approach of development and survival on the market. Sustainable business models combine many of the concepts that characterize social and environmental values next to the traditionally understood business dimension. The paper aims at presenting the general view on sustainable business models. The attention will be put on short cases that illustrate how the sustainability may be translated into business practice.

Keywords: sustainability, sustainable business models, business practice of sustainability, business models

1. INTRODUCTION

Management of modern enterprise requires a broad view on the business environment and its processes. The concept of sustainable development may be treated as a starting point for understanding the relationship between business and its noneconomic spheres of activities and be helpful to build a coherent system of goals, values and rules of conduct for companies. Sustainable development allows to look at business organization from long term perspective (as a business contribution to future generations). This is confirmed even in new sustainable development goals announced in 2015. The goals are set for the next 15 years and aim at ensuring prosperity for all.[2] To achieve 17 goals (196 targets) the tight cooperation with all sectors is needed. Business partners will play crucial role in e.g. climate action, responsible production and consumption, sustainable living in cities, ensuring decent work and economic growth or innovation and infrastructure.[3] To make it possible the changes of current business models need to be introduced. It is all not about the process of planning and setting operational goals but deeper analysis of opportunities and risks that may cause the problem of continuity and sustainability or other significant is-

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[2] Resolution adopted by the General Assembly on 25 September 2015

[3] UN Sustainable Development Goals, September 2015

sues affecting the stability of organizations. It requires in many cases far-reaching transformations including an approach to stakeholder management, strategy planning or KPIs. The concept of sustainability from business perspective is helpful in finding the equilibrium for the economic, social and environmental development. This is the reason why the term sustainable business model is more often used. Sustainable business models are oriented on the way to achieve business goals by respecting different values. Practical solutions in this respect are rather impressive. Business may implement different concepts and techniques which improve its environmental or social performance. Companies decided to what extent the concept will be adopted and used by them. There are many different factors that play a role in making final decisions like e.g. pressure of customers[4] and tightening up the law moving in the direction of adjusting regulations to actual and future societal and environmental challenges like e.g. low-carbon economy.[5]

Business adapts available solutions to its business models to build a competitive advantage on such elements as: alternative forms of exchange, environmental excellence or high social standards. Some practical examples will be presented in the paper.

2. CONCEPTS WHICH SUPPORT SUSTAINABILITY

There are many economic and managerial concepts and theories which support the development of the concept of sustainability. They all underline the role of complex social relationships and issues of environmental management. The focal point of these concept is the problem of the business on society and environment as well. The concept of stakeholder management[6] was the groundwork for the development of an approach taking into account the various stakeholders as important partners of organizational success.[7] It shows the diversity and complexity of business relationships[8] and indicates the need of taking into account the decisions and activities of the company as those stakeholders that are not directly related to business transactions but may have an impact on the success or failure of the market like potential customers or the public opinion. Companies which are aware of needs and expectations of their stakeholders and recognize the realm of non-economic relationships can better respond to emerging challenges in this area.

The concept of Corporate Social Responsibility (CSR)[9] seems to be equally important. The main idea of CSR is the analysis of environmental and social impacts[10] and the way in which companies respond to them in consideration of different stakeholders. The concept of social responsibility, despite the historically different roots, is often identified, especially by business, with sustainable development. CSR contributes the achievement of

[4] Maurer S., Pachl U., Durable goods: More sustainable products, better consumer rights, Consumer expectations from the EU's resource efficiency and circular economy agenda, http://www.beuc.eu/publications/beuc-x-2015-069_sma_upa_beuc_position_paper_durable_goods_and_better_legal_guarantees.pdf

[5] Framework UN Conference (UNFCCC).

[6] Freeman R. E., (1984) *Strategic Management: A Stakeholder Approach, Pitman, Boston*

[7] Preble, J. F. (2005), Toward a Comprehensive Model of Stakeholder Management. Business and Society Review, Vol. 110, p. 407–431

[8] Steurer, R. (2006), Mapping stakeholder theory anew: from the 'stakeholder theory of the firm' to three perspectives on business–society relations. Bus. Strat. Env., Vol. 15, p. 55–69

[9] Dahlsrud, A. (2008), How corporate social responsibility is defined: an analysis of 37 definitions. Corporate Social Responsibility and Environmental Management, Vol. 15, p. 1–13

[10] Guidance on Social Responsibility, ISO 26000

sustainable development.[11] It gives space for planning and implementation of different activities aimed at the society and the environment. An awareness of social responsibility among organizations gives the opportunity to build mutually beneficial relations and implement the strategies and projects aimed at reduction of the negative impact on environment.

Business ethics[12], in turn, induces the use of moral values in making all business decisions. Ethical behavior applies to all levels of organization. The minimum and starting point is complying with the provisions of the law. Ethics describes an important area directly related to the social norms and support to establish a framework for the desired and acceptable business behavior.[13] In this regard it assists the concept of sustainable development paying attention to the need of taking responsibility, intergenerational justice, respect and honesty.

The concept of shared value[14] (Shared Value Creation/ Multiple Value Creation) may be a staple for sustainability complex structure. It is assumed that the company seeks to maximize the positive values (that benefit the widest range of stakeholders) and minimizes the negative (avoiding the creation of products or taking actions that are not beneficial from the point of view of stakeholders) using the win-win strategy.

Multiplying values is also the domain of social economy. It is an economic order in which the economic operator pursues economic objectives while fulfilling a social mission. It is heavily focused on the social sphere of sustainable development. In this spirit, companies may also develop social innovations to address the specific problem of social or environmental issues. Firms achieve economic benefits while serving society by improving the quality of life (cheap diagnostic tests, solutions to increase security in the cities and on the roads, solutions for people with disabilities, etc.).

An important concept is the circular economy aimed at reducing the negative impact on the environment and the design of products and services come from recycling, upcycling and using methods of improving environmental conditions.[15] It is worth mentioning other solutions serving environment like e.g. environmental life cycle assessment, cleaner production and voluntary standards and initiatives such as ISO 14001. The table 1. presents the impact of these concepts on business decisions.

[11] Moon J., (2007) The Contribution of Corporate Social Responsibility to Sustainable Development, Sustainable Development, Vol. 15, p. 296–306

[12] Bradburn R., Understanding Business Ethics, Cengage Learning, UK, 2011

[13] Clegg, S., Kornberger, M., Rhodes, C. (2007), Business Ethics as Practice. British Journal of Management, Vol. 18, p. 107–122.

[14] Porter M. E., Kramer M. R., Creating Shared Value, Harvard Business Review, January-February 2011

[15] Lieder M., Rashid A., (2016) Towards Circular Economy Implementation: a Comprehensive Review in Context of Manufacturing Industry, Journal of Cleaner Production, Vol. 115, p 36-51

Table 1. Sustainability related concepts and their impact on business decisions

Concept	**Impact on business decisions**
Stakeholder Management Concept	- including needs and expectations of different groups of stakeholders - shareholders are one of key groups of interested parties not the most important - economic profits must be considered equally with social and environmental - win-win strategy as a basis for business operation
Corporate Social Responsibility (CSR)	- social engagement - positive impact on environment is a part of business operations - improving social and environmental conditions in the - - whole supply chain as one of business challenges
Business Ethics	- moral judgement of decision making process - individual responsibility of managers and consequences of their decisions are considered - final decision depends on values
Shared/Multiply/Integrated Value Creation	- win-win strategy as a basis for business operation - the whole life cycle is analyzed - company is treated as one (not the most important) link in the whole value chain - the idea of positive values maximization (avoiding any kind of hurt to all groups of stakeholders)
Social Economy	- inclusion of vulnerable social groups as employers - social goals equally important like economic goals - alternative way of competitive advantage on the market - profit maximization including social needs and expectations
Circular/Closed Loop Economy	- the whole life cycle of products is analyzed - recycling and upcycling are very important elements of products' strategies - social and environmental criteria of products are taken into consideration on strategic level
Cleaner Production	- pollution prevention and environment friendly solutions are priorities
LCA	- building transparency in a whole supply chain

Source: Own elaboration

The list presented above is not complete and definitely closed. It only shows the range of possible strategies, directions and principles that may be taken into consideration in designing and implementing sustainable business models.

3. SUSTAINABLE BUSINESS MODELS

Business models may be defined as **"**a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm."[16] They are aimed at answering some crucial questions such as: Who is the custom-

[16] Osterwalder A., Pigneur Y., Tucci Ch. L., (2005), Clarifying Business Models: Origins, Present, and Future of the Concept, Communications of the Association for Information Systems: Vol. 16, Article 1.,

er? And what does the customer value? How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?[17] Business models cover two spheres: the first is operations and related resources, the second is about created and captured value. Sphere of activities and resources play a subordinate role in relation to the creation of customer value and its ability to capture and maintain.*[18]*

One aspect of current business models is broadly discussed. It is the place and role of sustainable development in today's business. The inclusion of issues related to sustainability to business models helped shape a concept of sustainable business models which may be a new paradigm of modern business management. Sustainable business models "incorporate a triple bottom line approach and consider a wide range of stakeholder interests, including environment and society. They are important in driving and implementing corporate innovation for sustainability, can help embed sustainability into business purpose and processes, and serve as a key driver of competitive advantage."[19] They are also understood as business models "that create competitive advantage through superior customer value and contributes to a sustainable development of the company and society'.[20] According to Jonker "a sustainable business model must meet the four following criteria:

- sharing knowledge,
- making connections (sustainability is between companies),
- awareness,
- multiple value creation." [21]

A need to seek a competitive advantage based on sustainability is the result of the time and circumstances in which contemporary global society exists. "We need business models that operate within planetary limits and are sensitive to their roles as economic, environmental and social linchpins.[22] Build on this assumption the sustainable business models derive from triple bottom line approach proposed by John Elkington. The traditional business model elements are insufficient to show the full relationships and values that setting the direction of sustainable development in business context (tab. 2).

[17] Magretta J., Why Business Models Matter, Harvard Business Review, May 2002, p.3

[18] Brzóska J., Model Biznesowy – Współczesna Forma Modelu Organizacyjnego Zarządzania Przedsiębiorstwem, Organizacja i Zarządzanie Kwartalnik Naukowy 2(6), 2009, p.8

[19] Bocken N.M.P, Short S. W., Rana P, Evans S.(2014), A literature and practice review to develop sustainable business model archetypes Journal of Cleaner Production, Vol. 65, 42-56, p.42

[20] Lüdeke-Freund, F.(2010), Towards a conceptual framework of business models for sustainability [in:] ERSCP-EMU Conference, Delft, The Netherlands, p. 1-28.

