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Ladies and Gentlemen,

Foundation of Management (FoM) journal was established at the Faculty of Management at Warsaw University of Technology in order to provide an international platform of thought and scientific concepts exchange in the field of managerial sciences.

This new publishing forum aims at the construction of synergic relations between the two parallel trends in managerial sciences: social and economical – originating from economic universities and academies and the engineering trend – originating in from factories and technical universities.

Three of the great representatives of the engineering trend in managerial sciences - American Frederic W. Taylor (1856-1915) – developer of high speed steel technology and the founder of the technical with physiological trend in scientific management, Frenchman Henri Fayol (1841-1925), the author of basics of management and the division and concentration of work as well as the Pole Karol Adamiecki (1866-1933) graduate of the Saint Petersburg Polytechnic University and the professor of Warsaw University of Technology, creator of the time-scale system elements scheduling theory and diagrammatic method as well as the basics of the division of work and specialization – have, on the break of the XIX and XX century, all created the universal foundations of the management sciences. Therefore the title of the Foundation of Management is the origin of the scientific and educational message of the journal that is aimed at young scientists and practitioners – graduates of technical and economic universities working in different parts of Europe and World.

The target of the establishers of the Foundation of Management journal is that it will gradually increase its influence over the subjects directly linked with the issues of manufacturing and servicing enterprises. Preferred topics concern mainly: organizational issues, informational and technological innovations, production development, financial, economical and quality issues, safety, knowledge and working environment – both in the internal understanding of the enterprise as well as its business environment.

Dear Readers, Authors and Friends of the Foundation of Management – our wish is the interdisciplinary perception and interpretation of economic phenomena that accompany the managers and enterprises in their daily work, in order to make them more efficient, safe and economic for suppliers and receivers of the products and services in the global world of technological innovation, domination of knowledge, changes of the value of money and constant market game between demand and supply, future and past.

We would like for the Foundation of Management to promote innovative scientific thought in the classical approach towards economic and engineering vision of the managerial sciences.

The Guardian of the journal's mission is its Programme Committee, which participants of which will adapt to current trends and as an answer to the changing economic and social challenges in the integrating Europe and World.

Tadeusz Krupa

CONTENTS

IMPORTANCE OF COSTS OF RISKS IN MATERIAL MANAGEMENT

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Abstract: The article is an analysis of materials management in different areas of functioning of manufacturing enterprises, with particular reference to the costs generated by it and all possible risk factors. The overall objective is to demonstrate, on the basis of the study in the furniture industry, that the occurrence of a risk factor in one area of a company has financial consequences for even a few more stages of the process. This affects the calculation of the actual cost of implementing the process and naturally carries consequences in the profit achieved by the company. For the analysis, the well-known algebraic principle of logic characterization of V.A. Gorbatov was applied.

Keywords: materials management, logistics processes, risk, risk management, characterization principle, manufacturing enterprises, total cost, actual cost.

1   Introduction

While treating an enterprise as a system of mutually interacting logistics processes in the sense of the flow of material and information streams, the reliability of functioning of each of the processes is of crucial importance. Materials management is one of the key supporting processes. It is due to the fact that materials and products, regardless of their actual character, appearing in any enterprise engage certain material and personnel resources as well as generate certain logistic costs, which influence the business result significantly.

A comprehensive analysis of materials management is the basis for distinguishing risk factors of the process, which gives rise to implementation of the risk management in the given enterprise. Securing the proper functioning of logistics processes, including material management, through risk management has a significant impact on the level of the net profit achieved.

An analysis of materials management in individual spheres of functioning of manufacturing companies with particular emphasis on its costs and possible risk factors is the purpose of this article.

The general objective is to demonstrate on the basis of the studies conducted in the furniture industry, that the occurrence of a risk factor in one area of the business activity has financial consequences for several consecutive stages of the implementation process. It affects the calculation of actual costs of the implementation of the given process and consequently has an impact on the profit achieved by the enterprise.

The V.A. Gorbatov Characterization Principle well-known from algebra of logic was applied in the analysis.

2   The problem of costs in materials management

The coordination of processes related to materials management is one of the most difficult logistical tasks. Materials management applies to all spheres of functioning of manufacturing companies and largely determines quality, time, flexibility and many other factors essential in the parameterization of main processes. The specificity of collection, storage and allocating materials in individual spheres of functioning of manufacturing companies is a little bit different and each of them has its critical points, at which risk factors and disorders of continuity of the process implementation may appear with even a little carelessness.

The materials of the supply sphere and relatively high maintenance costs associated with them give rise to naturally distinguished different division criteria and different categories of supply materials in every enterprise. A general model for classification of the materials of the supply sphere, including the influence on the financial result, share in costs and the impact of risk factors (see Fig. 1).

MATERIALS OF THE SUPPLY SPHERE

| Strategic | Difficult to obtain | Available | Other |

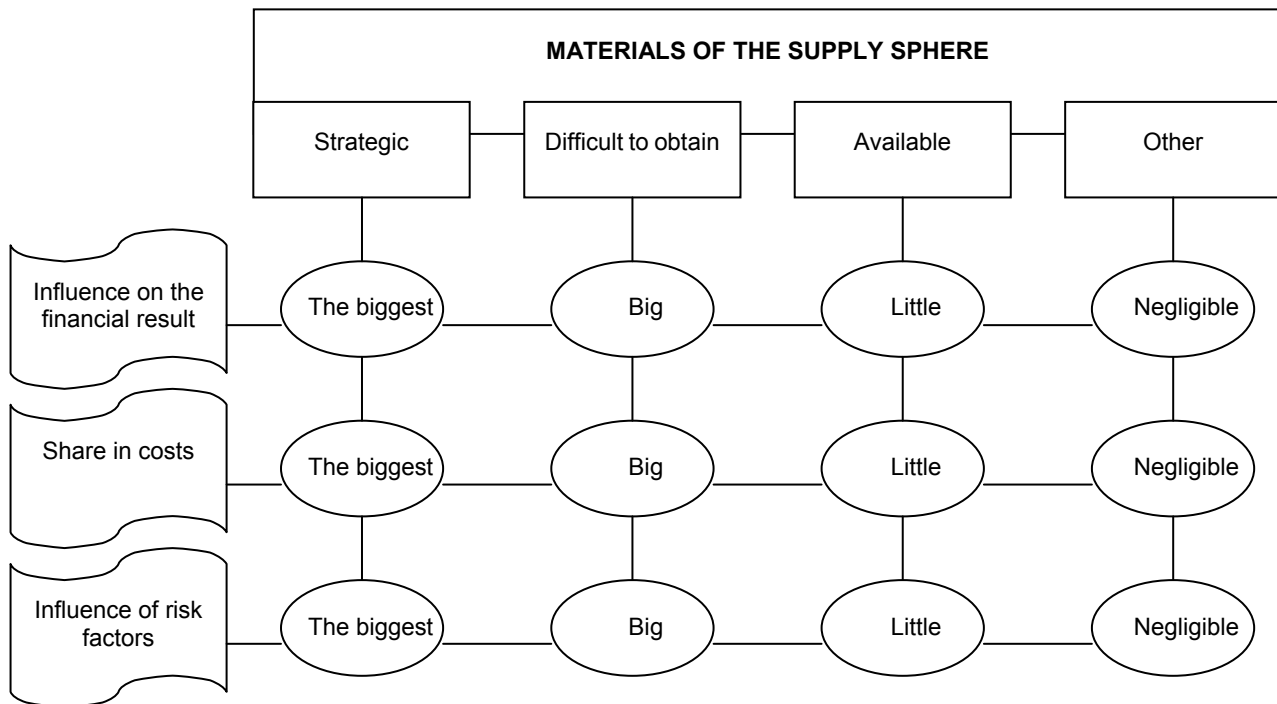|	Strategic	Difficult to obtain	Available	Other
Influence on the financial result	The biggest	Big	Little	Negligible
Share in costs	The biggest	Big	Little	Negligible
Influence of risk factors	The biggest	Big	Little	Negligible

Figure 1. Classification of the materials of the supply sphere - a model approach

Regardless of the industry in which the company operates, it is possible to distinguish groups of strategic materials in the supply sphere, which are difficult to obtain, available and others specific to the industry, geographical location and such. As it can be seen on the presented figure, the strategic materials affect the achieved financial result to the greatest extent, are the most expensive ones, as well as the presence of a risk factor in this group causes the most severe consequences. Most often, these are materials, which are not only a base for manufactured products but are also a "showpiece" determining the brand and the quality. Therefore, while expecting a net profit on business activities, it is necessary to pay special attention to the management of these materials.

The materials difficult to obtain, even though they do not have strategic importance for functioning of companies, play a significant role in maintaining continuity of production. Therefore, it is very important to maintain a "safe" supply level of these materials.

The management of the materials, which are generally available, does not require meeting very rigorous requirements, as in the case of the two previous groups. These materials play the role of a stimulus in the structure of economic processes; they are generally available in the market that gives rise to the possibility of negotiating their prices and delivery conditions,

that is, the factors, which are important from the point of view of the costs and the impact on the financial result.

The physical flow in the logistics sphere of the production, in terms of the material management, includes:

- transfer of raw materials, semi-finished products, spare parts and finished products,
- securing technological supplies and stocks of the work in progress.

There are shown two groups of materials in Fig. 2; a dynamic and a static one. The dynamic one is a group of materials that is being used in the production process at the particular moment; these materials accompany value creation (net profit). The static group consists of stocks of work in progress, that is, these are generators of costs. It is on the correct functioning of the materials management that the continuity and appropriate intensity of the production depends. The minimization of stocks of work in progress at the operational level is of utmost importance in this sphere, since it is directly associated with the minimization of costs of the frozen capital and reduction of the costs of maintaining stock, which translates into liquidity and efficiency of the whole production process in turn.
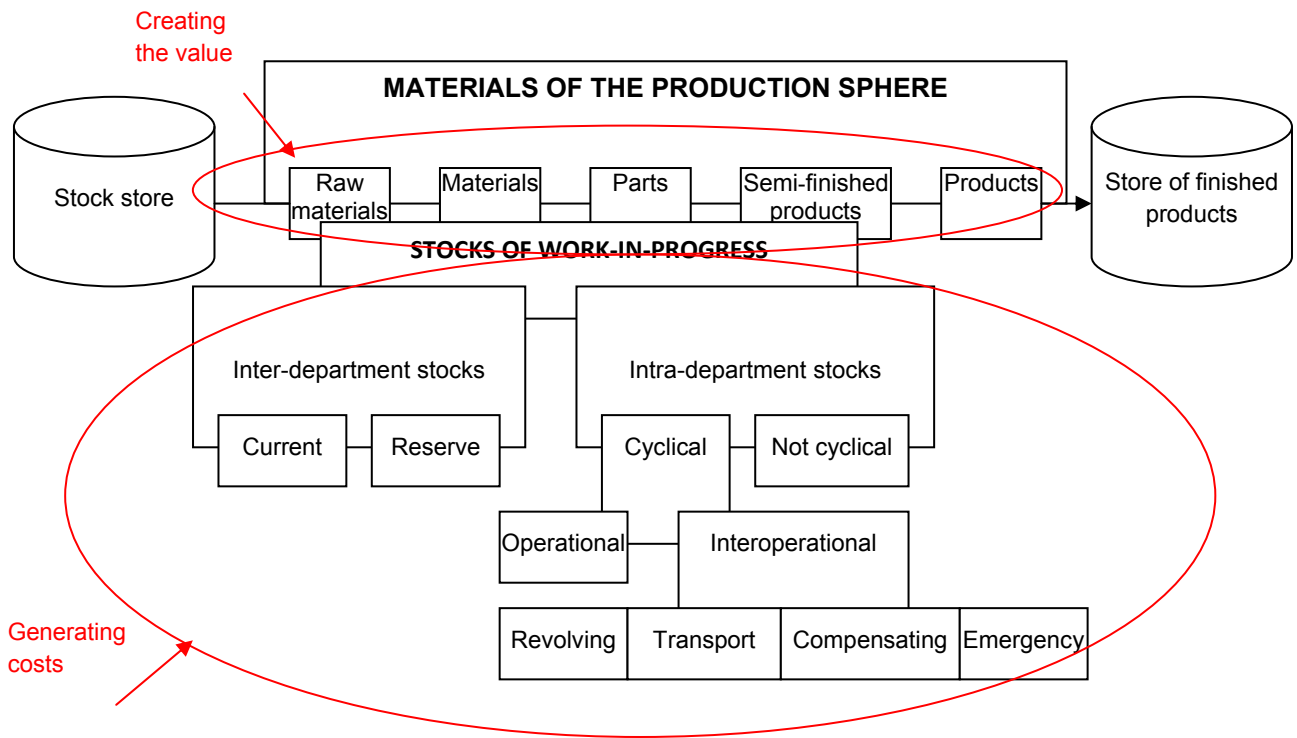
Figure 2. Classification of the materials of the production sphere - a model approach

A reduction in the level of stocks of work-in-progress and of frozen working capital as well as of maintenance costs of stocks are essential for generating costs and thus for the net profit. Collecting, storing and controlling such a comprehensive system of stocks of work-in-progress entail large time, technical and organizational efforts and, as a result, also high costs.

With regard to the management of the materials in the distribution sphere, it can be considered in a narrow and wide view.