[21] Jonker, J., New Business Models, An exploratory study of changing transactions creating mutiple value(s), Working Paper, Nijmegen School of Management, Radboud University Nijmegen – The Netherlands 2012,

[22] Model Behavior, 20 Business Model Innovations for Sustainability, electronic file, http://www.sustainability.com

Table 2. Elements of business models including sustainability issues

Pillar	**Element and description**	**Extended meaning including sustainability**
Product	**Value Proposition** - gives an overall view of a company's bundle of products and services.	**Mutliply Value Proposition** – gives an overall view of a company's benefits provided to the whole society
Customer Interface	**Target** - describes the segments of customers a company wants to offer value to.	**Target** – goes beyond the groups of customers and includes all group of stakeholders
	Distribution Channel -describes the various means of the company to get in	User and other stakeholder friendly channel of distribution
	Relationship - explains the kind of links a company establishes between itself and its different customer segments	**Relationship** – the broad definition of all link between the company and its all stakeholders.
Infrastructure Management	**Value Configuration** - describes the arrangement of activities and resources	Put attention on value configuration in the sense of environmental and social impact minimization.
	Core Competency - outlines the competencies necessary to execute the company's business model.	**Core Competency** – include also all competencies necessary to cover sustainability issues in business model like e.g. LCA, DfE etc.
	Partner Network -portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value.	**Partner Network** - contains also non-profit organizations and semi-commercial organizations like social cooperatives.
Financial Aspects.	**Cost Structure** - sums up the monetary consequences of the means employed in the business model	Extended to the social and environmental values of business decisions like e.g. SROI, environmental costs, or CO2 footprint etc.
	Revenue Model - describes the way a company makes money through a variety of revenue flows.	

Source: Own elaboration and Osterwalder, Alexander; Pigneur, Yves; and Tucci, Christopher L. (2005) "Clarifying Business Models: Origins, Present, and Future of the Concept," Communications of the Association for Information Systems: Vol. 16, Article 1., p.10

The sustainable business models do not take into account the distinction between business goals and noneconomic goals. All are treated equally as a challenge to achieve to satisfy different market participants. It seems, however, that in practice to achieve sustainability may entail some difficulties and sometimes be considered only as hypothetical concept. This does not mean that companies do not undertake intensified efforts to fulfill the commitment to the concept of sustainable development. Usually, however, each sphere is analyzed separately and competitive advantage is built only on one main dimension. It is much harder to find examples that would show a holistic excellence for sustain-

ability. This is confirmed by the current literature which presents rather the theoretical assumptions of sustainable business models.

One of possible typology of business models including sustainability was presented in the report Model Behavior**,** 20 Business Model Innovations for Sustainability.[23] The main attention was put on such element as:

Environmental impact (models: Closed-Loop Production, Physical to Virtual, Produce on Demand, Rematerialization)

Social impact (models: Buy One, Give One, Cooperative Ownership, Inclusive Sourcing)

Financial innovation (models: crowdfunding, Freemium, Innovative Product Financing, Pay for Success, Subscription Model)

Base of the Pyramid (models: building a Marketplace, Differential Pricing, microfinance, micro-Franchise)

Diverse Impact (Alternative Marketplace, Behavior Change, Product as a Service, Shared Resource)

The other example of sustainable business models was proposed by Jonker. He distinguished three main models[24]:

Sharing – "Models are based on a variety of collaborations such as sharing people, ideas, equipment, property, data and transport. […] Sharing knowledge and networks also seems to be an important basis for conducting business in a lot of models; it leads to raison d'être and growth. […] Constantly exchanging tangible and intangible things between different parties is the essence of these new business models."

Trading – models focuses on alternative forms of transaction with associated benefits. Next to the monetary dimension one can distinguish such form of payment like: points, credits or advertisements. They contain the social values of capital, networks and attention as well as sources of the capital being organized.

Creating – based on multiply value creation. It creates the win-win situation for involved stakeholders.

Presented models do not restrict the ability of companies to develop an approach based on sustainability. They are only an attempt to describe the complexity of organizational reality, in which the dominant role is played by alternative methods of exchange, looking at the whole life cycle of a product or generating social value . Therefore instead of the notion of sustainable business models (suggesting sustainability in all dimensions) is more reasonable to define business models that are aware about the sustainability. This approach seems to be a compromise between the need to translate sustainable development for business DNA and the current stage of achievement. The following examples illustrate a possible range of business engagement in improving social and environmental aspects of their business models.

[23] Model Behavior, 20 Business Model Innovations for Sustainability, electronic file, http://www.sustainability.com

[24] Jonker J., New Business Models, An exploratory study of changing transactions creating mutiple value(s), Working Paper, Nijmegen School of Management, Radboud University Nijmegen – The Netherlands, 2012, p. 20-22.

4. PRACTICAL EXAMPLES OF BUSINESS MODELS INCORPORATING SUSTAINABILITY ISSUES

Presented examples include elements of business models which take into account sustainability issues and in particular elements of business models. Examples were chosen in order to illustrate the theoretical models presented in the previous part of the article. The main attention is put on the approach introduced by Jonker[25] (tab. 3).

Table 3. Examples of business models incorporating sustainability

Company	Country	Characteristics of business model
MUD Jeans	The Netherlands	The main idea is to create the product that is environment friendly by closed loop supply chain, recycled and organic materials. The innovative approach is that the consumers do not buy but only lease the product (jeans) by paying some monthly fee. The whole life cycle of products is known and most materials are back to the production process by using the recycling. Next to the alternative form of possessing equally important is water and resources saving and waste reduction. The company pay much attention on environmental aspects and educate about responsible consumption making buying decisions more conscious and sustainable.
FLOOW2	The Netherlands	Business to business platform of sharing system. Interested companies and institutions may sell or rent their equipment, services, personnel or knowledge. The system aims at minimization of cost by using instead of possessing. It lover the cost of companies and generate the additional turnover. The platform enhance the relationship among enterprises and develop the economic issues based on sustainability.
Local Farmer	Poland	The local system of production is one of the possibility to improve the environmental and social performance. The idea of Local Farmer is to produce and deliver on local scale to minimize the costs and negative effects related to the transport, storage and indirect links. Moreover the process of production is sustainable in the meaning of amount of pollution and resources used. The distribution channel is based on small local societies what strengthen the relationships.
Trykot	Poland	The presented business model is based on upcycling process. All materials come from things that are treated in classic definition as waste. Bags are sewn from old bags, curtains or tablecloths. Products are handmade and unique. The company uses the idea of circular economy to build its competitive advantage.
Badel 1862	Croatia	The traditional business model is filled with the exchange part. It is innovative approach in which cooperating partners can exchange products and services without cash transaction. It assumes the partnership among different companies. This kind of exchange system is especially useful for smaller organizations or organizations that experience some financial problem. In the presented case it was the conscious decision to run business activities based on exchange instead of financial transactions.

[25] Author of the article is a member of the team that took part in international research project aimed at New Business Models initiated by Professor Jan Jonker.

Company	Country	Characteristics of business model
Zipcar	USA	The idea of sharing economy is the main principle for Zipcar. The business model assume the peer to peer cooperation to reduce the environmental impact. It engages people to resign from the ownership and promote sharing.
EIREbloc	Ireland	The described company is oriented on production of pallet blocs from recycled wood. It converses the waste from saleable and valuable products. The whole processes are closed loop what is in environmental and economic sense. Offered products are approved by EPAL and FSC certification.
Social Cooperative Issa	Poland	The idea of social economy assume the reintegration and return to the labor market of people at risk of social exclusion. The organization has business oriented goals (hostel, catering and canteen) and simultaneously takes care of environment and society (vegan products, social events for local society etc). The difference from the regular business appears when taking into account the way of profit distribution. Some part of profits is reinvested in the organization and development of HR to fullfil the social mission.

Source: Own elaboration based on own research and J. Jonker (ed.), New Business Models across Europe, A database with briefs of current cases, Research Document Nijmegen School of Management, Radboud University Nijmegen 2013

Searching for alternative ways to achieve competitive advantage leads to many new solutions, which at first glance are not attributable to the business sphere. The concept of sustainable development opens up new business opportunities related to the area of innovation and development. The concept of sustainable development gives the possibility to look at the whole system from the perspective of a single organization. Afterthought on strategic approach to plan and implement business activities respecting the real influence it has on society and environment.

The presented short cases demonstrated a variety of ideas which may include the sustainability into business models. It might happen by for example product design, alternative way of transaction or integrated value creation. Business has the ability to generate ideas that, beside the enormous social value, also give tangible financial benefits. Understanding of needs and expectations of stakeholders and results that go beyond the economic equilibrium diagram gives effects in the form of innovative products, alternative means of exchange or strengthening the labor market by social inclusion. It shows the potential of meeting the market need respecting principles of sustainable development. Presented examples are only a part of possible solutions, and do not exhaust the scope and scale of possible range of involvement. There is a need for further discussion about the demarcation for sustainability in business models. The research about the transformation of enterprises in approaches to achieve common goals such as New UN Goals for sustainable development is also planned.

5. SUMMARY

Business plays a crucial role in economy and society. Moreover, as a member of society it has to adapt to changing conditions. Thanks to extensive tools and sources business may support the development of sustainability on local and global scale. The current change is visible in approaches of searching for competitive advantage, building relation-

ship and delivering products that not only meet consumer needs but also create value for the entire society and environment. Business models determine the nature of the business and the way in which it will achieve its goals. The more important seems to be the question of the place and necessity of sustainability in business models the more social and environmental challenges appear. The transformation from the traditional model to a more sustainable one is needed. The topic is very complicated and many questions are still open and will designate directions of discussion among both scientific experts and business practitioners.

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MODELE BIZNESOWE W OPARCIU O ZRÓWNOWAŻONY ROZWÓJ. PRAKTYCZNE PRZYKŁADY

Współczesne przedsiębiorstwa poszukując źródeł przewagi konkurencyjnej coraz częściej sięgają po koncepcje, które pozwalają im na szersze niż tylko finansowe czy marketingowe spojrzenie na prowadzoną działalność. Jedną z nich jest zrównoważony rozwój. Koncepcja zrównoważonego rozwoju staje się ważnym elementem debaty nad rolą i miejscem biznesu we współczesnym świecie. W literaturze pojawiają się również inne koncepcje takie jak: społeczna odpowiedzialność przedsiębiorstw, etyka biznesu czy ekonomia społeczna dodatkowo mogą okazać się wparciem dla zrozumienia i przełożenia zrównoważonego rozwoju na potrzeby organizacji biznesowych.

Co więcej przedsiębiorstwa upatrując w zrównoważonym rozwoju szansy biznesowej adaptują jego zasady do swoich strategii i modeli biznesowych. U podstaw zrównoważonych modeli biznesowych leży tworzenie wielu wartości i strategiczne podejście do rozwoju i utrzymania się na rynku. Duże znaczenie ma nie tylko sposób pomnażania zysków, ale również to, jak tworzone i utrzymywane są relacje z interesariuszami a przede wszystkim przełożenie perspektywy długookresowej nad krótkoterminową. Zrównoważone modele biznesowe łączą w sobie wiele koncepcji, które charakteryzują, obok tradycyjnie rozumianego wymiaru biznesowego, wartości społeczne i środowiskowe. Artykuł ma na celu przybliżenie problematyki zrównoważonych modeli biznesowych oraz w szczególności przykładów, które zilustrują jak wyglądać może ich praktyczna realizacja. Wśród opisanych przypadków znalazły się przedsiębiorstwa rozwijające swoją działalność na różnych rynkach.

Słowa kluczowe: zrównoważony rozwój, zrównoważone modele biznesowe, praktyki biznesowe na rzecz zrównoważonego rozwoju, modele biznesowe

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THE ROLE OF FINANCIAL STATEMENT IN PERFORMANCE MANAGEMENT

The essence of financial statements has been used as a background to present the elements of performance management, providing the required characteristics of balance, profit and loss account, additional information, cash flow statement, statement of changes in equity and the business activity report as a supplementary statement of the financial statement of selected entities.

The article focuses particularly on the possibilities of using financial statements as a final product of financial accounting, used as a source of data supporting the process of performance management. The paper contains considerations concerning traditional methods of application of financial statement in performance management. It also indicates directions for improvements in the structure and principles of preparing financial statements in order to increase the usefulness of the provided data in performance management. The conducted analysis leads to the conclusion that particular elements of financial statements may be very useful in assessing performance in selected areas of performance management. It particularly concerns the multidimensional measurement of property resources, results of activity, cash flows (financial measures), as well as various assessments and judgements, including the evaluation of effects, determination of risk factors and specification of threats (non-financial measures). Legally formalised by the accounting act, Polish financial statements provide limited capabilities of using in performance management. The entities that prepare financial statements according to the International Accounting Standards/International Financial Reporting Standards have considerably better capabilities in that field. The analysis has been prepared using the methods of review and analysis of literature and legal acts, while conclusions have been based on the methods of induction, deduction and analogical reasoning.

Keywords: performance management, financial accounting, financial statement.

1. INTRODUCTION

Performance management is all about improvement – synchronizing improvement to create value for and from customers with the result of economic value creation to stockholders and owners[3]. Enterprise performance management requires creating a database in a form of a proper information system. The primary source of information concerning the performance of the company is accounting, which is the most important system of business activity measurement.

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[3] G. Cokins, *Performance Management. Integrating Strategy, Executions, Methodologies, Risk and Analytics*, John Wiley&Sons, Hoboken, New Jersey 2009, p. 9.

In business practice, accounting is identified with the "accounting system", functioning as a permanently integrated registration and information system that should provide a reliable and clear presentation of the property and financial situation as well as the financial result of the company. According to the Polish balance sheet law, one of the key elements of business entity accounting is preparing financial statements, and in particular cases, also analysing and announcing them.[4]

The financial statement is a final element of business entity financial accounting and contains multidimensional data obtained from the accounting books. To a small extent, data from management accounting are also used in preparation of financial statements.

The aim of this study is to indicate the possibilities of using financial statement as a source of economic data supporting performance management.

The assumed goal has been achieved using the methods of induction, deduction and analogical reasoning on the basis of the study of Polish reference books and analysis of legal acts concerning accounting.

2. THE ESSENCE AND STRUCTURE OF THE FINANCIAL STATEMENT

Financial reporting uses data obtained from financial accounting records kept by the company. It presents valuable information with any required supplementary descriptions. Financial data included in particular components of the financial statement, due to proper organisation and grouping, should enable a comprehensive assessment of the property and financial situation of the enterprise and the achieved results.

According to the conceptual assumptions for preparing and presentation of financial statements[5], fundamental quality features of practical financial data are usefulness and reliable presentation, determined by comparability, verifiability, timeliness and comprehensibility (supplementary features). These quality features of the financial statement, confirmed by a revision in larger entities[6], determine the usefulness of the presented information from the point of view of the recipients.

The major task of the system of financial accounting oriented on performance is to provide data supporting the process of performance management. Financial accounting achieves it directly and indirectly.

Performance management of the enterprise is based on using financial measures (expressed in monetary units) and non-financial measures (not expressed in monetary units).

The system of financial accounting, by its nature supports generating data required to build financial measures. The categories that create critical financial measures, evaluated directly in financial accounting, are:

- property resources,
- results (effects) of activity,
- cash flows.

[4] Article 4 par. 3 of the Accounting Act of 29 September 1994 (consolidated text, Journal of Laws of 2013, item 330, as amended).

[5] *Międzynarodowe Standardy Sprawozdawczości Finansowej [International Financial Reporting Standards]*, Stowarzyszenie Księgowych w Polsce, Warszawa 2011.

[6] Z. Fedak, *Rewizja rocznych sprawozdań finansowych*, part I, Stowarzyszenie Księgowych w Polsce, Warszawa 1996, pp. 8-10.

Property resources of the company are presented in form of the account balance as of the particular date in objective (assets) and subjective (liabilities - capitals) aspects, with a special focus on changes in equity (fund).

The result of activity has the form of income, extraordinary profit, extraordinary cost or loss, as well as individual categories of financial result.

Cash flows are presented in the context of inflows and expenses for operating, investment and financial activity.

Beside financial measures, influenced directly and exclusively by the categories determined in financial accounting, there are also non-financial measures in which data from the financial accounting system are used in estimating other measures of financial achievements (e.g. total corporate value or value creation measures).

Best quality financial data used in company performance management (used for creating financial measures and then in measuring achievements), are included in the financial statement. It presents numerical data expressed in monetary units, that synthetically characterise the property and financial condition as well as the results achieved by the given entity.

The financial statement reflects global economic events related with the business activity of the enterprise, that are transformed into numbers and included (processed) in the accounting books constituting the financial statement database. Mastering and understanding the data included in the financial statement provides a comprehensive image of the enterprise (property, finances and results)[7].

The financial statement may concern a single enterprise or many enterprises. For that reason, unit and consolidated financial statements can be distinguished.

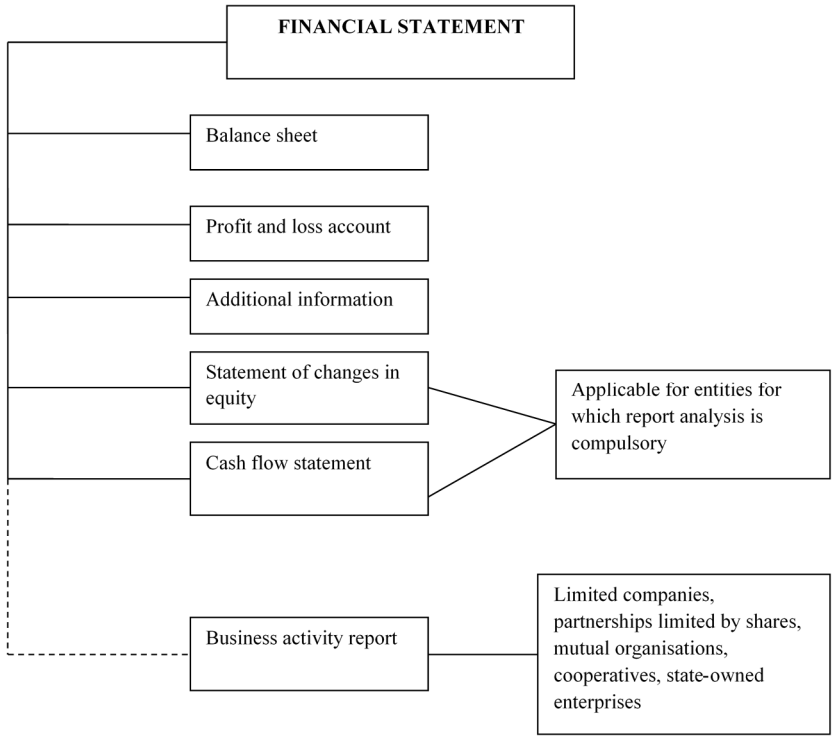
Unit financial statement of a company encompasses the balance sheet, profit and loss account and additional information. In addition to that, larger entities, subject to financial statement analysis, prepare cash flows statements and a statement of changes in equity. Yearly financial statements of joint-stock companies, limited liability companies, partnerships limited by shares, mutual organisations, cooperatives, state-owned enterprises and other entities are provided along with a yearly business activity report (however, it does not constitute a financial statement component but only its supplement).

Financial statement components are mutually related and constitute an internally consistent entirety, thus they should not be treated as separate and not related parts[8]. The structure of the financial statement is presented in figure 1.

[7] K. Sawicki, *Analiza finansowa na potrzeby rady nadzorczej*, „Rachunkowość", 2001, nr 3, p. 144.

[8] E. Nowak, *Analiza sprawozdań finansowych*, PWE, Warszawa 2014, p. 16.

Figure 1. The structure of financial statement



Source: individual study.

Consolidated financial statement concerns corporate groups and is prepared by a parent unit. It contains the data concerning the parent unit and its subsidiaries.

A multi-plant enterprise which distinguishes organisational units functioning within its structure, that prepare financial statements individually, submits a common financial statement which is a sum of all items of the financial statement of the unit and its branches (plants), with exclusions envisaged by the balance sheet law.

The financial statement should present data concerning the current financial year, as well as the previous financial year. It provides the possibility to compare the changes that occurred in time using the values specified in the financial statement.

Balance sheet is a key component of the financial statement that provides information on the property and financial condition of the enterprise. It summarises by value the property resources of the enterprise (assets) as well as the sources of financing (liabilities) at a given moment (balance sheet date). In other words, it is a "photograph" of the enterprise which represents it property and financial status on a given day.

Profit and loss account is one of the major and obligatory components of the unit financial statement. It provides the information concerning the efficiency of individual types of activity and the overall financial result of the enterprise. The profit and loss ac-

count presents stream values, i.e. the income and profit gained in a given reporting period as well as costs and losses incurred - in that sense it shows the financial result fulfilment during the reporting period.

The profit and loss account includes profit and income as well as costs and losses determined by economic events taking place during the reporting period, and also results of balance sheet valuation of assets and liabilities as of the balance sheet date.

The financial result indicated in the balance sheet has the character of a synthetic information, while in the profit and loss account, it has a more detailed form. The multilevel layout of the profit and loss account allows to distinguish five categories of the financial result[9]:

1) sales result,
2) operating activity result,
3) business activity result,
4) gross financial result,
5) net financial result.

Cash flow statement is an analytical presentation of the data presented in the balance sheet, concerning the change in funds that has been made in the reporting period. It is prepared on the basis of the balance sheet, the profit and loss account, additional information as well as the data included in the summaries of turnover and general ledger accounts balances and also in summaries of subledgers accounts balances. It provides an answer to the question whether the accounting profit was followed by cash taking and whether possible loss would result in sudden loss of financial liquidity[10].