The narrow view, associated with the supply side of the business activity, is concentrated on:

- tasks related to the physical, time-spatial flow of finished products from the producer to the end user
- activities related to the logistic determinants of sale transactions in the sphere of stocks management as well as transport and handling processes.

A wide range of materials processes in the distribution sphere includes: ordering goods and their transport, storing and shaping supplies, packing finished products and maintaining delivery channels (see Fig. 3).
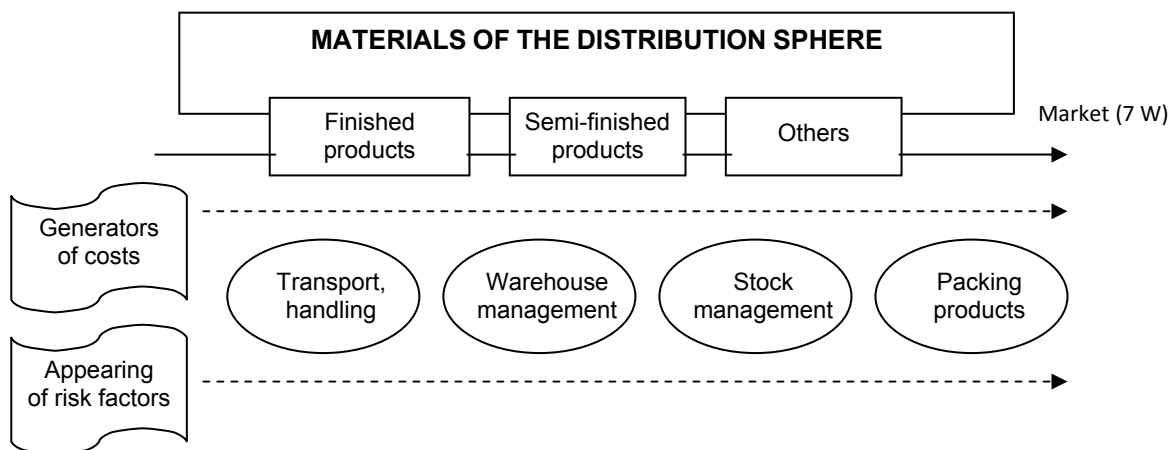

Figure 3. Classification of materials of the distribution sphere - a model approach

The problems of material management of the distribution sphere of goods, products and finished products should be considered as a whole, in accordance with the logistic approach, as an essential link of a logistic chain of flows of material goods. It is very important, since there are many decision-making problems affecting costs related to materials management such as:

- logistic management of processes of distribution of goods,

- physical control over the flow of goods from a producer to a consumer,

- developing physical distribution processes of products and finished products,

- determining optimal inventories in indirect links of distribution channels,

- determining the number and the length of distribution channels and the number of indirect links (places of storage),

- maintaining an adequate level of finished products,

- determining the level and the structure of stocks.

The strategic objective of the materials management of the distribution sphere is to minimize the total costs of logistics and distribution, while maintaining smoothness of economic processes and standards of the customer service.

To sum up, the costs of materials management should not be identified exclusively with prices of the purchased materials. Additional costs of transport and storage, different types of warehouses, accurate forecasting restocking and correct schedules for orders are equally crucial factors, which require consideration. The logistics management of stocks is a comprehensive arrangement of the flow of materials and information. It should satisfy the needs of customers and enable reduction in the costs of the management of materials. A properly implemented strategy of materials management should enable integration of the materials and information market as well as timeliness and completeness of the services provided, minimization of stocks, increasing throughput, high flexibility of operations and supply, minimization of the order cycle time and the most important - cost savings.

The logistic approach to the management of the economic sphere, in particular, requires compliance with the principle of thinking about the whole; it means that while arranging for materials management, the issues of material supplies, transport, storing, packing and many others should be taken into account.

Such an extensive system, even if it is managed in the best way, cannot be free of risk factors. The risk management in this sphere is particularly important, since materials management itself generates high costs. Every additional factor, which extends time or increases costs, may significantly affect the profitability of the materials management and hence influence the net profit achieved.

3   The analysis of risk factors at strategic points

Risk factors appear in each of the logistic processes in enterprises; in particular, a lot of them affect the materials management sphere. Regardless of the fact to which sphere the risk management applied is to, it has to be a continuous process, that is, a logically ordered sequence of successive events, actions, decisions and arrangements.

The risk management should cover all activities of the enterprise; concentrate on the identification of potential events that could negatively affect the objectives of the enterprise, the assessment of the risk associated with it and then defining and implementing solutions aimed at reducing the risk and keeping it within controlled limits [12].

The risk factors can be identified at different levels of detail. It is easier to identify such risk factors, which may appear in every operational sphere of materials management in the enterprise (see Fig. 4).

However, if the system of the risk management is supposed to be effective, it is much better to analyze the whole process of the material management in individual logistic spheres of functioning of the enterprise for the presence of risk factors. On the basis of schematics described in the previous subsection, it is possible to distinguish the following risk factors of the material management (see Tab. 1).

Certainly, such a specification is not the only one possibility and does not exhaust the catalogue of risk factors, which may appear in this field. It is rather a starting point for deliberations in this respect.

The analysis of risk factors can be carried out much more effectively on a real example. This article also includes the costs of the risk factors analyzed, which appeared in the materials management of an enterprise of the furniture industry functioning in the Opole voivodeship.

Table 1. The selected risk factors of material management

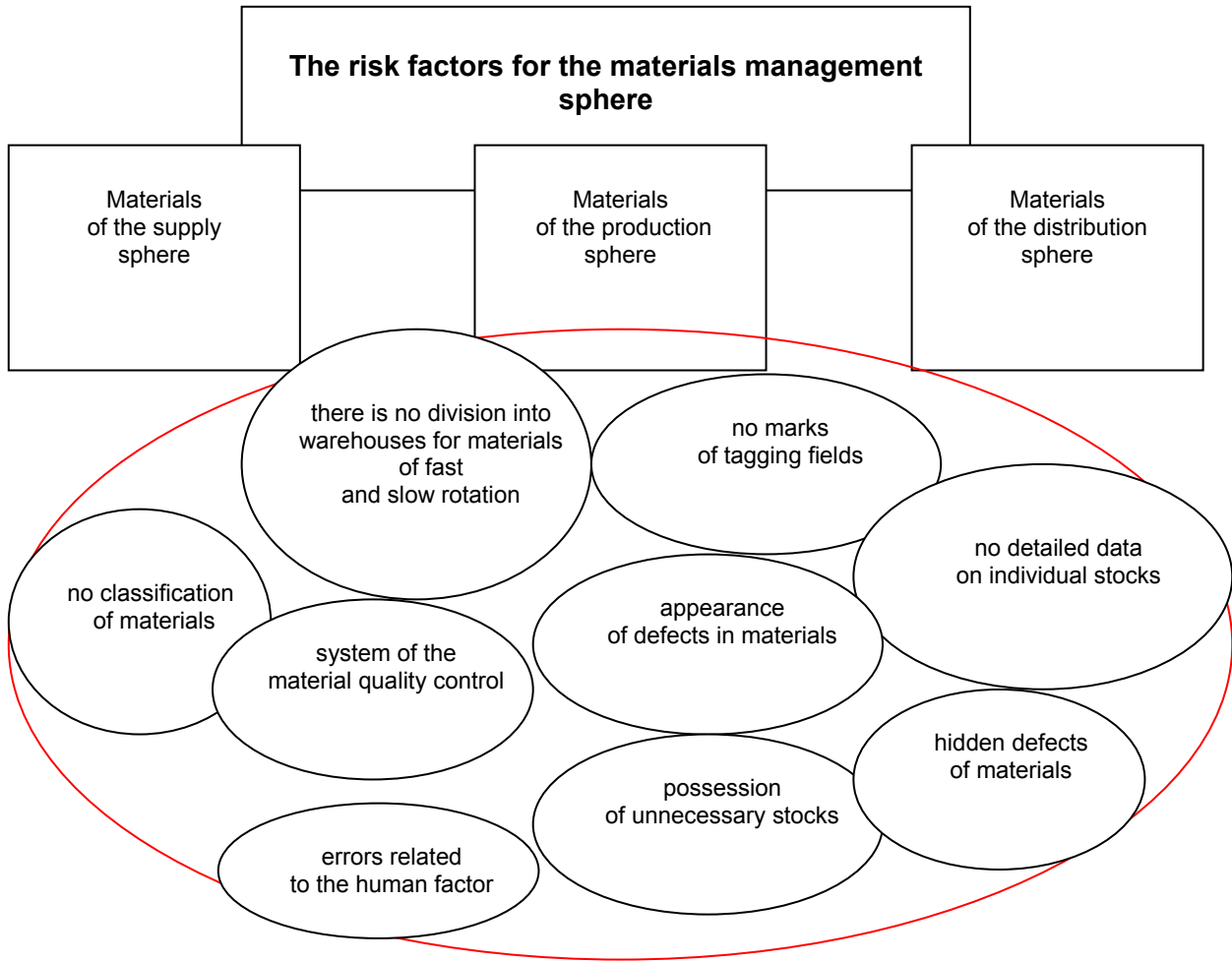|	RISK FACTORS
SUPPLY SPHERE	Strategic materials: − forecasting market needs, − errors while planning the supply level, − choice of suppliers, − negotiating terms of delivery, − negotiating supply prices, − supply reliability, − regularity of supplies, − impact of random factors, − seasonality of production, − wrong level of stocks.
SUPPLY SPHERE	Materials difficult to obtain in the market: − risk of supplies, − disturbances in intensity of technological processes, − disturbances of smoothness of technological processes, − high costs of collection, − high maintenance costs, − errors in short-term forecasts, − errors in plans of demand and supply; − errors in recruitment of staff at the operational level. Materials available in the market: − lack of a stable supply strategy, − lack of a flexible pricing policy, − errors in negotiations with suppliers, − collection of a very high level of stocks, − errors in staff recruitment at lower levels of the organization.
PRODUCTION SPHERE	− too low or too high level of interoperable stocks, − errors in inventory control in the course of production, − high dynamic of creation, rotation rate, high cyclicality of consumption, − running out of stock on one or several working stations, − too-long time of interoperable logistic procedures related to the transfer of materials, − errors in the division of labor, − errors in connecting work positions, − errors in connecting production units (slots), − lack of one-way flow of physical materials, − too many logistic channels.
DISTRIBUTION SPHERE	− problems with selling manufactured products, goods and services, − errors in ordering and transport of goods, − errors in storage and shaping stocks, − improper packaging of finished products, − lack of proper maintenance of distribution channels.

The risk factors for the materials management sphere

| Materials of the supply sphere | Materials of the production sphere | Materials of the distribution sphere |

- there is no division into warehouses for materials of fast and slow rotation
- no marks of tagging fields
- no detailed data on individual stocks
- no classification of materials
- system of the material quality control
- appearance of defects in materials
- hidden defects of materials
- possession of unnecessary stocks
- errors related to the human factor

Figure 4. The selected risk factors for the materials management sphere

4 The materials management of an enterprise of the furniture industry

Based on the data of an enterprise in the furniture industry, six risk factors important from the point of view of the materials management were identified within logistic processes carried out. It is on this basis that the propositional function was created:

$$ZP_x(P_1, P_2,\ldots,P_{52}) = X_1\, X_5 \lor X_2 \lor X_1\, X_2\, X_3\, X_4 \lor X_1\, X_2\, X_4 \lor X_1\, X_3\, X_5 \lor X_1\, X_2\, X_6$$

Each of the risk factors of the furniture company $X_1\, X_2\, X_3\, X_4\, X_5\, X_6$ includes the information on the frequency (probability) of the appearance of risk factors and potential effects (measured with the maximum cost of eliminating the effects of the appearance of the risk factors). While taking the analyzed enterprise into consideration, these values developed as follows (see Table 2).

Table 2. The juxtaposition of the probability and effects of the appearance of risk factors in the ZP_x function
(source: own study based on research results)

THE AREA OF THE APPEARANCE OF RISK FACTORS	PROPOSITIONAL VARIABLE	2013		QUANTITY * COST
		QUANTITY	MAX COST	
SUPPLIES	X_1	15	2,000	30,000
	X_5	60	5,000	300,000
PRODUCTION	X_2	41	3,500	143,500
DISTRIBUTION	X_1	15	2,000	30,000
	X_2	41	3,500	143,500
	X_3	48	2,500	120,000
	X_4	5	2,000	10,000
TRANSPORT	X_1	15	2,000	30,000
	X_2	41	3,500	143,500
	X_4	5	2,000	10,000
STORAGE	X_1	15	2,000	30,000
	X_3	48	2,500	120,000
	X_5	60	5,000	300,000
MANAGEMENT LOGISTICS PROCESSES	X_1	15	2,000	30,000
	X_2	41	3,500	143,500
	X_6	10	20,000	200,000
			$\sum$	**1,784,000**

The data was juxtaposed for the period from December 2012 to August 2013. Based on this data, it can be stated that the model contains information on all-in costs of the appearance of risk factors in the material management within the logistic processes carried out. While considering only the mentioned factors, the value added of the enterprise could be higher by about PLN 1,784,000.