This statement indicates incoming and outgoing cash flows that have effect on the condition of funds. The result category of the cash flow statement are net cash flows. They are the difference between cash takings and expenditures that took place during the reporting period. They may have the form of surplus funds or shortage of funds.

Cash flows should be indicated separately for particular areas of activity: operating, investment and financial.

Summary of changes in equity is an analytical presentation of the data concerning the shape of individual parts of equity, presented commonly in balance sheet liabilities. It contains information on increases or decreases in share capital, outstanding share capital contributions, own shares (stocks), capital reserves, revaluation reserve, other reserve capital and accumulated profit (loss) after taxation from previous years - with specified titles of the presented changes.

Additional information is a descriptive and numerical supplement and specification of the data indicated in particular quantitative summaries (reports) included in the yearly financial statement. The supplementation consists in presenting detailed data and explanations to the aggregated values indicated in the balance sheet, profit and loss account, summary of changes in equity and cash flow statement. The specification consists in disclosing information not mentioned in the other parts of the report, both descriptive and numerical, given in monetary and natural units, that may be significant for the assessment of the economic and financial condition of the enterprise.

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[9] In the profit and loss account of natural persons and partnerships (civil law partnerships, general partnerships, limited liability partnerships, limited partnerships, partnerships limited by shares) net financial result is equal to gross financial result - as PIT income tax is not paid by companies but each owner (partner) individually.

[10] G. K. Świderska, *Jak czytać sprawozdanie finansowe- przewodnik menedżera*, Difin, Warszawa 2009, p. 118.

Additional information encompasses the introduction to the financial statement as well as additional data and explanations. The introduction to the financial statement contains formal and descriptive information concerning the enterprise and assumed accounting solutions.

Additional data and explanations concern the items of the balance sheet, profit and loss account, summary of changes in equity and cash flow statement, proposed profit division or loss coverage method, basic information concerning the employees and enterprise organisational units as well as other information that may be used in order to comprehend the financial statement.

The legislator has not determined the form that additional information should have, therefore each enterprise should assume an individual shape of this report, considering the legal acts and standards to be followed and the functions to be fulfilled. It may be provided in form of a description or charts, or using both descriptions and charts. In practice, the most common format is based on using descriptions and charts.

Business activity statement contains crucial information concerning the property status and financial situation of the enterprise, including the evaluation of effects and indication of risk factors along with description of threats. According to the accounting act, this statement should particularly contain the data concerning:

1) the events having crucial effect on the business activity, that took place during the financial year and later, until the date of acceptance of the financial statement,
2) the expected direction of development,
3) significant achievements in the area of research and development,
4) the current and expected financial situation,
5) the purchase of own shares (stocks) with further purchase characteristics,
6) the branches (plants) of the enterprise,
7) the risk related with possessed financial instruments as well as assumed goals and methods of financial risk management,
8) following the rules of corporate governance (applies only to specific entities).

The act also requires disclosing data in form of financial and non-financial indexes when it is essential to assess the situation of the enterprise, including the information concerning the natural environment and employment as well as additional explanations to the amounts indicated in the financial statement.

The business activity statement attached to the financial statement has a wider economic approach (wide and multi-aspect range), puts emphasis on the usefulness of data in the decision-making process, takes into account the future perspective, introduces non-financial (descriptive) information and accepts subjective judgement of the management. As a result, it constitutes a supplement to the financial statement, increasing its informative capacity[11].

[11] E. Nowak, *Sprawozdanie z działalności jako źródło informacji o dokonaniach przedsiębiorstwa*, in: *Pomiar i raportowanie dokonań przedsiębiorstwa*, edited by. E. Nowak, CeDeWu, Warszawa 2012, p. 143.

3. TRADITIONAL OPTIONS OF USING FINANCIAL STATEMENTS IN PERFORMANCE MANAGEMENT

Financial statements may be used in enterprise performance management in various areas and on different levels of management. The typical options of using financial statements drawn up according to the Polish balance sheet law include[12]:

- using unit and consolidated financial statements in performance management of a corporate group,
- using financial statements of self-balancing plants (branches) in evaluating them as units responsible for result,
- using financial statements in economic and financial analysis on the budget level (planning of achievements), during the implementation (monitoring of achievements) and after completion (evaluation of achievements),
- using the profit and loss account as well as its simplifications in measuring results in responsible units,
- using the cash flow statement in evaluating the fulfilment of assumed relations between cash flows from the operating, investment and financial activity,
- using the balance sheet in creating the optimum structure of the financing sources.

The data included in the financial statement for management purposes, beside the amounts from the current and the previous period, should also include the budgetary information.

There are specific formats of financial statements defined by the Polish balance sheet law, with presentation of categories also indicated by the law. In order to increase their usefulness in measuring achievements, the acceptable alternative options allow to adjust the accounting policy, in particular in the area of the methods of valuation of assets and liabilities as well as determining the financial result, and also the method of running the accounting books.

Other possibilities in this area are provided by the systems of financial accounting based on the rules set by the International Accounting Standards and the International Financial Reporting Standards. These standards do not impose the scope of information to be presented in any financial statement. Financial accounting functioning according to these rules, in order to increase the usefulness of presented information, even promotes presenting new items in financial statements, which allows to adjust them more easily to the management needs.

4. TRENDS OF IMPROVEMENT OF FINANCIAL STATEMENTS FOR THE PURPOSES OF PERFORMANCE MANAGEMENT

Measurement of achievements is followed by many challenges for accounting, constituting the informational basis of performance management. It mainly concerns management accounting, but also, to a smaller extent, financial accounting including financial statements.

Performance management requires using many various measures that enable multidimensional measurement and evaluation of achievements in all fields of business activity. The essential condition of using accounting in the role of a system that provides informa-

[12]A. Szydełko, *Rachunkowość jako baza informacyjna controllingu,* in: *Controlling dla menedżerów,* edited by E. Nowak, CeDeWu, Warszawa 2013, p. 129.

tive support to the processes of performance management, is to create an integrated accounting system, focused on generating multidimensional information concerning various achievements.

The issue of financial statements is associated with the integration of the financial accounting principles, as well as with the integration of financial accounting and management accounting.

The integration processes in financial accounting, oriented on the measurement of achievements, occur less frequently, since their consequences have effect not only on the performance management requirements, but also result in appearance of categories that must meet the requirements of the balance sheet law. It is usually related with improvement of quality of categories already determined in the financial accounting system, rather than generation of new categories allowing to create directly or indirectly new measures of achievements (which would require certain changes in the balance sheet law), which finally improves the informative values of financial statements and also usefulness of achievement measures.

The major area of financial accounting where these processes occur, is the cost account. Appearance of the category of product generation, comprising variable costs and fixed costs in relation with the degree of using the current production capacity of the enterprise, is an example of a hybrid solution[13] formed as a result of "crossing" the reporting full cost account with the variable cost account[14]. Such integration results in improvement of credibility of data concerning the costs incurred for the products and the costs of the period, and as a consequence, the financial result is determined more precisely as a measure of total yearly business performance of the enterprise. It is specially reflected in the profit and loss account.

The issue of integration of financial accounting and the methods of management accounting in order to improve the possibilities of informative support of performance management, is also interesting. Processes of this type particularly appear in international accounting regulations (standards), e.g. IAS/IFRS, US GAAP) and in the guidelines of the international accounting organisations (e.g. IFAC), and also in the scientific research.

This area of integration particularly concerns the structure of the financial statement. An interesting solution in this field has been presented by J. Gierusz[15], who proposed measuring economic value added (EVA) using the balance sheet formulas of the profit and loss account.

Irrespective of the integrating processes taking place for the purposes of performance management, there is a noticeable trend of using achievement measurement tools in order to improve the quality and increase the scope of data provided in statements regulated by the balance sheet law. One of the examples is the National Accounting Standard No. 9 "Business activity report"[16] which aims at facilitating the preparation of the financial

[13] A. Szydełko, *Hybrydowe rachunki kosztów w kreowaniu informacji na potrzeby zarządzania kosztami,* „Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, 2010, nr 123, pp. 506-509.

[14] A. Szydełko, *Możliwości wkomponowania rachunku kosztów zmiennych w ewidencyjne rozwiązania systematycznego rachunku kosztów,* „Controlling i Rachunkowość Zarządcza", 2000, No. 8.

[15] J. Gierusz, *Koszty i przychody w świetle nadrzędnych zasad rachunkowości. Pojęcia. Klasyfikacja. Zakres ujawnień,* ODDK, Gdańsk 2005, pp. 232-245.

[16] Announcement No. 4 of the Minister of Finance dated 30 April 2014 concerning the publication of the National Accounting Standard No. 9 "Business activity report", Official Journal of the Minister of Finance of 2014, item 17.

statement as well as other similar statements, according to the needs of the stakeholders, and also promoting good practices in this scope.

That standard requires that in order to characterise the activity, results and situation of the enterprise, the key financial and non-financial measures used for the evaluation should be presented along with a description and indication of the purpose of using, principles of calculation, sources of data, trends and reference to standard values. The recommendations of the standard refer to using the measures originating in the financial statement. In case of measures generated through modification of that statement (EBIT, EVA), any introduced modifications shall be explained.

5. CONCLUSION

Environment analysis is particularly important in this context. Effective performance management requires using a range of various data. One of the sources of these data are financial statements, which are the final "product" of financial accounting. They provide credible information required for performance management through the aspect of assessment of the property and financial status of the enterprise, as well as the results achieved.

Supporting performance management with the data provided by financial statements may be fulfilled traditionally, using the existing obligatory formats of these statements, based on the principles of financial statements preparation. The article also indicates the directions for improvements in the structure and principles of preparation of financial statements in order to increase the usefulness of the provided data in performance management.

The conducted analysis has led to the conclusion that particular elements of financial statement are very useful in assessing achievements in selected areas of performance management. It particularly concerns the multidimensional measurement of property resources, results of activity, cash flows (financial measures), as well as various assessments and judgements, including the evaluation of effects, determination of risk factors and specification of threats (non-financial measures). However, Polish financial statements legally formalised by the accounting act provide limited capabilities of using them in performance management. The entities that prepare financial statements according to the International Accounting Standards/International Financial Reporting Standards have considerably better capabilities in that field.

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[8] Sawicki K., 2001, *Analiza finansowa na potrzeby rady nadzorczej,* „Rachunkowość", No. 3.
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[12] Świderska G.K., 2009, *Jak czytać sprawozdanie finansowe- przewodnik menedżera*, Difin, Warszawa.
[13] *The Accounting Act of 29 September 1994*, with further amendments (consolidated text, Journal of Laws of 2013, item 330

ROLA SPRAWOZDANIA FINANNSOWEGO W ZARZĄDZANIU DOKONANIAMI

Celem opracowania jest wskazanie możliwości wykorzystania sprawozdania finansowego jako źródła informacji ekonomicznych wspomagających zarządzanie dokonaniami. Na tle istoty sprawozdania finansowego zaprezentowano poszczególne jego elementy, dokonując równocześnie niezbędnych charakterystyk bilansu, rachunku zysków i strat, informacji dodatkowej, rachunku przepływów pieniężnych, zestawienia zmian w kapitałach (funduszach) własnych oraz sprawozdania z działalności jako sprawozdania uzupełniającego sprawozdanie finansowe w wybranych jednostkach. W artykule zwrócono szczególną uwagę na możliwości wykorzystania sprawozdań finansowych jako finalnego produktu rachunkowości finansowej do informacyjnego wspomagania procesów zarządzania dokonaniami. Przeprowadzono rozważania na temat klasycznych możliwości aplikacyjnych sprawozdania finansowego z zarządzaniu dokonaniami. Wskazano równocześnie kierunki doskonalenia konstrukcji i zasad sporządzania sprawozdań finansowych na potrzeby zwiększenia przydatności dostarczanych przez nie informacji na potrzeby zarzadzania dokonaniami. Przeprowadzone rozważania doprowadziły do stwierdzeń, że poszczególne elementy sprawozdania finansowego znakomicie nadają się do pomiaru dokonań w wybranych obszarach zarządzania dokonaniami. Dotyczy to szczególnie wieloprzekrojowego pomiaru zasobów majątkowych, rezultatów działalności, przepływów pieniężnych (mierniki finansowe), jak również różnego rodzaju ocen i osądów, w tym ocenę uzyskanych efektów, wskazanie czynników ryzyka i opis zagrożeń (mierniki niefinansowe). Sformalizowane prawnie przez ustawę o rachunkowości polskie sprawozdania finansowe mają jednak ograniczone możliwości co do ich dostosowywania do potrzeb zarzadzania dokonaniami. Znacznie większe możliwości w tym zakresie mają jednostki sporządzające sprawozdania finansowe zgodnie z wymogami MSR/MSSF. W rozważaniach wykorzystano metody przeglądu i analizy literatury oraz aktów prawnych, a wnioskowanie przeprowadzono z uwzględnieniem metod indukcji i dedukcji oraz rozumowania przez analogię.

Słowa kluczowe: zarządzanie dokonaniami, rachunkowość finansowa, sprawozdanie finansowe.

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ENTERPRISE ENVIRONMENT ANALYSIS – METHODS IN USE AND DEVELOPMENT TRENDS

The purpose of the article is to describe the methods of analysis of enterprise environment and to determine future trends in analysis development. The environment analysis is presented in detail along with the major analytical methods in use. The focus is on the macro environment (economic, political and legal, social and cultural, technological, international factors) and the competitive environment (which is the source of data that enable to determine the opportunities and threats for enterprises in a given sector). The article contains a synthetic presentation of selected methods of analysis of the close and distant environment. In this aspect, it contains a description of non-scenario methods (trend extrapolation, strategic gap analysis, expert opinions – Delphi method) and scenario-based methods (scenarios of possible events, simulation scenarios, environment condition scenarios, environmental processes scenarios), Porter's five forces analysis, sector economic profile, score evaluation of sector attractiveness, strategic groups mapping, clusters analysis, experience curve analysis and sector globalisation capability analysis. Additionally, goals for improvement of enterprise environment analysis methods are set. Particular emphasis in this regard is put on the aspects related with enterprise environment scanning, integration of existing methods (integration at the level of macro environment and competitive environment analysis methods), introduction of new methods and integration of enterprise environment analysis with management instruments, such as strategic management accounting focused on enterprise environment. The purpose of the article determined the selection of research methods. The following methods have been used: critical review of Polish and international literature, deductive reasoning and analysis.

Keywords: analysis of distant and competitive environment, enterprise environment scanning, strategic management accounting focused on enterprise environment

1. INTRODUCTION

All enterprises that desire to survive on a given market must continually adjust to the conditions and requirements of the changing and dynamic environment[3] and meet the constantly growing expectations of customers. These goals can only be fulfilled when the enterprise undergoes continuous changes that not only affect its existence on the market, but also enforce actions that facilitate introducing new products, improving quality of service, consulting and post-purchase support as well as improving the flexibility of the

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[3] P. T. Ward, R. Duray, *Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy*, "Journal of Operations Management", Vol. 18, 2000, p. 124.

organisational structures. Choosing a right strategy of action and the methods of its implementation is essential for the company to succeed, increasing its corporate value.

Proper identification and formulation of strategy, as well as implementation and strategic control are the most important elements of strategic enterprise management. It is impossible to determine the actions that enable reaching the set strategic goals without conducting an in-depth strategic analysis.

Enterprise environment analysis is certainly of key importance in this field and this article presents the methods used in for the purposes of the analysis and future development trends. The article refers to the following research methods: critical review of Polish and international literature, deductive reasoning and analysis.

2. STRATEGIC ANALYSIS VERSUS COMPANY ENVIRONMENT ANALYSIS

Defining the strategic analysis and determining its scope is a hard task. Some researchers treat it as a set of activities that provide a diagnosis of the enterprise and its environment and enable to develop and implement a strategic plan[4]. It must be mentioned that most often it is done with the assumption of business risk minimising. The data derived from strategic analysis enable development and implementation of the strategy of action (identification and formulation of strategy, implementation and strategic control).

Strategic analysis provides a comprehensive (overall) view of the enterprise along with its environment. It allows to identify the weak and strong points of the business entity and indicate possible opportunities and threats that may occur in its environment. In order to acquire these data, enterprise environment analysis and internal environment analysis must be performed[5].

The analysis of enterprise environment should refer to the macro environment and the competitive environment (industry, sector). The macro environment is often referred to as the distant environment encompassing:[6]

1) economic,
2) political and legal,
3) social and cultural,
4) technological,
5) international fields.

Enterprises must take into account the economic conditions for running business in a given country. While developing the strategy, it is important to envisage future trends in GDP, rate of unemployment, currency exchange rates, inflation rate, interest rates, salary increase/decrease dynamics, industrial production and retail indexes, tax rates (corporate income tax, personal income tax, value added tax, excise tax), tax-like burdens (social security charges) and many other economic parameters. Variability in materials prices and other production-related factors must also be considered.

The data derived from the economic environment should generally determine the future trends (framework) of business activity. Owners of enterprises as well as managers

[4] G. Gierszewska, M. Romanowska, *Analiza strategiczna przedsiębiorstwa*, PWN, Warszawa 2002, p. 17.

[5] A. T. Joseph, *Formulation on Manufacturing Strategy*, "The International Journal of Advanced Manufacturing Technology", Vol. 15, 1999, pp. 522-523.

[6] R. Krupski, *Analiza otoczenia*, [in:] *Zarządzanie strategiczne. Koncepcje – metody*, edited by R. Krupski, Wydawnictwo Akademii Ekonomicznej we Wrocławiu, 2003, p. 114.

employed must pay particular attention to these parameters, as in many cases they have direct effect on profitability of business (business model).

The political and legal conditions are also very important. In this context, stability of the economic law, tax regulations, labour law, civil law, financial, administrative, criminal and fiscal laws largely affects decisions determining the future of the enterprise. It is also worth noting whether a given country belongs to any international organisations (e.g. European Union). In many cases, such organisations compel unification of certain legal and political regulations. What should not be underestimated is the fact that state interference in certain areas of economy may depend on the economic views of the ruling party or coalition.

The social and cultural environment is quite often neglected, or even marginalised while developing the strategy of business entities. Demographic changes within the societies are not taken into account very often (ageing society generates demand for quite different products in comparison with societies with dynamic population growth). Education and mobility of potential customers, as well as their capability to adapt to certain fashion trends are also ignored.

The technological environment is related with all aspects of technological development reflected in the changes in the methods of production. The Internet has gained a very significant role in this area. It has enabled rapid flow of information and reaching potential customers using new distribution channels. The latest technological solutions facilitate choosing the most appropriate method of production and optimising the use of production factors. Enterprises that implement innovative technologies may be more competitive and, certainly, be managed more effectively.

The international environment may pose both opportunities and threats for business, noticeable in certain international conditions (factors) that have positive or negative effect on the demand for particular products. For instance, international organisations may impose sanctions on certain countries, which is favourable for enterprises that are not restricted on the market in any way.

In the strategic analysis it is not enough to identify the macro environment. The research of the competitive environment is also required. The data concerning the competitive environment may be used to identify the opportunities and threats for enterprises in a given sector. The sector is defined as a part of the industry which encompasses enterprises supplying products of similar purpose and selling them on the same geographical market[7]. Additionally, managers should perform a relevant in-depth analysis of suppliers and customers as well as current and possible (future) competitors and certain trends in occurrence of substitute products.

In order to perform a thorough analysis of the sector, strategic segmentation should be made. It means that uniform products and markets characterised by the same combination of key success factors and requiring particular competitive skills and assets must be distinguished in the enterprise activity[8].

Most frequently used criteria, on the basis of which such segments can be distinguished, are branch and geographic variables. In certain situations, other determinants are considered, among others: type of customer, utility function, type of distribution network, type of production technology in use, competitors as well as direct and indirect costs (cost

[7] M. E. Porter, *Strategia konkurencji. Metody analizy sektorów i konkurentów [Competitive Strategy: Techniques for Analyzing Industries and Competitors]*, PWE, Warszawa 2000, p. 23.

[8] G. Gierszewska, M. Romanowska, *Analiza…*, *op. cit*., p. 96.

structure related with production, relation of costs and the object of calculation – the product)[9].

Some authors claim that complete description of a segment requires identification of the following dimensions[10]:

1) groups of customers buying the product,
2) functions offered by the product to the customers,
3) forms in which the product can be expressed.

A three dimensional view of the segment enables direct specification. However, it is worth pointing out that a given dimension of the strategic segment should be detailed. Customers may be identified more precisely and properly grouped. The functions offered by the product (to the customer) can be treated in a similar way, so as the forms in which it is expressed.

3. SELECTED METHODS OF ANALYSIS OF ENTERPRISE ENVIRONMENT

In the theory and practice there is a variety of methods used in analysing the enterprise environment. The distant environment can be analysed using non-scenario techniques (multiple possibilities) or scenario-based techniques[11].

In case of non-scenario methods, only one possibility of action is assumed (development strategy), encompassing major threats posed by the environment and very often neglecting the opportunities that may occur. This method of analysis is based on the conclusions resulting from the changes that have already occurred within the environment (*ex post*), or have been identified as possible in future (*ex ante*).

What is characteristic for the scenario approach is that there are numerous variants of possible actions (development strategies) that depend on the future condition of the macro environment. The major problem related with this method of analysis is predicting the future condition of the distant environment. It is not easy to do, since it requires making certain assumptions concerning the future. Most often it is done on the basis of previous observations of the macro environment.