The determination of the actual costs requires carrying out an analysis in accordance with the rules of the Gorbatov characterization principle. The model of functioning of Ψ_a of the ZPx propositional function as a juxtaposition of:

$$\Psi_a = < M, R_1, R_2, R_3, R_4>$$

where:

M - a set of propositional variables,

R_1 - a set of relationships defined with 1 element alternative modules,

R_2 - a set of relationships defined with 2 element alternative modules,

R_3 - a set of relationships defined with 3 element alternative modules,

R_4 - a set of relationships defined with 4 element alternative modules.

$$M = < X_1\ X_2\ X_3\ X_4 X_5\ X_6 >$$
$$R_1 = \{\ \{\ X_2\}_2\ \}$$
$$R_2 = \{\ \{\ X_1\ X_5\ \}_1\ \}$$
$$R_3 = \{\ \{X_1\ X_2\ X_4\}_4, \{X_1\ X_3\ X_5\}_5, \{X_1\ X_2\ X_6\}_6\}$$
$$R_4 = \{\ \{\ X_1\ X_2\ X_3\ X_4\ \}_3\ \}$$

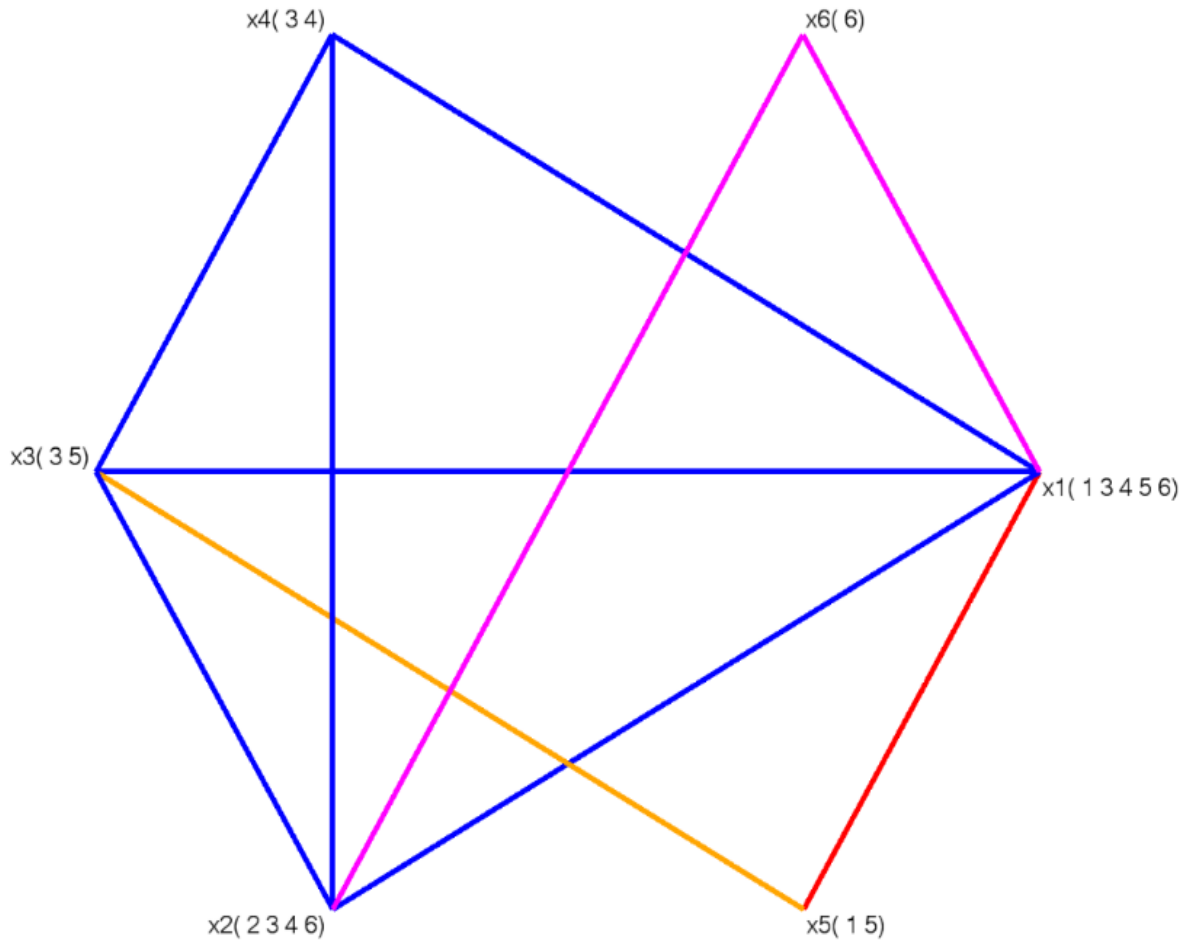The graphical form of the operating model is presented in the Fig. 5.

Figure 5. The operating model of the ZPx propositional function

The aim of modelling is to obtain a model of the structure, which solves a determined research problem, that is, searching for actual costs of the appearance of risk factors in materials management within the logistic processes carried out. It is obtaining the result that requires limiting the structural model so that its X_i elements create a partially ordered set, that is, a set whose elements satisfy the partial order relation. Therefore, it is necessary to identify prohibited figures of the type Q^A and Q^B [5, 9, 13].

For the ZP_x function, 4 prohibited figures of the type Q^A and 4 prohibited figures of the type Q^B were identified. The identified figures of the Q^A type are:

$$Q_1^A = \{X_1, X_3, X_5\}$$

$$Q_2^A = \{X_1, X_2, X_3\}$$

$$Q_3^A = \{X_1, X_2, X_4\}$$

$$Q_4^A = \{X_1, X_3, X_4\}$$

The graphical representation of the figure is presented in the Fig. 6.

The analyzed function also contains 4 prohibited figures of the type QB, which graphically are graph submodels in the form of triangles with hanging vertexes. The identified figures of the Q^B type are:

$$Q_1^B = \{X_1, X_3, X_2\} \{X_1, X_6\} \{X_3, X_5\} \{X_2, X_4\}$$

$$Q_2^B = \{X_1, X_4, X_2\} \{X_1, X_5\} \{X_2, X_6\} \{X_4, X_3\}$$

$$Q_3^B = \{X_1, X_4, X_3\} \{X_1, X_6\} \{X_4, X_2\} \{X_3, X_5\}$$

$$Q_4^B = \{X_2, X_4, X_3\} \{X_2, X_6\} \{X_4, X_1\} \{X_3, X_5\}$$

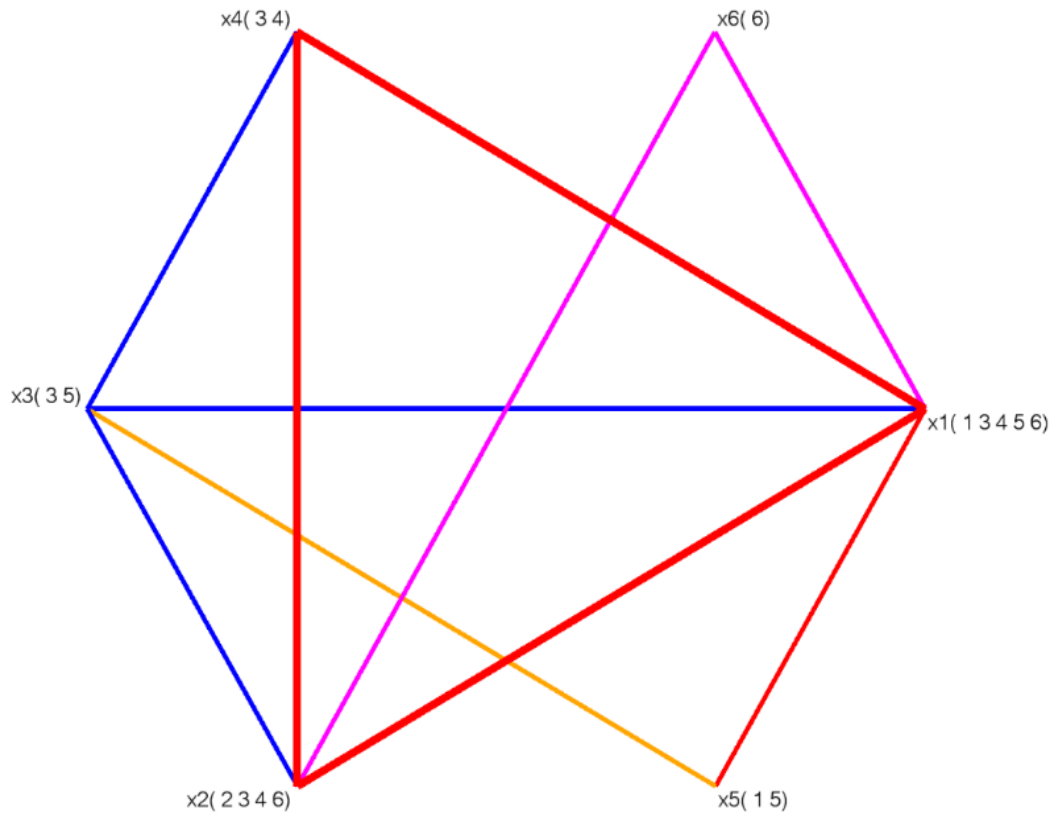A graphical representation of the figure Q_1^B is presented in Fig. 7.

Figure 6. A graph model of functioning of the ZPx function with the marked prohibited graph figure of the type Q_3^A
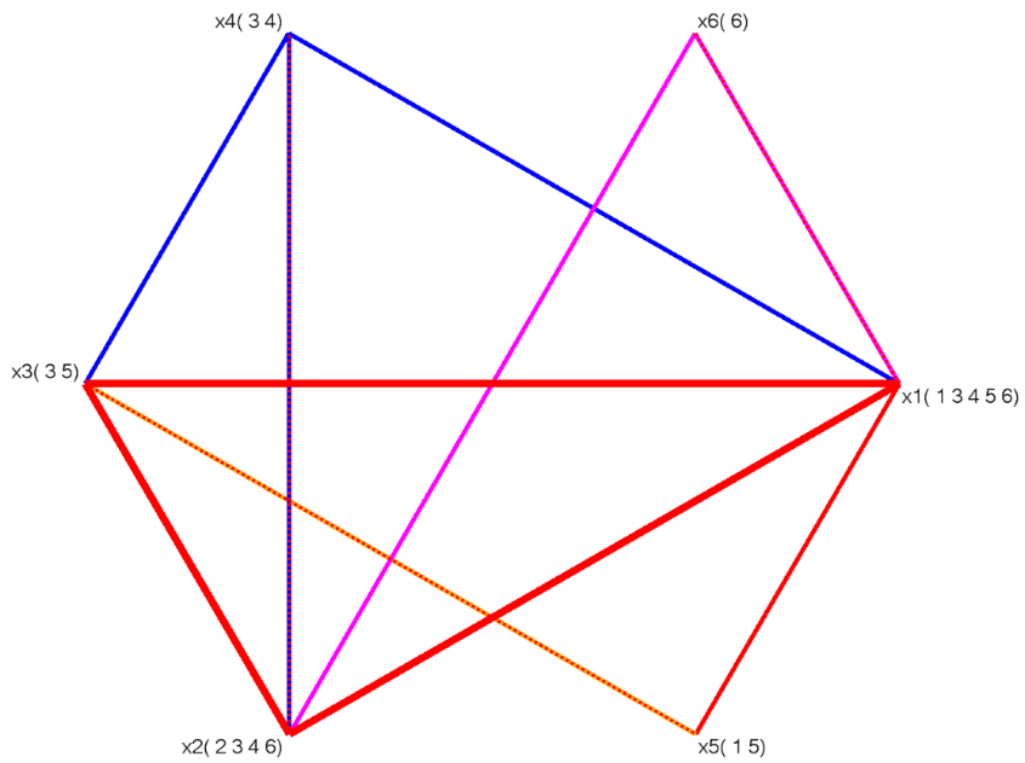

Figure 7. A graph model of the ZPx propositional function with a marked prohibited figure of the type Q_1^B

Table 3. The semantic table of the ZP_x function

	X_1	X_2	X_3	X_4	X_5
Q_1^A	1	0	1	0	1
Q_2^A	1	1	1	0	0
Q_3^A	1	1	0	1	0
Q_4^A	1	0	1	1	0
Q_1^B	1	1	1	0	0
Q_2^B	1	1	0	1	0
Q_3^B	1	0	1	1	0
Q_4^B	0	1	1	1	0

A semantic table was created in order to split the prohibited figures that appeared in the graph presentation of the analyzed propositional function (see Tab. 3).

It is in the first row of the table that the propositional variables are entered, which occurred in all identified prohibited figures. On the other hand, the prohibited figures are entered in the first column. In the following rows, we mark propositional variables with the digit 1 as vertexes of the prohibited graph figure, which appeared in the given prohibited figure (see Tab. 3). A minimal subset of propositional variables, which will cause elimination of all prohibited figures, is chosen on the basis of the frequency of the appearance of the propositional variables in the prohibited figures (the largest number of "1" in the column in the semantic table), as well as from the point of view of the cost analysis of logistic processes - among alternative solutions, we choose the ones, which represent the risk factors with the lowest probability (frequency) of the appearance and the lowest cost of potential effects.

In the analyzed function the propositional variable X_1 combined with the propositional variables X_2 or X_3 or X_4 or X_5 causes splitting of all prohibited figures. The choice of the variables will determine the form of a new model of functioning ψ'_a, and hence the form of the resultant Hasse diagram and the level of actual costs of the appearance of the risk factors in the process of the materials management in the examined enterprise. Due to mathematical and economic reasons, the propositional variables X_1, X_2, X_3, X_4 and X_5 were marked out for splitting. The form of the new model Ψ'_a is presented in Fig. 8.