Each method of macro environment analysis, both non-scenario and scenario-based, is closely related with methods of implementation. Table 1 contains a brief description of each method.

Table 1. Macro environment analysis - methods

Non-scenario macro environment analysis		Scenario-based macro environment analysis	
Method	Method application	Method	Method application
Trends extrapolation	Having the knowledge concerning the past and the present course of changes within the macro environment, their future course is planned, assuming that the current trend is maintained.	Scenarios of possible events	The method is based on creating a set of actions possible to be taken in future and very important for the enterprise. This approach also defines the causes of the future events, trends, effect strength and adjustment capabilities of a given business entity.

[9] Strategor, *Zarządzanie firmą. Strategie, struktury, decyzje, tożsamość*, PWN, Warszawa 1999, pp. 113-115.

[10] D. F. Abell, *Dualizm w zarządzaniu. Dziś i jutro firmy [Managing with dual strategies: Mastering the present, preempting the future]*, Poltext, Warszawa 2000, p. 63.

[11] H. Kozarowicz, *Czynnik czasu w analizie strategicznej*, [w:] *Zarządzanie strategiczne…, op. cit*., pp. 114-118.

Non-scenario macro environment analysis		Scenario-based macro environment analysis	
Method	Method application	Method	Method application
Strategic gap analysis	The method analyses the convergence of the existing strategy along with the procedures of action followed by the enterprise and the future changes within distant environment. In case of failure to adjust, certain discrepancies occur, that may be described as the strategic gap. The type of the gap is essential (conformity gap, surplus gap, deficiency gap).	Simulation scenarios	This method enables anticipating evaluation of possible strategic decisions of the enterprise depending on the impact of the environment (impact of specific factors). It enables to evaluate the consequences of particular strategic decisions and the capability of the organisation to adjust to different possibilities in the distant environment.
Expert opinions – Delphi method	Potentially possible future changes within the distant environment are determined on the basis of the knowledge and experience of experts.	Environment condition scenarios	It is a quality-based method that provides the evaluation of potential impact of particular changes occurring in the distant environment on the organisation. It enables estimating the possibility of occurrence of these changes in future (optimistic, pessimistic, unexpected with low possibility, most likely scenarios).
		Environmental processes scenarios	In this method, processes that occur in the macro environment and affect business entities are significant. These processes include key processes (strong impact on the organisation and most likely to occur in future) and processes of discrete changes (with strong impact on the organisation and little possibility of occurrence). Knowing these processes and relations between them, as well as the occurring trends allow to envisage the future behaviour of the macro environment. It is very important in development of business strategies.

Source: individual work on the basis of: G. Gierszewska, M. Romanowska, *Analiza strategiczna przedsiębiorstwa*, PWN, Warszawa 2002, pp. 49-91; B. Olszewska, *Analiza strategiczna otoczenia*, [in:] *Zarządzanie strategiczne*, edited by S. Kiełczewski, Wydawnictwo Akademii Ekonomicznej we Wrocławiu, 2000, pp. 92-103.

There are advantages and drawbacks of all presented methods. In many cases they will be applied with certain assumptions. Certainly, it is noticeable that they conform to the goals to be fulfilled in the analysis of the macro environment.

The analysis of the competitive environment is also performed using various methods. Specific sectors can be analysed on the basis of the distinguished strategic segments. The methods used in the competitive environment analysis are described in Table 2.

Table 2. Sector environment analysis - methods

Method	Method application
Porter's five forces analysis	This method analyses five factors that have effect on decisions made by investors. They are: • bargaining power of suppliers and buyers, • threat of new entrants and substitutes, • competitive rivalry within the sector. The method enables determining the scale of competition and profitability within a given sector.
Sector economic profile	This method describes and quantifies the characteristic features of the sector. The factors taken into account include: • market size, • scope of competition, • market growth rate, • number of competitors and their relative market participation, • number of buyers, • degree and possibilities of forward and backward integration, • scale of entry and exit barriers, • degree of differentiation of competitors' products, • occurrence of the scale and learning effect, • capital requirements, • sector profitability. Sector economic profile enables comparing various sectors with each other.
Score evaluation of sector attractiveness	This method provides a precise sector assessment tool and enables comparing sectors due to application of multiple-criteria and weighted scoring. It is possible due to: • identification of major features determining the sector value, • adopting certain assessment criteria, • attributing particular values to proper features, • specifying total score for particular sectors.
Strategic groups mapping	This method provides a graphic representation of the competitive situation within the sector. The mapping encompasses strategic groups containing enterprises competing with use of similar methods (techniques). The data provided by the map of strategic groups determine the decision whether to change a given strategic group or sector.
Clusters analysis	This method is used in determining mutual geographic relations between manufacturers of final products and: • specialised suppliers, • service units, • financing institutions, • enterprises operating in related sectors, • closest competitors, • closest clients, • branch institutions, • governmental and non-governmental organisations, • producers of complementary goods.

Method	Method application
Experience curve analysis	Is constructed on the basis of the accumulated production size and the unit cost of production for products supplied by enterprises within the sector. This curve facilitates determining the position of the enterprise within the sector and the feasible cost strategy. Entry barriers of a given sector can also be specified.
Sector globalisation capability analysis	This method enables determining the capability to develop global competition within sectors. According to M. Porter, the factors favourable for globalisation include: • occurring of comparative costs or benefits in certain countries, • production scale, logistics, marketing and supply economy, • experience in a global scale, • product differentiation in terms of benefit for the country of origin, • technique exclusivity in terms of high expenditures on technologies, • mobility of production.

Source: individual work on the basis of: G. Gierszewska, M. Romanowska, *Analiza strategiczna przedsiębiorstwa*, PWN, Warszawa 2002, pp. 92-160; M. E. Porter, *Strategia konkurencji. Metody analizy sektorów i konkurentów [Competitive Strategy: Techniques for Analyzing Industries and Competitors]*, PWE, Warszawa 2000, pp. 272-275; L. Berliński, I. Penc-Pietrzak, *Inżynieria projektowania strategii przedsiębiorstwa. Konstrukcja i technologia*, Difin, Warszawa 2004, pp. 202-219.

Differentiation of the presented methods facilitate comprehensive analysis of the competitive environment. It is also noticeable that individual methods are associated with fulfilment of particular goals related with that analysis. Additionally, the methods that can be applied facilitate continuous monitoring of everything that happens in the competitive environment of the enterprise. The emphasis on accuracy of individual analytical methods, with consideration of the structure and dynamics, is crucial in this field of analysis.

4. DEVELOPMENT TRENDS IN ENTERPRISE ENVIRONMENT ANALYSIS

The close and distant environment is undergoing continuous changes, which results in occurrence of certain processes in the field of analysis of these environments. The analysis itself is certainly developing in various directions[12]. The following areas of development can be distinguished:

1) Environment analysis as the element of enterprise environment scanning,
2) Integration of existing methods of enterprise environment analysis,
3) Introduction of new methods of enterprise environment analysis,
4) Integration of environment analysis with other instruments, e.g. strategic management accounting with focus on enterprise environment.

Enterprise environment scanning may be defined in various ways. In theory and in practice it is described as acquiring and using data concerning events, trends and relations between them in the external environment of the enterprise, which is useful in planning future moves (actions) of the enterprise[13]. The wide definition of scanning allows to reach beyond data acquisition in a certain way, and also concerns data analysis and its use in

[12] A.U. Khan, N.M. Alam, S. Alam, *A critical analysis of internal and external environment of Apple Inc.*, International Journal of Economics, Commerce and Management, Vol. III, Issue 6, 2015, pp. 955-967.

[13] Ch. W. Choo, *The Art of Scanning the Environment*, „Bulletin of the American Society for Information Science",1999, pp. 21-24.

management[14]. The described process is related with the macro environment and the competitive environment. Modern analysis of enterprise environment may certainly be considered a part of scanning in a multi-aspect view.

It is possible to integrate the environment analysis methods. Distinguishing the following fields of integration may be useful:

1) Integration of methods used only in macro environment analysis,
2) Integration of methods used only in competitive environment analysis,
3) Integration of methods used in macro environment and competitive environment analysis.

Irrespective of the field of matching, integrated methods should always provide multidimensional and detailed information concerning the trends and relations occurring within the enterprise environment. In some cases, that environment undergoes dynamic and turbulent changes, which requires searching for new (yet unknown) methods in the literature and economic practice.

Recent time has brought emergence of concepts of integrating the enterprise environment analysis with other management instruments. One of the most interesting proposals is the idea of using strategic management accounting in identifying opportunities and threats in the external environment of the enterprise[15]. In this case, environment analysis can be integrated with properly focused strategic management accounting (particularly in the field of application of strategic management accounting instruments**).**

5. CONCLUSION

Turbulent environment affects business and the scope of strategic analyses. Environment analysis is particularly important in this context. Analysing the close and distant environment allows to indicate the possibilities of adjustment to external conditions that undergo continuous and dynamic changes. The described analysis must be performed with the use of certain methods that should particularly concern the macro environment and the competitive environment.

Besides this the possible trends of improvement should refer to enterprise environment scanning as well as internal integration processes between various methods of environment analysis and external integration processes with management instruments such as strategic management accounting.

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ANALIZA OTOCZENIA PRZEDSIĘBIORSTWA – STOSOWANE METODY I KIERUNKI ROZWOJU

Celem artykułu było przedstawienie metod analizy otoczenia przedsiębiorstwa oraz określenie przyszłych kierunków rozwoju tej analizy. Przedstawiono w sposób szczegółowy analizę otoczenia i jej główne metody. Skoncentrowano się na makrootoczeniu (otoczenie: ekonomiczne, polityczno-prawne, socjo-kulturowe, technologiczne, międzynarodowe) oraz otoczeniu konkurencyjnym (dzięki informacjom pochodzącym z tego otoczenia można określić szanse i zagrożenia płynące dla przedsiębiorstw w danym sektorze). W sposób syntetyczny zaprezentowano wybrane metody analizy otoczenia bliższego i dalszego. Opisano w tym zakresie metody bezscenariuszowe (ekstrapolacji trendów, analizę luki strategicznej, opinie ekspertów – metodę delficką, i scenariuszowe (scenariusze możliwych zdarzeń, scenariusze symulacyjne, scenariusze stanów otoczenia, scenariusze procesów w otoczeniu), analizę „5 sił Portera", profil ekonomiczny sektora, punktową ocenę atrakcyjności sektora, mapę grup strategicznych, analizę gron, analizę krzywej doświadczeń oraz analizę potencjału globalizacyjnego sektora. Wskazano również kierunki doskonalenia metod analizy otoczenia przedsiębiorstwa. Szczególną uwagę w tym zakresie zwrócono na aspekty związane ze skanowaniem otoczenia przedsiębiorstwa, integrację istniejących metod (integracja na poziomie metod analizy makrootoczenia, integracja na poziomie metod analizy otoczenia konkurencyjnego, integracja na poziomie metod analizy makrootoczenia i otoczenia konkurencyjnego), wprowadzenie nowych metod oraz integrację analizy otoczenia przedsiębiorstwa z instrumentami zarządczymi takimi jak np. strategiczna rachunkowość zarządcza ukierunkowana na otoczenie przedsiębiorstwa. Przyjęty cel artykułu zdeterminował wybór metod badawczych. Wykorzystano w tym zakresie metody: krytycznego przeglądu literatury polskiej i zagranicznej, wnioskowania dedukcyjnego i analizy.