As a result of splitting, the new operating model is obtained, Fig. 8, which corresponds with the appropriate Hasse diagram presented in the Fig. 9.

The new form of the ZP'_x function:

$$ZP_x(P_1, P_2,\ldots,P_{52}) = X_1 X_5 \ V \ X_2 \ V \ X_1 X_2 X_3 X'_4 \ V \ X_1 X'_2 X_4 \ V \ X_1 X'_3 X'_5 \ V \ X'_1 X_2 X_6$$

for which the latest operating model takes the following form:

$M' = \ < X'_1 X_2 X'_3 X'_4 X_5 X_6 >$

$R'_1 = \{\{ X_2 \}_2 \}$

$R'_2 = \{\{ X_1 X_5 \}_1 \}$

$R'_3 = \{\{X_1 X'_2 X_4\}_4, \{X_1 X'_3 X'_5\}_5, \{X'_1 X_2 X_6\}_6\}$

$R'_4 = \{\{ X_1 X_2 X_3 X'_4 \}_3 \}$

After having analyzed the operating model, having identified prohibited figures and having analyzed the semantic table, the structural model was obtained. [5, 9, 12 and 13].

It is necessary to interpret the structural model in order to obtain information on actual costs caused by risk factors in the materials management of the examined enterprise. Based on this, it is known that the replicas of the variables X'_1, X'_3, X'_4 were obtained. It has consequences for the calculation of the costs of the risk factors in the materials management within logistics processes carried out.
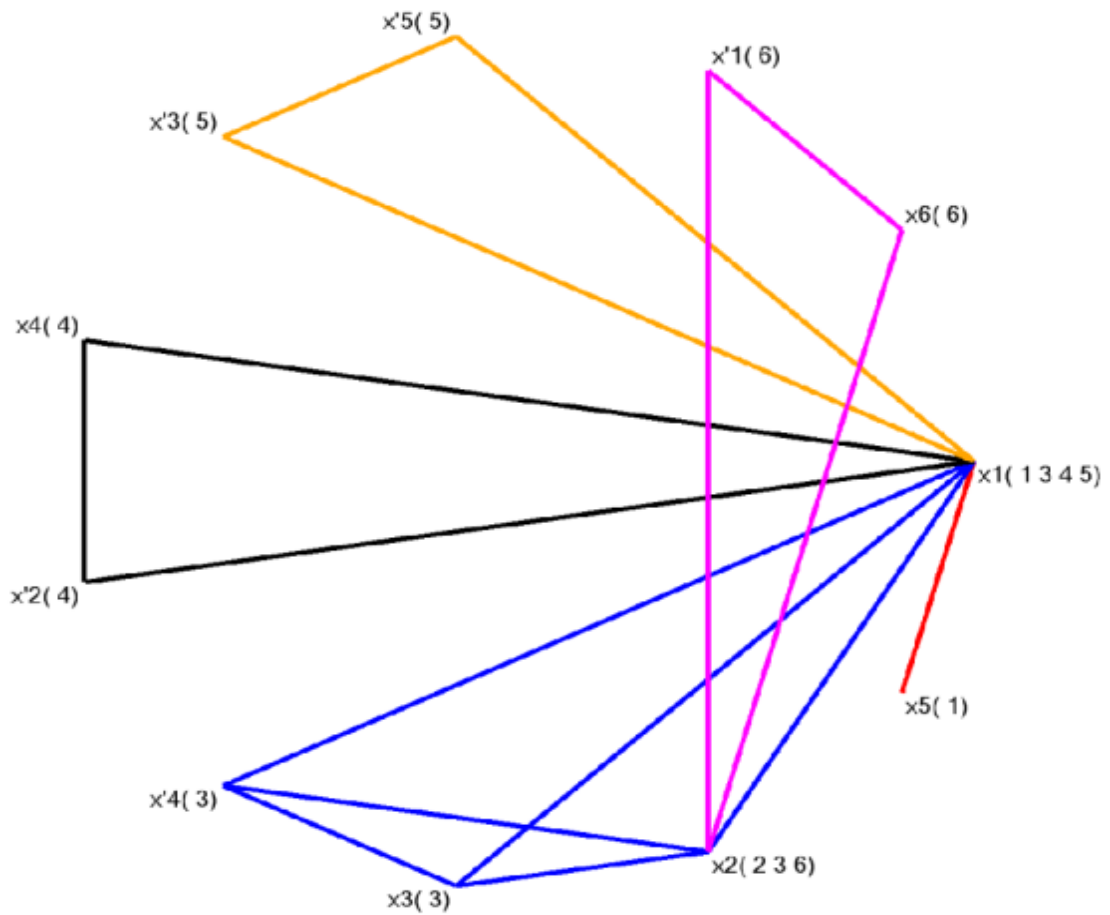
Figure 8. The new graph operating model Ψ'_a of the ZP_x propositional function after splitting prohibited graph figures
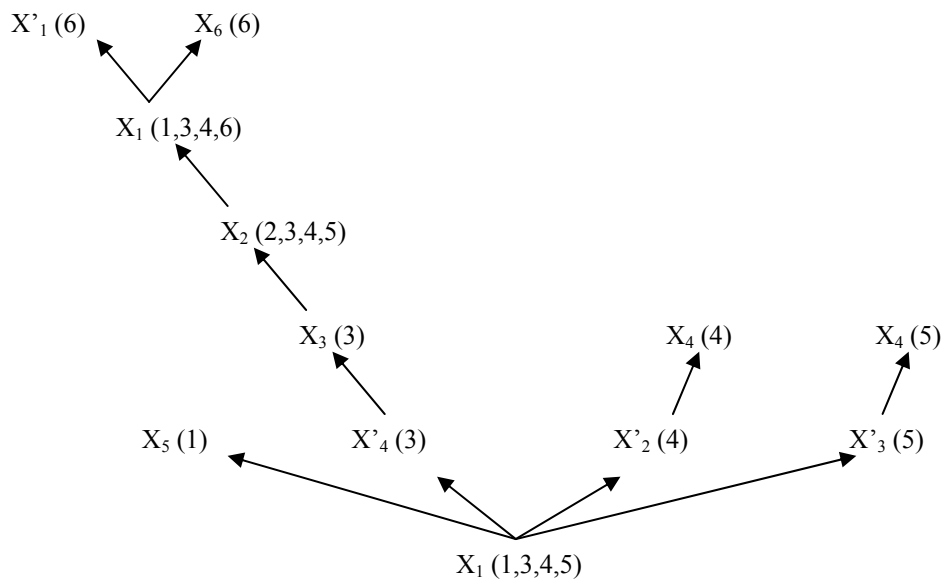
Figure 9. A structural model Ψ_b of the ZP_x propositional function

Table 4. The analysis of the costs of the elimination of the individual risk factors for the selected propositional variables in the ψ'_a operating model of the ZP'_x function

THE AREA OF THE APPEARANCE OF RISK FACTORS	PROPOSITIONAL VARIABLE	2013		QUANTITY * COST
		QUANTITY	MAX COST	
SUPPLIES	X_1	15	2,000	30,000
	X_5	60	5,000	300,000
PRODUCTION	X_2	41	3,500	143,500
DISTRIBUTION	X_1	15	2,000	30,000
	X_2	41	3,500	143,500
	X_3	48	2,500	120,000
	X_4	5	2,000	10,000
	X'_4	5	2,000	10,000
TRANSPORT	X_1	15	2,000	30,000
	X_2	41	3,500	143,500
	X'_2	41	3,500	143,500
	X_4	5	2,000	10,000
STORAGE	X_1	15	2,000	30,000
	X_3	48	2,500	120,000
	X'_3	48	2,500	120,000
	X_5	60	5,000	300,000
	X'_5	60	5,000	300,000
MANAGEMENT LOGISTICS PROCESSES	X_1	15	2,000	30,000
	X'_1	15	2,000	30,000
	X_2	41	3,500	143,500
	X_6	10	20,000	200,000
			Σ	**2,387,500**

It is in the Tab. 4, that the costs of risk factors were put together on the basis of the obtained new Ψ'_a operating model.

While comparing the total and actual costs of the appearance of risk factors, it can be seen how important it is to calculate them correctly. After examining a small number of risk factors, the difference amounted to PLN 603,500 - Tab. 5; it gives preliminary information on the scale of the phenomenon.

Table 5. The comparison of the total and actual costs of the elimination of effects of risk factors

BALANCE	
Total costs	**Actual costs**
1,784,000	2,387,500
603,500	

It was proven in the example that the characterization principle enables presenting a significant difference between total and actual costs of the appearance of risk factors in materials management within the logistic processes carried out. The difference in costs shown on the basis of the characterizations carried out indicates that not all expenses incurred in the enterprise were correctly categorized; it means that they were not correctly linked to the costs triggered by risk factors.

Not including actual costs of the appearance of risk factors may significantly affect errors in decision-making processes by giving an incorrect picture of the financial situation. Adding the false picture of the created value may consequently translate into worsening operational conditions of the enterprise in the market.

The consequences of underestimating costs associated with the elimination of the adverse effects of undesired events are visible in financial documents of the examined enterprise.

The difference in costs presented on the basis of the characterizations carried out shows how many risk factors being found in one sphere of the enterprise affects other spheres, causing the so-called avalanche effects. It results from increasing costs of implementation of processes.

After the analysis conducted with the use of the model based on the characterization principle, it can be seen that the actual costs of risks that is the ones that cover not only the elimination of the adverse effects of the events at the place of their appearance but also the effects that occurred in other areas of the given process are considerably higher than the ones we were able to analyze while taking into account quantity and costs.

5   Conclusions

Materials management is one of the most important areas to be managed in the sense of searching for savings in any enterprise. Many crucial elements of the materials management, the correct coordination

of which is translated into the net profit achieved by the enterprise, were indicated in the contents of this article.

The minimization of the costs in the area of the material management means also implementing a risk management system. The range of factors is really impressive here.

In the presented example the importance of correct cost accounting of the appearance of risk factors in the material management while manufacturing furniture - was shown. Not including the actual costs of the appearance of risk factors may significantly affect mistakes in decision-making processes by giving an incorrect image of the financial situation. False picture of the created value added may consequently translate into deterioration of operational conditions of the enterprise in the market.

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TRENDS IN THE CONSUMPTION OF HOUSEHOLD DURABLES

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Abstract: The aim of the paper is the analysis of the household use of durables in Poland and other European countries. Relatively, the highest amount of money for household furnishing with durables was spent by the Bulgarians and the Italians (more than 7% of the total household expenses). In Poland, the highest expenditure occurred for the wealthiest households and those where the head of the household had a university degree while the least money was spent in numerous-family households. The best equipped households (quantity wise) were such that had one or two children and those where the household head had a university degree. The cluster analysis allowed distinguishing household groups of similar durables ownership level. These groups may be treated as consumer segments. The presented analyses also indicate the trends of the Polish consumers regarding the possession of durables.

Keywords: electronic equipment, electronic goods, mobile durables, types of households, Poland, cluster analysis.

1   Introduction

An apartment is a space filled with a variety of objects that facilitate the process of consumption. The number and the quality of the owned equipment indicate the level of fulfilment of the owners' needs and boost housing satisfaction. The equipment in the households are objects and devices satisfying the basic needs (household appliances), entertainment needs (electronic equipment, Hi-Fi, video), recreational needs (sports equipment) and other.

It is indicated [23, p. 334] that the more durables in a household, the higher the ease of management of the household finances, hence higher average evaluation of the level of life. It happens that consumers from certain socio-economic groups emphasize their status in order to come closer to a certain pattern created by the mass media, fashion, customs, social ranks, preferences, etc. Such behavior is a determinant changing the consumption behavior of the society, modernizing the structure of consumption and the structure of household equipment with durables [21, p. 90].

The aim of this paper is to present the household level of equipment with durables in Poland and indicate the expenses for these goods and their share in the total expenses in Poland and other European countries.

In light of the formulated aims, the research problems are:

- indicating the share of the expenses for household furnishings in European households;

- indicating the level of expenses for durables in various types of Polish households;

- indicating the variability of the possession of durables in Polish households in the years 2000 – 2012;

- dividing Polish households into groups of similar level of household equipment.

The solution to the fundamental research problems will enable business to systematize knowledge on the consumers and facilitate the creation of appropriate marketing strategies in the design and implementation of durables on the market. The distinguishing of the groups (segments) of households of similar equipment level with durables should constitute a helpful tip for the marketing departments. The information on the structure of consumers may be disseminated in Internet databases [17].

The paper is composed of the following parts: after the introduction and presentation of the objective, the authors present the research methodology. Next, an analysis of the expenses for durables in different types of households in Poland is conducted. In the latter part of the paper, an attempt is made to distinguish clusters of households of similar household equipment level.

The households are classified with regard to socio-demographic and economic features. In the next section, the share of expenses for household equipment is presented for selected European countries and then the accessibility of these households to the Internet. The paper ends with a summary and conclusions.

2   Literature analysis

The standard of living of the European nations is increasing steadily. The difference between the Western and Eastern Europe is still visible [14]. Companies from the western part of Europe, following the saturation of their markets, export their goods and services to the East. The information on the structure and size of the consumption of households is important for the entrepreneurs. This information enables development of company operating strategies and their proper management. The information on the consumption is also used by the central government and non-government organizations.

According to Eurostat [7], the conditions of living are different for Eastern and Western Europe. In 2010, 115.5 million people lived on the verge of poverty and were threatened with social exclusion, which constitutes approximately one-fourth of the population of the European Union (EU). Unfortunately, the problem pertained mainly to the East European member states that also included Poland, Bulgaria, Slovakia, Latvia, Lithuania and Estonia. In Poland, 30% of the population lived below the social minimum; in Hungary and Latvia, this value reached 40% and in Romania and Bulgaria, over 50%. For comparison, in Luxembourg, the richest state of the EU, this value was 3%. People threatened with poverty usually live in apartments without basic amenities, such as utility water, sewage systems and electricity. In Eastern Europe, the number of such apartments reached approximately 15% in Poland and up to 30% in Romania.

However, as the society gets wealthier, the households of the poorer countries strive to reach the level of consumption of the richer states [16].

We are observing the societies getting wealthier, particularly in the Western Europe. The consumption structure is thus changing. Larger apartments are purchased and there is more space for the household equipment. A single television set is not sufficient anymore. Television sets are now installed in other rooms

as well (kitchens or children rooms). The inhabitants of larger cities devote more time to traveling. They spend less time at home and eat more processed and ready-to-eat unhealthy meals. The expenses for entertainment, education and transportation are increasing [6, p. 34]. The companies, in light of the increasing budgets of the people, generate demand for their products that are beyond fundamental human needs. Excessive consumption is particularly visible in the middle class. Additional EU support schemes aim at boosting the revenues of the citizens of the new EU member states. This will lead to an elevated demand for goods that have not yet been regularly purchased. The construction of roads in Eastern Europe will indirectly lead to an increased demand for vehicles and the motivation to drive one's own vehicles rather than the public transit [4].

Ben-Shabat and others [1] have analyzed the structure of consumption in 86 countries for 70 categories of products. It is forecasted that the revenues of the consumers in 2010 compared to 2020 will grow by 12 trillion dollars, 3% per annum, on average. The expenses for the household furnishings, fixed assets and related services will constitute 18% of this value. The authors claim that the consumption expenses do not only depend on the country of living but also on the people's revenues, social status, education, and dynamics of the changes of the population. The expenses will be different in different countries. The authors of the report divided the consumers into wealth levels: basic, emerging, escalating, and established. The consumers from the first group constitute 75% of the society, purchasing only the basic commodities and food. Their share in the market will drop from 10% in 2010 to 2% in 2020. The most dynamically developing group of consumers is the emerging group living in the suburbs of large agglomerations aspiring for the middle class identification, spending most of their income on basic products, food, education, and transport. These consumers also buy home equipment and electronics. To this group, the authors of the study ascribe Polish consumers. The consumers from the escalating and established groups are a small part of the society and their expenses are over 75% of all expenditure in the economy.

Another trend influencing the consumption is migration of people to the cities. In Europe, 75% of the population live in the cities [6, p. 10]. It is forecasted that by 2020, this number will grow to 80%.

Large cities will develop faster than the small ones. The cities will become multinational. The number of immigrants coming to large cities for jobs will increase. City centres will depopulate while the population in the suburbs will grow. The singles will mostly populate city centers. Families will move to the suburbs. The development of cities will be uneven. In the cities in the Mediterranean climate, the number of elderly people will grow. The cities of Western Europe will advance faster than the cities of the Eastern Europe. Aside from the native population of the cities, wealthy retired people will move there. In Eastern Europe, there will be more young people, which is related to the demographic boom of the 1980s. The trends in the size of homes are changing. In general, the houses are getting smaller but their number will grow. The smallest homes are located in Northern Europe, the greater ones are in the Central and Eastern Europe, while the largest ones are in the south. People do not want to give up their living space. The size of the housing space per person will grow. The reduction of the home size is related to the high costs of heating. The increasing living space per citizen is related to greater demand for durables. Due to the development of cities, the demand for utility water, electricity, and consumer goods will increase [3].

Due to the reduction of the size of households, the use of energy, utilities and other resources will increase per capita. Due to high road congestion, the citizens will be forced to use public transit, bikes or simply walk. Small towns will depopulate. Public transit, schools, hospitals, shops will become unprofitable. The need to heat unoccupied apartments will increase the energy consumption by 30%. The use of water supply and sewage systems at a reduced rate will lead to health issues [6].

The structure of the consumption is greatly influenced by the age of the society [13]. In general, the population is ageing. By 2065, the number of citizens of age 65 and over will exceed one-third of the society. The number of young people in the society will decrease. Older people tend to travel for extended periods of time. Their demand for food and transit grows and house equipment decreases. Due to the growing life expectancy of humans and the increase in the number of the elderly citizens, the adaptation of durables is necessary to the reduced agility of the latter. Luehrmann [12] emphasizes the change in the consumption structure after retiring. Income reduced by one-third and increased expenses for drugs and health-related

services prevent the retired people from the freedom of choice regarding the consumer goods. The expenses for household equipment and services are reduced by approximately 15%. Retired people devote approximately 90 minutes per day (more than before the retirement) to making necessary goods and services themselves. An increased number of immigrants also lead to changes in the consumption structure. Usually, immigrants do not assimilate with the society, trying to preserve their own traditions. The needs of the immigrants are different than those of the local society. This also applies to the patterns of purchased products.

The consumer demand depends on the location of the cities. In the more developed regions, particularly in Western Europe and Scandinavia, the city authorities, observing the environment pollution and increased production of waste, promote intelligent development. The distance of bike paths is growing, so is the extent of the pedestrian zones and recreational areas, public transport is improving, saving energy and renewable energy sources are promoted. Making incoherent decisions advantageous only for individual entrepreneurs is impossible. The authorities attempt to centrally optimize the development of cities and styles of consumption [8].

Another trend in the consumption is, as we call it, cocooning of the consumption. The consumers bored with changes prefer to stay at home. Part of the activities in the public space is transferred to the home, for example, instead of going to the movie theater, we invest in home theaters; instead of going to the gym, we build gyms at home. This phenomenon is referred to as democentralization of consumption.

The problem of free time also appears in modern societies. Despite the fact that research shows that people now have more free time than they used to have in the past, it is more frequently filled with more tasks. Free time becomes a privilege.

An invaluable role in the consumption is played by access to the Internet. Books, movies, newspapers and magazines can be uploaded to a computer, tablet or other media. The power of the Internet is growing with every passing year. Figure 1 presents the level of availability of the Internet in Poland and the EU. Within the last 10 years, the Internet became generally available. The breakthrough came in 2009 when half of the EU population gained access to the Internet.
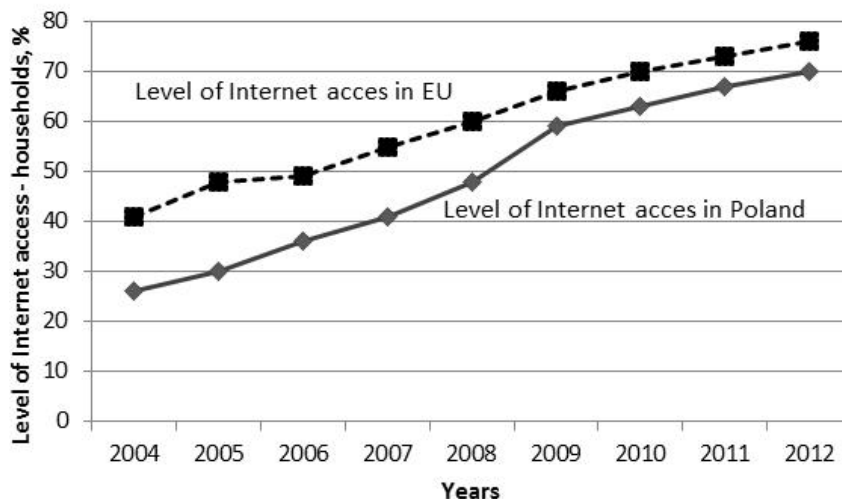
Figure 1. Level of Internet access in Poland and in European Union
(*source: own work based on data from Eurostat*)

The number of people using the Internet is growing continuously but unfortunately is not even throughout the EU. In Holland, the access to the Internet is at a level of 90% while in Bulgaria, it is only 30% (Figure 1). Every third citizen of the EU purchases products over the Internet 40%, which are durables 40% computers, more than 35% computer accessories and almost 20% computer parts.

It is also indicated that [23, p. 128] the advancement of the mobile technology leads to a situation that phones, aside from their fundamental function, serve a variety of purposes: cameras, mobile Internet, tour guides, etc. A phone may also be used for shop payments.

The growing financial disparity among the members of societies should be a starter for the variation of the market offer of products in terms of their price level. Disproportions in material wealth are particularly conspicuous in the developing countries. Companies operating in the household equipment sector must carefully monitor the trends in the consumption and adapt their products to the changing situation.

Schuh [19] thinks that the 2008 economic crisis has spared Eastern Europe. This results from the direct foreign investments made here 20 years ago. Since 2008, the countries of Western Europe have been recording a drop in the National Gross Product, while Poland's situation, in particular, was compared to that of the rapidly developing Ireland (referred to as the Green Island on the European map). Despite a higher development than in Western Europe, a drop in the

economic growth was recorded. This was particularly conspicuous in the Baltic States and Ukraine. Foreign investors must face the challenge of collapsing and shrinking markets, poorer consumers or their local partners going bankrupt. The stream of foreign investments flowing to Eastern Europe has shrunk since 2008 from 35 to 85% depending on the country. Despite such significant changes, Schuh maintains that direct investments in the countries of Eastern Europe are still a good solution. These are 20 states populated by 330 million people. Such a large market cannot be neglected by the international concerns complaining about a reduced demand in Western Europe. Until 2008, direct investments in Eastern Europe were made because of low labor costs, access to cheap sources of natural resources, particularly in the automotive industry, durables, machine construction materials and paper, friendly policies of the government, long-lasting tax incentives, low energy costs or the possibility of penetrating a large market. The process of formation of a competitive economy using intelligent electro-energetic networks is presented by Ludynia [11]. These investments carried a risk of bad infrastructure in Eastern Europe and incompatible legislation. It was believed that this risk was justified by the need to adapt to the European requirements and principles. Direct investments in Eastern Europe until 2008 returned much higher profits. Currently, at the time of crisis, the reality in Eastern Europe changed, yet it is still worth investing here.

The crisis did not cause reduction in qualified personnel and additionally, the employees' salaries got reduced, along with the prices of purchase or rental of real estate, the costs of supplies, exchange rates, and the costs of bank operations—all these making attractive grounds for investments.

Today the investment strategies changed from fast expansion and market penetration to selective and optimized actions. Schuh [19] maintains that countries with the greatest potential are: Poland, The Czech Republic, Slovakia, Slovenia and Estonia. These are countries where the largest economic transformations have been carried out and they are the EU member states. Russia and Ukraine are very large markets, yet their consumers still have a limited purchasing capacity. The economy of these states is heavily dependent on the export of energy carriers and unprocessed goods. Omnipresent bureaucracy and corruption and small progress in the transformation of the economy are not an incentive to invest in these countries. Romania and Bulgaria are still behind compared to Poland, Czech Republic and Slovakia, and have a poorly developed infrastructure, undeveloped markets and bad legislation. Corruption is commonplace. The Eastern European states are no longer perceived as a homogenous Eastern Bloc. They are grouped according to the level of advancement, risk or conditions for economic operations. Currently, investing in Eastern Europe is facilitated by the proximity to the West, access to high-level specialists accepting lower salaries than their western counterparts, industry advancement faster than in Western Europe, large market, acceptance of copyright laws or strong cultural bonds with Western Europe. In Eastern Europe, more than half of the citizens are poor people with an income of not more than US$ 10,000 per annum. Hence, their expenses for durables are reduced and the basic commodities are most frequently bought at discount prices from private brands of supermarket chains. In the market of fast-moving consumer goods, the manufacturers have already gotten used to this situation and they offer products for poorer customers. The manufacturers of durables will have to give up costly brand products and modify their strategy, which will have to be preceded by a detailed analysis of their areas of operations and financial abilities of the consumers. Krupa and Ostrowska [10] presented the principles of defining the strategies of companies that can be used when creating investment strategies. Rzeszutek [18] presents an example of modification of a company structure in response to the changing market and customer requirements. Seretny M. and Seretny A. [20] proposed, in these difficult times, a change of the approach to marketing - sustainable marketing, rebranding and open and honest communication with the customer. Crossleyy and others [5] analyzed the consumer expenses during the crisis in the UK. In the crisis, the expenses for durables and other consumer goods decrease. Large furniture and other household appliances are purchased for the lowest amount. It turned out, however, that when the prices of these goods were reduced (for example, the products were offered at prices less VAT), the purchase level of these products increased. Durables are thus characterized by high price-related flexibility of demand. The authors compared the purchasing trends of durables in the crises from the 1980s, 1990, and 2008. After the crisis began, the sale of durables dropped in the UK and after 2 years, it began to grow. In the last crisis, after a 2-year period of sales drop, the trend changed for 18 months and until 2011, the sales decreased. Only recently, has a small increase been observed. The authors conclude that the purchasing of durables depends on the type of household, location of residence, income, education and age.