Słowa kluczowe: analiza otoczenia dalszego i konkurencyjnego, skanowanie otoczenia przedsiębiorstwa, strategiczna rachunkowość zarządcza zorientowana na otoczenie przedsiębiorstwa

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Petre Iltchev, Anna Piechota, Remigiusz Kozłowski, Michał Marczak: The capital market as a source of financing for small innovative companies in the medical industry

ADDITIONAL INFORMATION

The Journal annually publishes a list of reviewers: in the last issue of the quarterly - no. 4/2016 and on the website:
http://oficyna.prz.edu.pl/pl/zeszyty-naukowe/modern-management-review/
http://mmr.prz.edu.pl/pl/recenzenci-wspolpracujacy/

Previous name of the Journal: *Zarządzanie i Marketing*, ISSN 1234-3706
http://oficyna.prz.edu.pl/pl/zeszyty-naukowe/zarzadzanie-i-mar/
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The Journal uses as described on its website the procedure for reviewing:
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Reviewing standards, information for authors, the review form, instruction for authors and contact details to MMR Editors and to Publishing House are also published in the fourth number of Modern Management Review, no. 23 (4/2016).

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Zasady recenzowania artykułów naukowych w Zeszytach Naukowych Politechniki Rzeszowskiej

Procedura recenzowania artykułów naukowych w Zeszytach Naukowych Politechniki Rzeszowskiej jest zgodna z zaleceniami MNiSzW opracowanymi w formie broszury „Dobre praktyki w procedurach recenzyjnych w nauce", Warszawa 2011 r.

1. Do oceny każdego artykułu redaktorzy tematyczni (naukowi) powołują dwóch niezależnych recenzentów spoza jednostki naukowej afiliowanej przez autora artykułu.
2. W przypadku artykułów napisanych w językach obcych, co najmniej jeden z recenzentów jest afiliowany w instytucji zagranicznej innej niż narodowość autora artykułu.
3. Redaktorzy tematyczni (naukowi) dobierają recenzentów najbardziej kompetentnych w danej dziedzinie.
4. Między recenzentami i autorami artykułów nie występuje konflikt interesów; w razie potrzeby recenzent podpisuje deklarację o niewystępowaniu konfliktu interesów.
5. Procedura recenzowania przebiega z zachowaniem zasad poufności – recenzenci i autorzy nie znają swoich tożsamości (double-blind reviev process).
6. Każda recenzja ma formę pisemną i kończy się wnioskiem o dopuszczenie lub odrzucenie artykułu do publikacji.
7. Nie są przyjmowane recenzje niespełniające merytorycznych i formalnych wymagań.
8. Wstępnie zakwalifikowany przez redaktora naczelnego do wydania artykuł zostaje wysłany do recenzentów, którzy wypowiadają się na temat jego przyjęcia lub odrzucenia. Recenzenci mają prawo do powtórnej weryfikacji poprawionego tekstu.
9. W przypadkach spornych powoływani są dodatkowi recenzenci.
10. Uwagi recenzentów są przekazywane autorowi, który ma obowiązek poprawienia tekstu.
11. Ostateczną decyzję o zakwalifikowaniu lub odrzuceniu artykułu podejmuje redaktor naczelny czasopisma, zasięgając opinii członków Komitetu Redakcyjnego.
12. Kryteria kwalifikowania lub odrzucenia artykułu są zawarte w formularzu recenzji.
13. Formularz recenzji znajduje się na stronie internetowej Zeszytów Naukowych.
14. Nazwiska recenzentów współpracujących będą podawane raz w roku – w ostatnim numerze czasopisma, a także opublikowane na stronie internetowej czasopisma (nazwiska recenzentów poszczególnych publikacji lub numerów wydań czasopisma nie są ujawnione).
15. Szczegółowe informacje nt. recenzowania artykułów oraz przebiegu prac w redakcji czasopisma i Oficynie Wydawniczej są opisane w wytycznych dla autorów artykułów naukowych.

Informacje dla autorów artykułów naukowych publikowanych w Zeszytach Naukowych Politechniki Rzeszowskiej zjawiska *ghostwriting* i *guest authorship*

Aby przeciwdziałać nierzetelności w nauce (ghostwriting, guest authorship), redakcje Zeszytów Naukowych Politechniki Rzeszowskiej prowadzą odpowiednie procedury charakterystyczne dla reprezentowanych dziedzin nauki i na bieżąco wdrażają podane rozwiązania:

1. Redakcja wymaga podania wkładu poszczególnych autorów w powstanie artykułu (z podaniem ich afiliacji i informacji, kto jest autorem koncepcji, założeń, badań itd.); główną odpowiedzialność ponosi autor zgłaszający artykuł.

2. Redakcja wyjaśnia autorom pojęcia ghostwriting i guest authorship, które są przejawem nierzetelności naukowej, a wszelkie wykryte przypadki tego typu działań ze strony autorów będą demaskowane, włącznie z powiadomieniem odpowiednich podmiotów (instytucje zatrudniające autorów, towarzystwa naukowe itp.).

3. Redakcja uzyskuje informacje o źródłach finansowania publikacji, wkładzie instytucji naukowo-badawczych i innych podmiotów (financial disclosure).

4. Redakcja będzie dokumentować wszelkie przejawy nierzetelności naukowej, zwłaszcza łamania zasad etyki obowiązujących w nauce.

Z ghostwriting mamy do czynienia wówczas, gdy ktoś wniósł istotny wkład w powstanie artykułu, lecz ani jego udział jako jednego z autorów nie został ujawniony, ani nie wymieniono go w podziękowaniach zamieszczonych w publikacji.

Z guest authorship mamy do czynienia wówczas, gdy udział autora jest znikomy lub w ogóle nie miał miejsca, a jego nazwisko jest podane jako autora lub współautora.

Formularz recenzji / Review Sheet

Zeszyty Naukowe (HSS i MMR) / Scientific Papers (HSS and MMR)

Tytuł pracy/Title:

A **Prosimy o odpowiedzi na następujące pytania**
Please respond to the following questions

1. **Czy tytuł pracy jest zgodny z jej treścią?** ❒ **Tak** ❒ **Nie**
Does the title of the paper reflect the content sufficiently? ❒ **Yes** ❒ **No**

2. **Czy podejmowane problemy są aktualne?** ❒ **Tak** ❒ **Nie**
Are the discussed issues up-to-date? ❒ **Yes** ❒ **No**

3. **Oryginalność pracy**
Paper originality ..... **Max. 20 points**

4. **Realizacja założeń sformułowanych w celu pracy**
Goals realization formulated in the paper objective **Max. 20 points**

5. **Poprawność języka i stylu pracy**
Language and style correctness ..... **Max. 20 points**

6. **Dobór literatury i wykorzystanych źródeł**
Proper selection of literature and sources ..... **Max. 20 points**

7. **Poprawność wnioskowania i jego zasadność wynikająca z treści pracy**
Correctness on drawing conclusions and its relevance resulted from the paper content ..... **Max. 20 points**

Suma punktów: .....
Total no. of points: .....

8. **Czy praca powinna zostać opublikowana?**
Is the paper suitable for publication?

❒ **Tak/Yes**

❒ **Tak, ale po wprowadzeniu wyszczególnionych w punkcie 9. uwag**
Yes, but after the remarks specified in point 9 are corrected

❒ **Nie, ponieważ/No, because**

B **Poufne/Confidential**

Imię i Nazwisko / Name and Surname

Adres / Address

.....
podpis Recenzenta / Signature of the Reviewer

Uzasadnienie odrzucenia recenzji/ Justification of review rejection

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9. Proponowane przez Recenzenta zmiany:
Suggested changes by the Reviewer:

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Instrukcja dla autorów artykułów naukowych publikowanych w Oficynie Wydawniczej Politechniki Rzeszowskiej

Dane podstawowe

1. Pole zadruku: 12,5 x 19 cm + 1 cm na numery stron
2. Marginesy: górny – 5,20 cm, dolny – 5,20 cm, lewy – 4,25 cm, prawy – 4,25 cm
3. Czcionka: Times New Roman 11 pkt
4. Edytor: Microsoft Word
5. Zapis tekstu: obustronnie wyjustowany, interlinia pojedyncza, wcięcie pierwszego wiersza 0,75 cm, nie należy zostawiać pustych wierszy między akapitami
6. Wszystkie kolumny artykułu powinny być w całości wypełnione; pierwsza strona nietypowa – zawiera nagłówek, nazwisko Autora (Autorów), tytuł artykułu, streszczenie i początek artykułu, kolejne strony zawierają dalszą część artykułu, w tym tabele (tablice), rysunki (ilustracje, fotografie, wykresy, schematy, mapy), literaturę i streszczenie
7. Należy wprowadzić automatyczne dzielenie wyrazów

Dane szczegółowe (układ artykułu)

1. Na pierwszej stronie (nieparzystej) należy umieścić nagłówek (do pobrania): 10 pkt, pismo grube
2. Na kolejnych stronach artykułu u góry należy umieścić paginę żywą: strona parzysta – numer strony do lewego marginesu, pismo podrzędne 10 pkt, inicjał imienia i nazwisko Autora (Autorów) do prawego marginesu, pismo podrzędne 10 pkt; strona nieparzysta – tytuł artykułu lub (w przypadku dłuższego tytułu) jego logiczny początek zakończony wielokropkiem, pismo podrzędne 10 pkt
3. W dalszym ciągu na pierwszej stronie należy umieścić pismem grubym (odstęp przed 42 pkt): imię (pismo podrzędne 10 pkt), nazwisko (wersaliki 10 pkt) Autora (Autorów)
4. Tytuł artykułu – wersaliki 15 pkt, pismo grube, do lewego marginesu (nie należy dzielić wyrazów w tytule), interlinia pojedyncza, odstęp przed 24 pkt, odstęp po 18 pkt
5. Streszczenie (w języku artykułu) – 200-250 słów, pismo podrzędne 9 pkt, wcięcie całości z lewej strony 2 cm, bez akapitu, interlinia pojedyncza, odstęp po 12 pkt
6. Słowa kluczowe – pismo podrzędne 9 pkt, bez akapitu, interlinia pojedyncza, odstęp po 24 pkt
7. Imię i nazwisko Autora do korespondencji oraz pozostałych Autorów, afiliacja, adresy pocztowe, numery telefonów, e-maile – na dole pierwszej strony, pod kreską, pismo podrzędne 9 pkt z odpowiednimi odnośnikami, odstęp przed 2 pkt
8. Śródtytuł 1. stopnia – pismo podrzędne 13 pkt, grube, do lewego marginesu, interlinia pojedyncza, odstęp przed 14 pkt, odstęp po 9 pkt
9. Tekst artykułu, a w nim tabele (tablice), materiał ilustracyjny, wzory oraz śródtytuły niższego stopnia