Based on the performed literature analysis, we can observe that the equipment of households with durables is influenced by many variables of different nature. In the paper, the authors particularly emphasize the analysis of the household equipment depending on the social, demographic and economic characteristics.

3   Material and research methodology

The commonly used attributes of satisfaction in the area of durables are: the level and structure of expenses for durables and the possession of these assets. The data related to the expenses for durables in Polish households and the households of other European countries and the level of equipment with these goods have been provided by the databases of the National Office for Statistics and Eurostat.

Various types of households were the objects of interest of the authors. Among the characteristics of the households that were included in the analysis, there were: wealth, presence of children in the family, location of the household, education level of the head of the household and the size of the household measured with the family members.
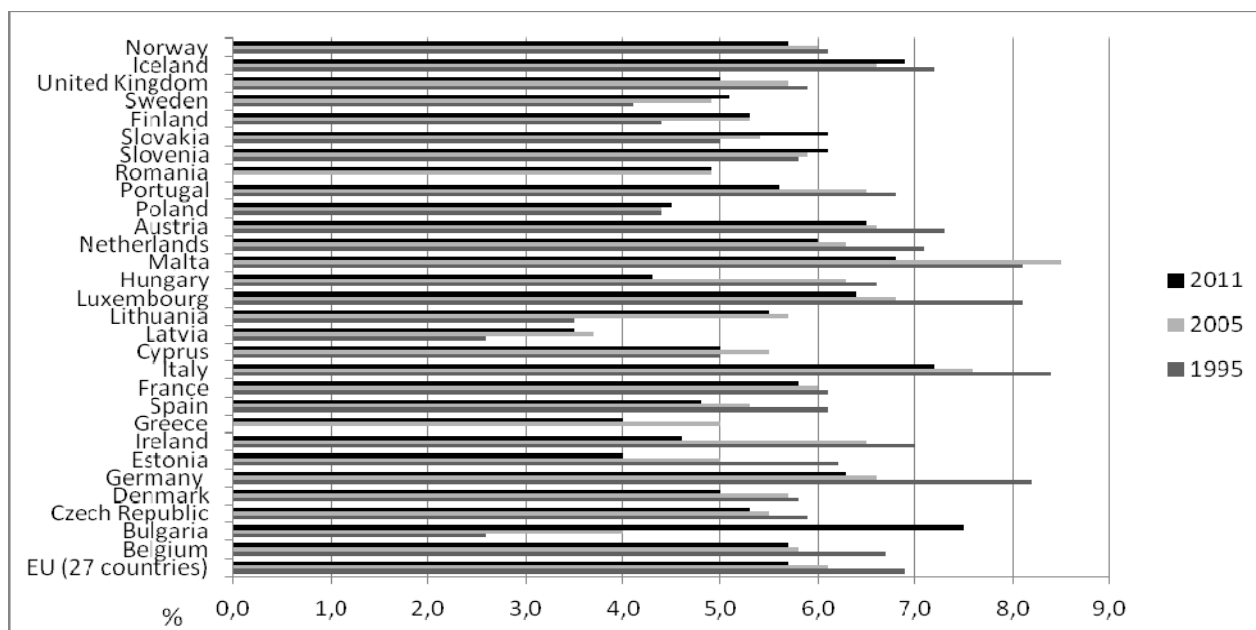
Figure 2. The share of expenses for household furnishings in the total household expenses
in selected European countries in the years 1995, 2005 and 2011
(*source: own work based on data from Eurostat*)

To give a better picture of the dynamics of the household equipment consisting of durables, the average rate of changes was applied. This measure determines the increment or a drop in the investigated phenomenon in the investigated period against the extent of this phenomenon in the basic period. Chain indexes were calculated first (1) and then from the obtained indices, the averages were calculated for the period under analysis (2).

$$i = y_n/y_{n-1} \qquad (1)$$

where:

i - chain index.

y_n - period under analysis, given year for which the index is determined.

y_{n-1} - base year, the year preceding the given year.

$$\overline{i_G} = \sqrt[n-1]{i_{n/n-1} \cdot i_{n-1/n-2} \cdot ... \cdot i_{2/1}} = \sqrt[n-1]{i_{n/1}} - 1 \qquad (2)$$

i_G - average rate of changes for the period under analysis (2004–2011).To create the groups of households and to picture the similarities and differences in the equipment with durables, the Ward method was applied, which is a hierarchic method of grouping. The characteristic feature of this method is that in order to estimate the distance between the clusters, the approach of variance analysis is used. In the Ward method, one aims at minimizing the sum of the squares of the deviations of any two clusters that may be

formed at any stage. In the beginning of the procedure, it is assumed that each object constitutes a separate cluster, then stepwise, the most similar objects are connected in groups until a single cluster is obtained containing all information. The method is deemed effective, as it ensures the homogeneity of the objects inside the clusters and at the same time, their heterogeneity among the clusters [22]. It is indicated that the optimum number of clusters can be received by cutting the dendrogram stems where they become too long, that is, where the distance between the clusters is getting significantly greater.

The statistical analysis has been performed with the use of Statistica 10 and Excel.

4   Expenses for home furnishings in the European households

In European countries the highest shares of the expenses for household equipment were recorded for Bulgaria and Italy - 7.5 and 7.2%, respectively (see Fig. 2). Then there were: Iceland - 6.9%, Malta - 6.8% and Austria - 6.5%. The lowest percentage of the income assigned for household equipment was recorded in Latvia - 3.5%, Estonia and Greece - 4% each, Hungary - 4.3% and Poland - 4.5%. In 2011, compared to 2005 or 1995, a decrease in the percentage of expenses for household furnishings was observed in many

countries. The reason for this situation might have been the economic crisis at the end of the first decade of the XXI century.

According to the data provided by National Office for Statistics [2] in Poland, the average monthly expenses for household furnishings in 2012 were PLZ 50 per person and grew by over PLZ 1 compared to 2011, and in 2006, they were just below PLZ 38. The share of the expenses for household equipment was reduced in 2006; it was 5.1% of the total expenses.

The expenses for the household furnishings varied, depending on the type of household. In 2012, the highest expenses for household furnishings were recorded for households with income generated by white-collar jobs and self-employment just below PLZ 72 and over PLZ 65 per month per person, respectively, while in the households where the income was generated by blue-collar jobs, the expenses oscillated around PLZ 36 and for the retired citizens, just below PLZ 37.

The effect resulting from the management scale is the fact that as the number of people in a household grows, the expenses for the household equipment per capita drops. In single-person households, the average monthly expenses amounted to over PLZ 71, while in the case of six-person households and greater, these were just below PLZ 24.

Significant differences in the level of expenses in households were observed when the households were divided with regard to financial situation. In households qualified to the I-quintile group[1], the average monthly expenses were at the level of PLZ 21, and in the households qualified to the V-quintile group, over PLZ 108.

The analysis of the expenses for the household equipment depending on the presence and number of children proves that in childless households, the greatest amounts of money were assigned for household equipment—almost PLZ 76 per capita. As the number of children grew in the family, the expense for the household equipment per capita decreased. In 2012, the monthly expenses in the households with one child were just below PLZ 68 per capita and in the house-

holds with three and more children - just below PLZ 30.

In general, much higher expenses for household equipment were incurred in households of people having a university degree - just below PLZ 89 per month per capita, while in the households of people at the level of primary education or with no education, these expenses were at the level of just below PLZ 31.

It has also been observed that the expenses of households located in larger cities were greater than those of the smaller ones and villages. In towns with population below 20,000, the average expenses for household equipment were PLZ 47 per capita and in the households of cities with the population of 500 and greater PLZ 77. In the villages, the expenses for the household equipment were the least PLZ 41 per month per person.

5   Household durables equipment level

In order to diagnose the situation of the household level of equipment with durables, we can use a three-degree scale of saturation [23, p. 335–336]. In a situation that a given piece of equipment is present in over 80% of the households, it indicates a high degree of saturation. Average degree of saturation is when 50–80% of the households own a given piece of equipment. If a given piece of equipment is owned by less than 50% of the population, we have a low degree of saturation. Based on the product life cycle[2], the household equipment level, and the degree of saturation, we can steadily forecast further development of a product in the market.

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[1] In the GUS (National Office for Statistics) poll, households are divided into five-quintile groups. The first-quintile group is the households of the lowest income - in 2012, the average monthly income per capita amounted to PLZ 411.25. The V group includes households with the highest income – in 2012, the households' available income amounted to PLZ 2679.19 per capita.

[2] Product life cycle is a term denoting a period in which the product is present in the market. This cycle is composed of four stages: market launch, increase in the sales, saturation/maturity, drop in the sales. At the first stage, the customers are informed that the product is available in the market and sometimes they are educated on how to use it. In the stage of the sales increase, the sales are growing rapidly, the effect of which is the reduction in the unit costs of production, promotion and further market growth. In this phase aftermarket, follow-on products may appear and their number and force may lead the producers to implement necessary modifications to the product. In the maturity stage, the sales grow but this growth is slower than in the previous stage. At this stage, the producers should aim at conquering new markets and/or new market segments on which the company operates. In the last stage, a drop in the production and sales takes place. Advertising the product does not bring expected results. A successful instrument for promotion maybe the reduction in price, finding new applications for the product, new distribution channels, product modification or targeting different segment of clients.
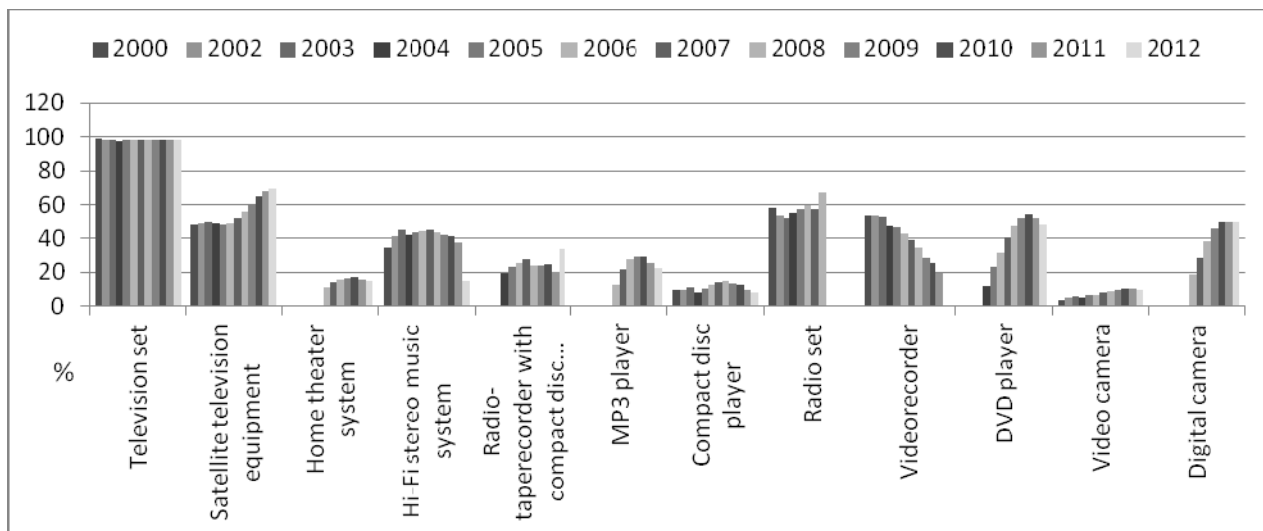
Figure 3. The share of Polish households owning audio entertainment equipment in the years 2000 – 2012
(*source: own work based on data from Eurostat*)

The data contained in the GUS Household Budget statistics indicate that such goods as satellite television, cell phones, washing machines, vacuum cleaners or refrigerators have a high degree of saturation in the Polish households. The lowest degree of saturation is of (below 20% of the households) home theaters, video cameras, video recorders, CD players, computers without access to the Internet, dishwashers, motorcycles and scooters. From the manufacturers of products having a high-saturation degree, we require introducing innovation so as to be distinguished among the competition and attract the consumer (product novelty, better functionality, and better cost effectiveness).

In the first decade of the XXI century, many changes took place in the Polish households. Modern data carriers made VCRs obsolete that in the beginning of the decade were owned by almost 52% of the households and in 2011 by approximately 19%. The market saw a relatively large increase in goods such as: cell phones (in 2001, 37% of the households; in 2011, over 90%), computers (from 16 to 67%), printers (from 9 to 40%), DVD players (from approximately 11 to almost 52%), digital cameras (from 28% in 2007 to 50% in 2011), microwave ovens (from 17 to over 53%) (see Fig. 3). In the case of some of the entertainment goods, a short-life cycle of products was observed resulting from the introduction of new technologies. The examples of the products with such a short-life cycle are radio receivers fitted with a CD player, CD players and MP3 players.

Among household appliances, the greatest increase was observed for microwave ovens, from 17% in 2000 to over 54% in 2012, and dishwashers, from approximately 2% in 2000 to almost 20% in 2012. The statistics for washing machines have been observed to grow as well from approximately 71% in 2000 to over 92% in 2012.

Relatively small changes in the household equipment were observed for vehicles. In 2000, 60% of the households had bicycles, approximately 4% mopeds and over 47% cars. In 2012, this was over 64%, approximately 6% and 60%, respectively.

On one hand, it is indicated that in the era of crisis, the consumers are more careful deciding about their purchases and services, while on the other hand, the analyses of ConsumerLab 2012 have shown that the crisis did not influence the use of electronic services. Among the most conspicuous consumer trends, access to the Internet was the most frequently appearing need. Household budgets indicate that the household level of equipment with computers with access to the Internet is growing gradually. In 2000, the share of Polish households having access to the Internet was 5.1% and in 2012 – 64.7%. Printers were a part of the household equipment with a share of 8.8% while in 2012, this was 37.2%. A similar situation was seen in the case of cell phones[3]. In 2002, 37.1% of the households had a cell phone while 11 years later, this grew to 92%.

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[3] In the GUS Household Budgets, the item indicating the household level of equipment with cell phones is given starting from 2002.
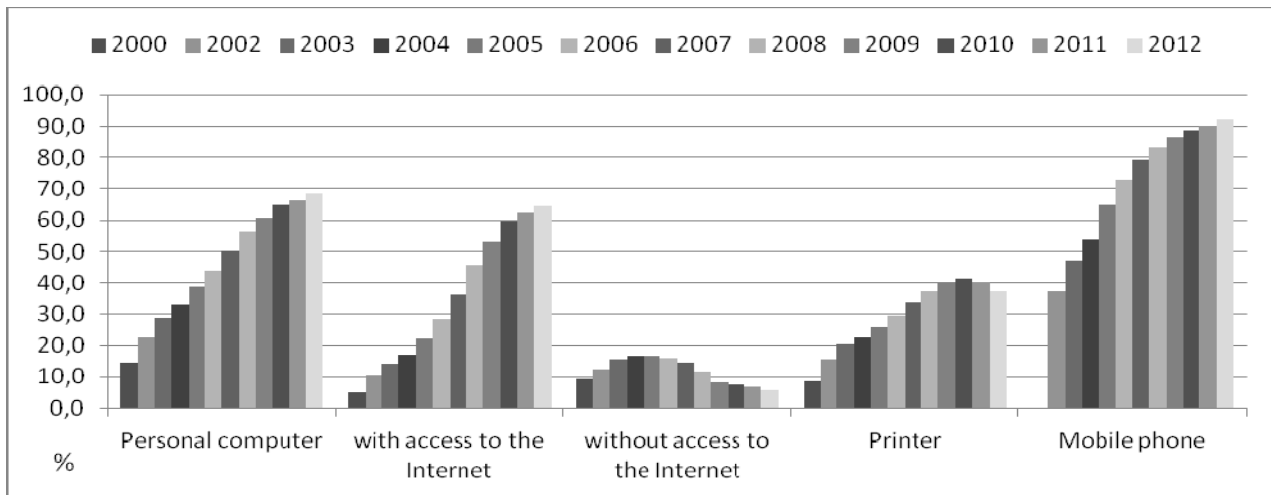
Figure 4. Average rate of changes in the equipment of households with durables in the years 2000–2012
(*source: own work based on data from Eurostat*)

In Europe in 2012, the greatest share of households having access to the Internet was recorded for Iceland, Holland, Luxembourg and Denmark – over 90% of the households had access to the Internet. On average, in the EU (27 states), 76% of the households had access to the Internet. The Internet access shares similar to that of Poland were observed for the Czech Republic and Latvia (69% each). The lowest share of the households having access to the Internet was observed in Bulgaria – 51% and Greece and Romania – 54%.

The number of people who can efficiently use the Internet is growing. The greatest share of people who can search for required information in the Internet was recorded in Norway - 91% and the UK and Iceland - 90%. The lowest number of people who can efficiently use the Internet was recorded in Romania 2%, Bulgaria – 49% and Greece – 53%. In Poland, 64% have declared the ability to search the Internet.

The ever-growing use of the Internet and the presence of social media may contribute to the entrepreneurs obtaining a competitive advantage. Integrity and reliability of the producers and service providers may result in good reviews on the internet forums.

Entrepreneurs cannot operate as they used to; they cannot end on declarations on social responsibility. Businesses have to open an honest dialogue with the consumers. We must also remember that the consumer is becoming increasingly demanding.

Analyzing the household level of equipment with durables, we can divide them into standard, that is, such that are available for each household and are owned by more than half of them, higher standard goods owned

by 10 to 50% of the households, and luxury goods owned by less than 10% of the households [9, p. 161, 164].

A new device that became popular in the beginning of the XXI century in Polish households was a dishwasher. In 2001 – 2.4% of the households were equipped with a dishwasher and 10 years later, the number grew to 17.7%. A luxury device in Polish households also turned out to be ceramic cooktops. In Household Budget Statistics [2, p. 198], it has been included since 2010 when 8.2% of the households declared having such a device. The number grew to 8.4% in 2012.

The index of the rate of changes in the equipment level of Polish households in the years 2000–2012 shows that the highest dynamics had the computers with access to the Internet. The average growth rate in the said years was 26%. A relatively high rate was also seen in the case of dishwashers (on average, from year to year, the share of dishwashers present in the households increased by 24.2%), DVD players (from year to year by 19.3%) digital video cameras (from year to year by 17.9%) (see Fig. 4). A relative stabilization in the share of durables in Polish households was observed for bicycles, refrigerators, freezers, vacuum cleaners, washing machines, radio cassette players and CD players, television sets and Hi-Fi stereo. The greatest negative rate of change was observed for VCRs – from year to year, the share of the households having this piece of equipment decreased by 9.7%, and computers without access to the Internet - from year to year, this share decreased by 4.1%.

6   Comparison of the equipment of different types of households

The level of household equipment with durables is an indicator of wealth and consumption position of the households. The equipment of households with certain goods also results from the need to have them. The greatest share of households equipped with dishwashers was recorded for the self-employed families (46.3%), for families where the head of the household had a university degree (35.6%), couples with two children (34.3%) and people generating their income from white-collar jobs (31.3%). The lowest share of households equipped with dishwashers was recorded for the families where the head of the households had high-school education (3.6%), retired people (5.3%) and singles (6.5%). The dishwasher then turns out to be a luxury device for some of the households and a higher-standard device for the other [2, p. 215]. The greatest share of the households equipped with a ceramic cooktop was recorded for self-employed families (20.9%) and the lowest for families of the lowest education

level (1.9%) and in the households located in the Podkarpackie (1.9%) and Świętokrzyskie (2.8%) regions of Poland. From the research [13, p. 101], it results that the presence of durables in households is most heavily dependent on the available income. The possession of ceramic cooktop significantly differed depending on the material status in the households. In 2011, this device was owned by 3.3% of the poorest households and 15.1% of the wealthiest ones [2, p. 215].

In the next tables, the shares of households equipped with selected luxury and higher standard goods have been listed depending on the type of household. A difference has also been calculated between greatest and lowest shares of the presence of a given device in a household in %.

From the analysis of the equipment with durables with regard to the financial situation in a household (quintile group), it results that the greatest differences were observed for laptop computers, printers, dishwashers, ceramic cooktops, video cameras and access to the Internet (see Tab. 1).

Table 1. The share of the households equipped with durables depending on the quintile income group
(*source: own work based on data from Eurostat*)

Specification	QG I	QG II	QG III	QG IV	QG V	The difference between the maximum and minimum in percentage points
Home theater system	11.2	13.9	14.9	15.3	19.4	8.2
Hi-Fi stereo music system	36.3	36.4	35.5	34.4	43.2	8.8
Radio with compact disc player or radio tape recorder with compact disc player	17.3	19.2	18.5	19.4	23.9	6.6
MP3 player	24.6	27.4	24.0	22.3	28.3	6
Compact disc player	7.3	9	8.5	9	11.6	4.3
Video recorder	16.9	18.8	18.0	19.7	21.5	4.6
Video camera	5.1	7.6	8.9	9.5	15.6	10.5
Laptop	23.7	28.8	30.1	34.0	52.3	28.6
Personal computer with broadband access to the internet	43.0	46.2	44.5	43.0	59.2	16.2
Personal computer without access to the internet	12.7	7.9	5.8	5.4	5.3	7.4
Printer	35.1	39.6	38.4	36.3	47.8	12.7
Electric ceramic cooker	3.3	4.5	5.6	7.3	15.1	11.8
Dishwasher	8.8	12.2	14.3	16.5	29	20.2
Motocycle, scooter, motorbike	9.2	8.2	6	4.7	4.4	4.8

The analysis of the household equipment with durables with regard to the socio-economic group proved that the greatest difference in the equipment were for (similarly, as in the case of the financial situation)

laptop computers, access to the Internet, printers, dishwashers but also MP3 players and Hi-Fi stereo (see Tab. 2).

Table 2. The share of the households equipped with durables depending on socio-economic group
(*source: own work based on data from Eurostat*

Specification	Households						The difference between the maximum and minimum in percentage points
	of employees in manual labour positions	of employees in non-manual labour positions	farmers	of the self-employed	retirees	pensioners	
Home theater system	19.4	24	12.4	32.2	5.1	4.7	27.5
Hi-Fi stereo music system	44.3	53.6	40.1	55.8	19.4	16.6	39.2
Radio with compact disc player or radio tape recorder with compact disc player	21.3	26.5	21.9	27.7	14.2	12.5	15.2
MP3 player	30.7	41.3	27.7	40.9	6.5	7.5	34.8
Compact disc player	10.2	14	11.2	15	4.9	3.8	11.2
Video recorder	19.7	21.2	24	22.4	18.4	14.7	9.3
Video camera	8.6	18.2	5.8	27.4	3.9	2.2	25.2
Laptop	34.4	61.5	26.4	64.7	14.7	12	52.7
Personal computer with broadband access to the internet	54.8	72.8	48.3	72.9	22.2	19.5	53.4
Personal computer without access to the internet	9.3	7.2	12.1	8.4	3.8	4.1	8.3
Printer	44.1	62.5	49.2	71.5	16.5	14	57.5
Electric ceramic cooker	4.7	14.1	5.4	20.9	4.3	3	17.9
Dishwasher	12.7	31.3	15.3	43.6	8.6	5.3	38.3
Motocycle, scooter, motorbike	8.8	5.7	17.4	10	2.7	2.7	14.7

The analysis of the household equipment with durables with regard to the biological type of family proved that the greatest differences were for MP3 players and access to Broadband Internet (see Tab. 3).

Table 3. The share of the households equipped with durables depending on the biological type of family (*source: own work based on data from Eurostat*)

Specification	Households without children	Marriage with one dependent child	Marriage with two dependent children	Marriage with three and more dependent children	Mother or father with dependent children	The difference between the maximum and minimum in percentage points
Home theater system	12.3	28.1	30.8	19.3	15.8	18.5
Hi-Fi stereo music system	30.1	52.7	55.9	51.5	44.4	25.8
Radio with compact disc player or radio tape recorder with compact disc player	17.4	24.4	27.7	26.6	23.6	10.3
MP3 player	10.9	41.5	47.2	44.9	42.9	36.3
Compact disc player	7.3	13.7	14.7	12.3	9	7.4
Video recorder	21.6	20.5	22.4	22.4	15.2	7.2
Video camera	8.3	19.1	23	13.9	11.3	14.7
Laptop	29.2	53.7	51.7	38.8	44.8	24.5
Personal computer with broadband access to the internet	37.0	69.2	70.4	61.6	58.8	33.4
Personal computer without access to the internet	4.5	7.4	9.8	13.2	10.4	8.7
Printer	27.6	60.6	66.8	59.6	45.1	39.2
Electric ceramic cooker	8.7	12.9	14.1	7.3	9.4	6.8
Dishwasher	18.3	28.4	34.3	24.2	18.8	16.0
Motocycle, scooter, motorbike	3.5	6.8	9.6	13.8	2	11.8

The greatest difference in the household equipment depending on the education level of the head of the household were, as previously, for computers, printers, access to the Internet and dishwashers (see Tab. 4).

Table 4. The share of the households equipped with durables depending on the education level of the head of the household (*source: own work based on data from Eurostat*)

Specification	Level of education of the reference person				The difference between the maximum and minimum in percentage points
	Tertiary	Post-secondary; secondary vocational and secondary general	Basic vocational	Lower secondary, primary, no formal education	
Home theater system	22.2	16.8	14.9	5.6	16.6
Hi-Fi stereo music system	50.5	39.6	37	17.4	33.1
Radio with compact disc player or radio tape recorder with compact disc player	26.9	21.4	19.3	10	16.9
MP3 player	37.6	27.7	23.3	8.6	29
Compact disc player	13.3	10.4	8.8	3.1	10.2
Video recorder	21.5	21.7	20	10.5	11.2
Video camera	19.9	11.1	6.8	1.7	18.2
Laptop	63.5	39.1	26.9	10.2	53.3
Personal computer with broadband access to the internet	70.3	52.2	44.7	17.6	52.7
Personal computer without access to the internet	6.8	6.8	7.9	5.3	2.6
Printer	61.3	44.3	36.2	11.8	49.5
Electric ceramic cooker	17.8	8.2	4.4	1.9	15.9
Dishwasher	35.6	18.3	12.1	3.6	32
Motocycle, scooter, motorbike	4.8	5.3	8	5.6	3.2

The size of the households also determined the access to the Internet, laptop computers, Hi-Fi stereo and printers (see Tab. 5).