10. Śródtytuł 2. stopnia – pismo podrzędne 11,5 pkt, grube, do lewego marginesu, interlinia pojedyncza, odstęp przed 10 pkt, odstęp po 8 pkt
11. Śródtytuł 3. stopnia – pismo podrzędne 11 pkt, do lewego marginesu, interlinia pojedyncza, odstęp przed 8 pkt, odstęp po 6 pkt
12. Nagłówek Literatura – pismo podrzędne 11,5 pkt, grube, do lewego marginesu, odstęp przed 12 pkt, odstęp po 8 pkt
13. Spis literatury cytowanej – pismo podrzędne 10 pkt, interlinia pojedyncza, nie należy zostawiać pustych wierszy między pozycjami literatury, odstęp po 2 pkt
14. Tytuł artykułu w języku angielskim (lub polskim) – wersaliki 11 pkt, pismo grube, do lewego marginesu, interlinia pojedyncza, odstęp przed 20 pkt, odstęp po 12 pkt
15. Nagłówek Summary (lub Streszczenie) – pismo podrzędne 9 pkt, grube, odstępy między znakami rozstrzelone co 2 pkt, odstęp po 6 pkt
16. Streszczenie w języku angielskim (lub polskim) – 200-250 słów, pismo podrzędne 9 pkt, wcięcie pierwszego wiersza 0,75 cm, interlinia pojedyncza, odstęp po 12 pkt
17. Słowa kluczowe – pismo podrzędne 9 pkt, bez akapitu, interlinia pojedyncza
18. Numer identyfikacyjny DOI – pismo podrzędne 9 pkt, bez akapitu
19. Terminy przesłania artykułu do redakcji i przyjęcia do druku – pismo podrzędne 9 pkt, kursywa, bez akapitu, interlinia pojedyncza

Rozmieszczenie rysunków (ilustracji, fotografii, map, wykresów, schematów)

1. Materiał ilustracyjny należy umieszczać możliwie jak najbliżej miejsca jego powołania
2. Nie należy przekraczać pola zadruku (12,5 x 19 cm), w którym musi się zmieścić i materiał ilustracyjny, i podpis
3. Większe rysunki (i inny materiał ilustracyjny) wraz z podpisem powinny zajmować całe pole zadruku, mniejsze zaś należy przesunąć odpowiednio – do lewego marginesu (na stronach parzystych), do prawego marginesu (na stronach nieparzystych)
4. Podpis w dwóch językach: w języku artykułu i w języku angielskim, należy umieścić pod rysunkiem (i innym materiałem ilustracyjnym), w jego ramach, bez kropki na końcu (jeśli jest to materiał zapożyczony, należy podać źródło), pismo podrzędne 9 pkt
5. Odstęp między materiałem ilustracyjnym a podpisem – 9 pkt, interlinia pojedyncza, odstęp między podpisami 4 pkt, odstęp po 14 pkt
6. Opis słowny na rysunkach należy ograniczyć do minimum, zastępując go liczbami arabskimi, a objaśnienia przenieść do podpisu – można użyć mniejszej czcionki (8 pkt)
7. Materiał ilustracyjny powinien mieć dobrą jakość, należy ujednolicić formę i opisy w całym artykule (pismo podrzędne proste, od małej litery, maks. 9, min. 6 pkt w zależności od wielkości rysunku)
8. Materiał ilustracyjny należy ponumerować kolejno w ramach artykułu

9. Jeżeli w artykule występują różne rodzaje materiału ilustracyjnego, każdemu z nich należy nadać odrębną, ciągłą numerację
10. Materiał ilustracyjny należy przygotować w odcieniach czarno-szarych (do 20% czerni), ponieważ przy wydruku czarno-białym kolorowe rysunki są słabo lub całkowicie niereprodukowalne
11. Rysunki do druku kolorowego (za zgodą redaktora naczelnego czasopisma) należy przygotować w plikach .tif, .jpg

Rozmieszczenie tabel (tablic)

Tabela – zestawienie tekstów i liczb bądź samych liczb uszeregowanych w kolumny i wiersze

Tablica – zestawienie tekstów i liczb wzbogacone dodatkowo elementami graficznymi lub kolorystycznymi (niekiedy stanowią je tylko ilustracje)

1. Tabele (tablice) należy umieszczać możliwie jak najbliżej miejsca ich powołania
2. Nie należy przekraczać pola zadruku (12,5 x 19 cm)
3. Większe tabele (tablice) włącznie z tytułem zajmują całe pole zadruku, mniejsze zaś należy przesunąć odpowiednio – do lewego marginesu (na stronach parzystych), do prawego marginesu (na stronach nieparzystych)
4. Nad tabelą (tablicą) należy umieścić tytuł w dwóch językach: w języku artykułu i w języku angielskim. Tytuł rozpoczyna się całym słowem tabela (tablica)/table i umieszcza nad nią, w jej ramach, bez kropki na końcu; pismo podrzędne 9 pkt, interlinia pojedyncza; jeżeli tabela (tablica) jest zapożyczona, należy podać źródło
5. Odstęp przed tytułem tabeli (tablicy) 12 pkt, odstęp między tytułami 4 pkt, odstęp między tytułem a tabelą (tablicą) 8 pkt
6. Legenda po tabeli (tablicy) – odstęp od tabeli (tablicy) 6 pkt, interlinia pojedyncza, odstęp po 14 pkt
7. Teksty w główce tabeli (tablicy), tj. w górnej, wydzielonej części tabeli (tablicy), objaśniające treść kolumn zapisuje się pismem grubym, rozpoczynając od dużej litery, teksty w boczku tabeli, tj. w bocznej, wydzielonej części tabeli, objaśniające treść wierszy rozpoczyna się dużymi literami – teksty w pozostałych rubrykach składa się małymi literami
8. Tabele (tablice) należy numerować kolejno w ramach artykułu. W przypadku występowania i tabel, i tablic należy nadać im odrębną, ciągłą numerację
9. Jeżeli tabela (tablica) nie mieści się w jednym polu zadruku, można ją podzielić i przenieść na następną stronę czy strony – wówczas nad wszystkimi częściami tabeli (tablicy) należy powtórzyć jej numer i tytuł, ze skrótem (cd.)
12. Tabele (tablice) należy przygotować w odcieniach czarno-szarych (do 20% czerni), ponieważ przy wydruku czarno-białym kolorowe tabele (tablice) są słabo lub całkowicie niereprodukowalne
13. Tabele (tablice) do druku kolorowego (za zgodą redaktora naczelnego czasopisma) należy przygotować w plikach .tif, .jpg

Rozmieszczenie wzorów

1. Wzory należy umieszczać z lewej strony, z wcięciem 0,75 cm, pismo proste 11 pkt, wartości indeksów i potęg 7 pkt
2. Numery wzorów należy umieszczać w nawiasach okrągłych, wyrównując do prawego marginesu, pismo proste 11 pkt
3. Wzory powinny być opatrzone objaśnieniem występujących w nich elementów
4. Wzory, do których są odniesienia w tekście, należy numerować kolejno w ramach artykułu
5. Dłuższe wzory można dzielić na znakach relacji lub działania – znak, na którym się przenosi wzór, należy pozostawić na końcu pierwszego wiersza
6. Przed wzorem i po nim należy zachować odstęp 10 pkt

Rozmieszczenie spisu literatury

1. Spis literatury umieszcza się za treścią artykułu, w kolejności alfabetycznej nazwisk autorów
2. Powołania na literaturę należy zapisywać w tekście w nawiasie kwadratowym
3. W spisie literatury należy umieścić wyłącznie te publikacje, które są powoływane w tekście

PRZYKŁADY:

Książki

Lewandowski W.M.: Proekologiczne źródła energii odnawialnej, Wydawnictwa Naukowo-Techniczne, Warszawa 2002.

Czasopisma

Pietrucha K.: Analiza czasu odnowy i naprawy podsystemu dystrybucji wody dla miasta Rzeszowa, Instal, nr 10, 2008, s. 113-115.

Dokumenty elektroniczne

Zanotti G., Guerra C.: Is tensegrity a unifying concept of protein folds? FEBS Letters, vol. 534, no. 1-3, 2003, pp. 7-10, http://www.sciencedirest.com (dostęp: 8 czerwca 2011 r.).

Rozmieszczenie streszczenia

1. Po literaturze umieszcza się tytuł artykułu, nagłówek Summary i streszczenie w języku angielskim
2. Gdy artykuł jest w języku angielskim, na początku należy umieścić streszczenie w języku angielskim, a na końcu w języku polskim
3. Gdy artykuł jest w innym języku kongresowym, na początku należy umieścić streszczenie w języku artykułu, a na końcu w języku angielskim
4. Po streszczeniu umieszcza się słowa kluczowe w tym samym języku co streszczenie

Rozmieszczenie numeru identyfikacyjnego i informacji dodatkowych

1. Po słowach kluczowych należy umieścić numer identyfikacyjny DOI
2. Pod numerem identyfikacyjnym zamieszcza się terminy przesłania artykułu do redakcji i przyjęcia do druku

Inne uwagi

1. W artykule można stosować wyliczenia – elementy wyliczeń należy oznaczać w całym artykule w sposób jednolity, np. za pomocą cyfr arabskich z kropką lub małych liter z nawiasem
2. W artykule należy stosować ogólnie przyjęte skróty, ale zdanie nie może się zaczynać od skrótu – należy go wówczas rozwinąć lub przeredagować zdanie
3. W artykułach każdy cytat musi być opatrzony informacją bibliograficzną (w formie przypisu na dole strony lub odwołania do spisu literatury)
4. Przypisy (pismo podrzędne 9 pkt) należy zapisywać w sposób jednolity w całym artykule, opatrując je odnośnikami gwiazdkowymi (gdy jest ich niewiele) lub liczbowymi, przyjmując ciągłą numerację w całym artykule i umieszczając każdy przypis od nowego akapitu

PRZYKŁADY:

[1] M. Hereźniak, *Kreowanie marki narodowej – rola idei przewodniej na przykładzie projektu „Marka dla Polski”*, [w:] H. Szulce, M. Florek, *Marketing terytorialny – możliwości aplikacji, kierunki rozwoju*, Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań 2005, s. 344-345.

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