Table 5. The share of the households equipped with durables depending on the size of the household
(*source: own work based on data from Eurostat*)

Specification	Households						The difference between the maximum and minimum in percentage points
	One-person	Two-persons	Three-persons	Four-persons	Five-persons	Six and more persons	
Home theater system	4.5	11.5	22.4	26.7	19.7	15.8	22.2
Hi-Fi stereo music system	18	30.5	47.8	53.3	50.8	47	35.3
Radio with compact disc player or radio tape recorder with compact disc player	12.4	17.8	22.9	26.3	24.6	27.3	14.9
MP3 player	9.4	13.6	34.2	43.4	40.1	34	34
Compact disc player	4.2	7.5	12.3	13.7	12.3	11.6	9.5
Video recorder	12.4	20.6	21.3	22.3	23.6	22.0	11.2
Video camera	2.7	7.7	14.4	18.1	12.8	8.7	15.4
Laptop	21.0	30.0	46.5	49.8	42.1	35.9	28.8
Personal computer with broadband access to the Internet	24.0	38.5	62.5	67.8	63.7	58.9	43.8
Personal computer without access to the Internet	3	5.1	7.5	9.9	11.2	13	10
Printer	14.5	28.8	53	62.7	59.7	54.6	48.2
Electric ceramic cooker	5.6	7.9	10.2	11.2	6.8	4.6	6.6
Dishwasher	6.5	16.2	22.3	28.1	22.1	17.6	21.6
Motocycle, scooter, motorbike	1.5	3.5	5.9	9.4	12.1	17.4	15.9

The greatest differences in the share of the households equipped with a given durable device with regard to the location of the household were recorded for laptop computers and access to Broadband Internet (see Tab. 6).

From the performed comparison, it results that the durables that differentiate the households most are: laptop computers, printers and access to the Internet.

Table 6. The share of the households equipped with durables depending on the classification of the location of residence

Specification	Town by size in thousand					Rural	The difference between the maximum and minimum in percentage points
	Less than 20	20–99	100–199	200–499	500 and more		
Home theater system	16.8	17.2	19.3	17.1	15.1	12.8	6.5
Hi-Fi stereo music system	36.1	37.2	39.9	42.1	41.6	34.6	7.5
Radio with compact disc player or radio tape recorder with compact disc player	20.6	20.6	22.2	21.9	22.8	17.3	5.5
MP3 player	23.5	24.5	26.5	30.2	34.3	20.9	13.4
Compact disc player	9.6	10.3	7.6	10.9	10.7	8.1	3.3
Video recorder	18.4	22.1	19.0	22.5	16.9	18.2	5.6
Video camera	9.8	11.4	10.5	12.7	14.2	6.8	7.4
Laptop	32.2	35.4	39	44.8	54.7	25.8	28.9
Personal computer with broadband access to the internet	44.3	46.4	55.3	55.2	64.2	39.7	24.5
Personal computer without access to the internet	6.3	6.6	5.3	6.1	5.3	8.7	3.4
Printer	40.6	39.7	38.8	43	45.2	37.7	7.5
Electric ceramic cooker	6.6	6.7	10.6	9.7	12.6	6.3	6.3
Dishwasher	17.8	17	18.8	18.5	23.9	14.8	9.1
Motocycle, scooter, motorbike	5.3	4	2.9	2.4	2.5	11.2	8.8

7   Classification of Polish households with regard to home entertainment and electronic equipment

In this chapter, a classification of the types of households has been performed with regard to durables.

Such a classification may be helpful when developing marketing strategy of a product, particularly in the pricing and promotion strategies. The household groups may be treated as market segments[4].

The application of cluster analysis allowed distinguishing five groups of households with regard to the home entertainment and electronic equipment (see Fig. 5). The dendrogram has been cut at the level of 50.

In cluster I, there were households (see Fig. 6): of self-employed and white-collar workers, couples with one or two children and families where the head of the household had a university degree. Four-person families were also a part of this group. These households turned out to be best equipped in home entertainment and electronics.

Cluster II included households: of single mothers or fathers, three- and five-person families as well as couples with three and more children.

In the said households, the equipment in home entertainment and electronics was greater than in clusters III, IV and V and lower than in I. It appears as though having children in the family forces the possession of many entertainment and electronic goods, yet a relatively more difficult financial situation in these households compared to the households from cluster I manifests through a much poorer equipment statistics.

For cluster III, the following households qualified: households located in cities with population above 100,000, households of blue-collar workers and families where the head of the household had high-school education and the wealthiest households.

The share of households equipped with home entertainment and electronics was similar to that of cluster II; only a lower share of households had MP3 players, DVD players and digital cameras.

The qualification of the wealthiest and other households to one cluster calls for an explanation. Average available income in households from quintile group V and households of blue-collar workers differ significantly.

Durables, including home entertainment are frequently a substitute for the consumption of certain market services, particularly those pastime-related. In the poll, the equipment of households with durables is analyzed, while in some of the households, these goods may be substituted by market services (movie theater).

The analysis shows the household level of equipment with durables, in terms of quantity and the level of wear and obsolescence is not analyzed, which may render individual households different.

In cluster IV, there were single-person households with the lowest education level and retired people. These were the households of the relatively worst entertainment and electronic equipment statistics.

A characteristic feature in this cluster is the highest share of equipment with radio receivers and cassette players. The features of the households, however, indicate that this kind of equipment is obsolete.

Cluster V included the most types of households, two-person households, childless households, the households from I to IV quintile group, those located in the rural areas and cities of the population below 100,000, farmers and families where the head of the households had a vocational education level.

These households were characterized by relatively poorer statistics in the equipment with home entertainment and electronic goods, while many of these households were equipped with obsolete devices such as radio receivers.

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[4] Market segment - a relatively uniform group of clients with distinguished features: geographical, demographic, psychographic, or behavioral.
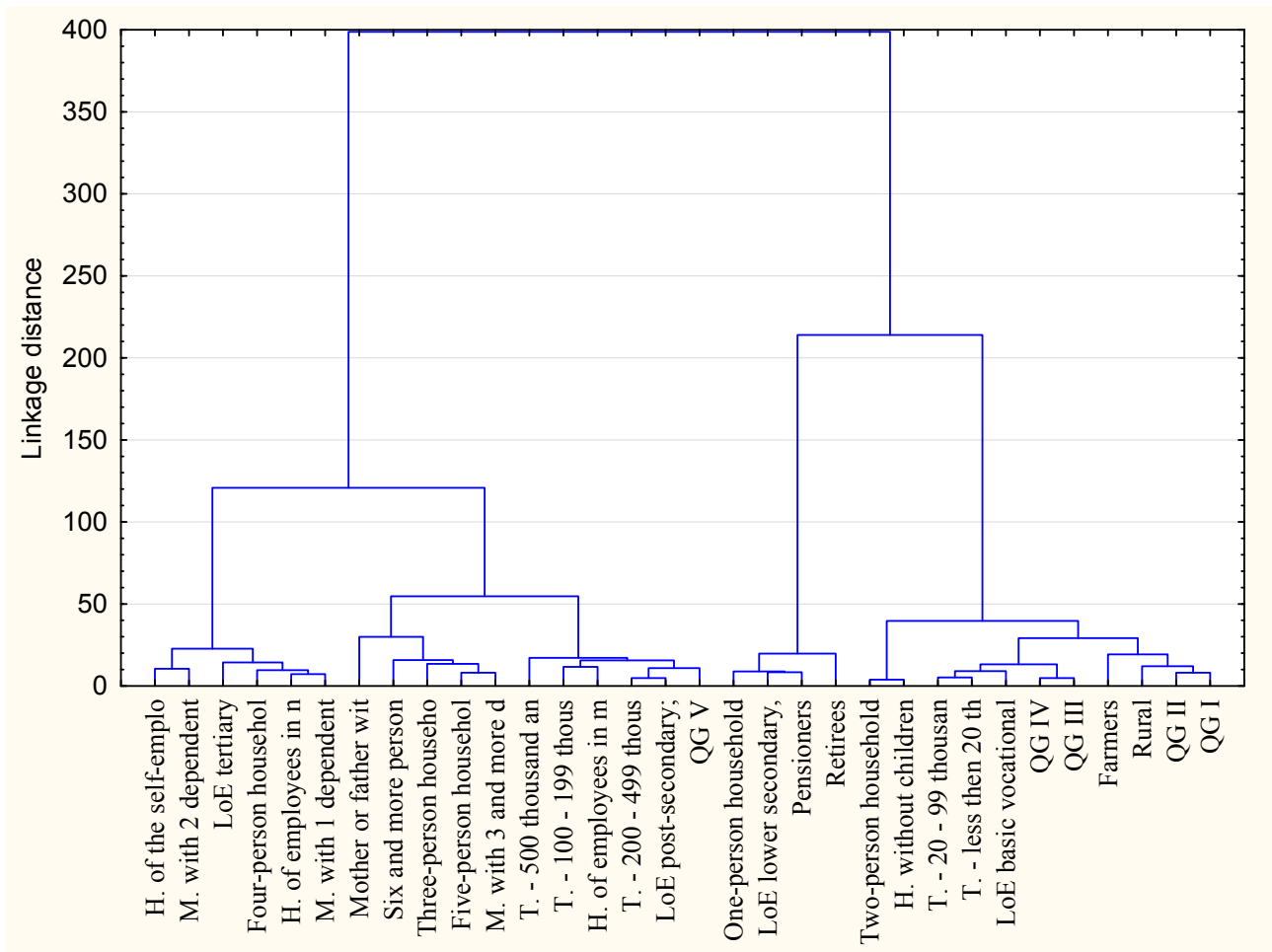
Figure 5. Groups of households distinguished with regard to home entertainment and electronic goods
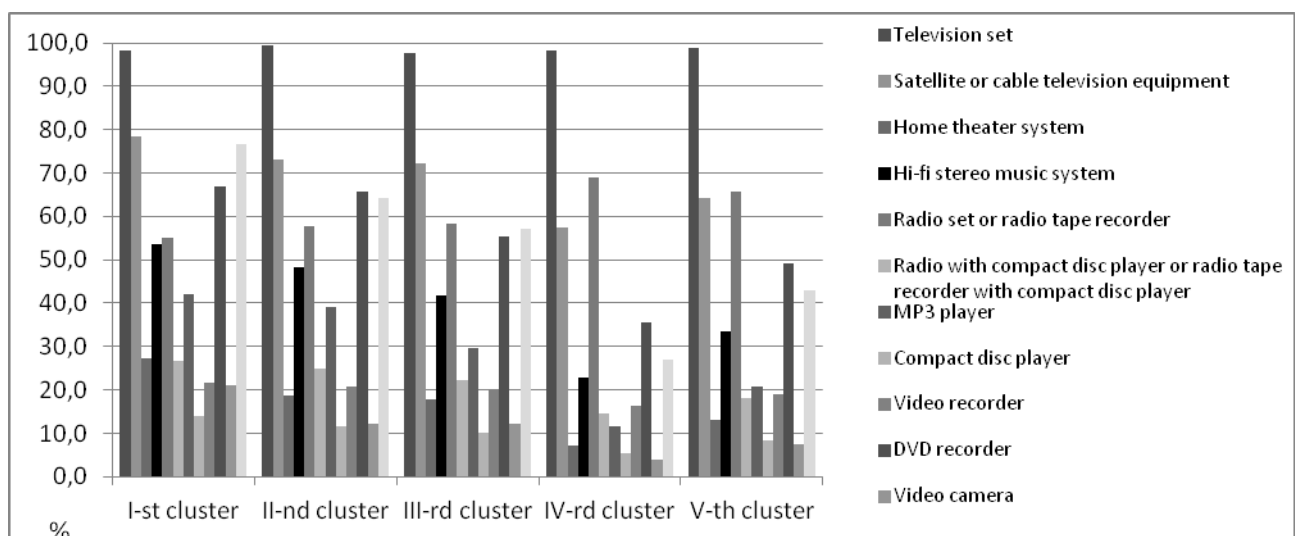
Figure 6. Average share of households in the subsequent clusters with regard to home entertainment
and electronic goods

8   Classification of Polish households with regard to equipment with household appliances

The application of the cluster method allowed distinguishing four groups of households with regard to the equipment with household appliances. The graph has been cut at the level of 30 (see Fig. 7).

Cluster I included the following types of households (see Fig. 8): households located in towns of population below 20,000 and villages, households whose source of income was agriculture and blue-collar jobs; three, five and more person families; and couples with three and more children. The equipment with household appliances of the said households we can place on the second position after cluster II. The analyzed types of households are characterized by a relatively good level of equipment. This may be the result of specificity of these households. It appears that in households located in the villages, because of, as we call it, self-supply, there is a need to own certain durables (freezers).

Cluster II included households whose source of income was white-collar jobs, households of the self-employed, families with one and two children, four-person families, the wealthiest households as well as the households whose head had a university degree. These households were characterized by a relatively highest level of equipment with household appliances.

Cluster III included single-person households, with the lowest education level of the head of the household and retired people. These were households of the lowest level of equipment with household appliances. In this cluster, there were households of the lowest number of persons for which, as it appears, there is no need to own certain household appliances.

Cluster IV covered households: located in towns and cities of the population greater than 20,000 and villages, with no children, households of single mothers or fathers, two-person households, households from I to IV quintile group, with basic vocational education of the household head. The said types of households had a lower share of household appliances than clusters II and I.
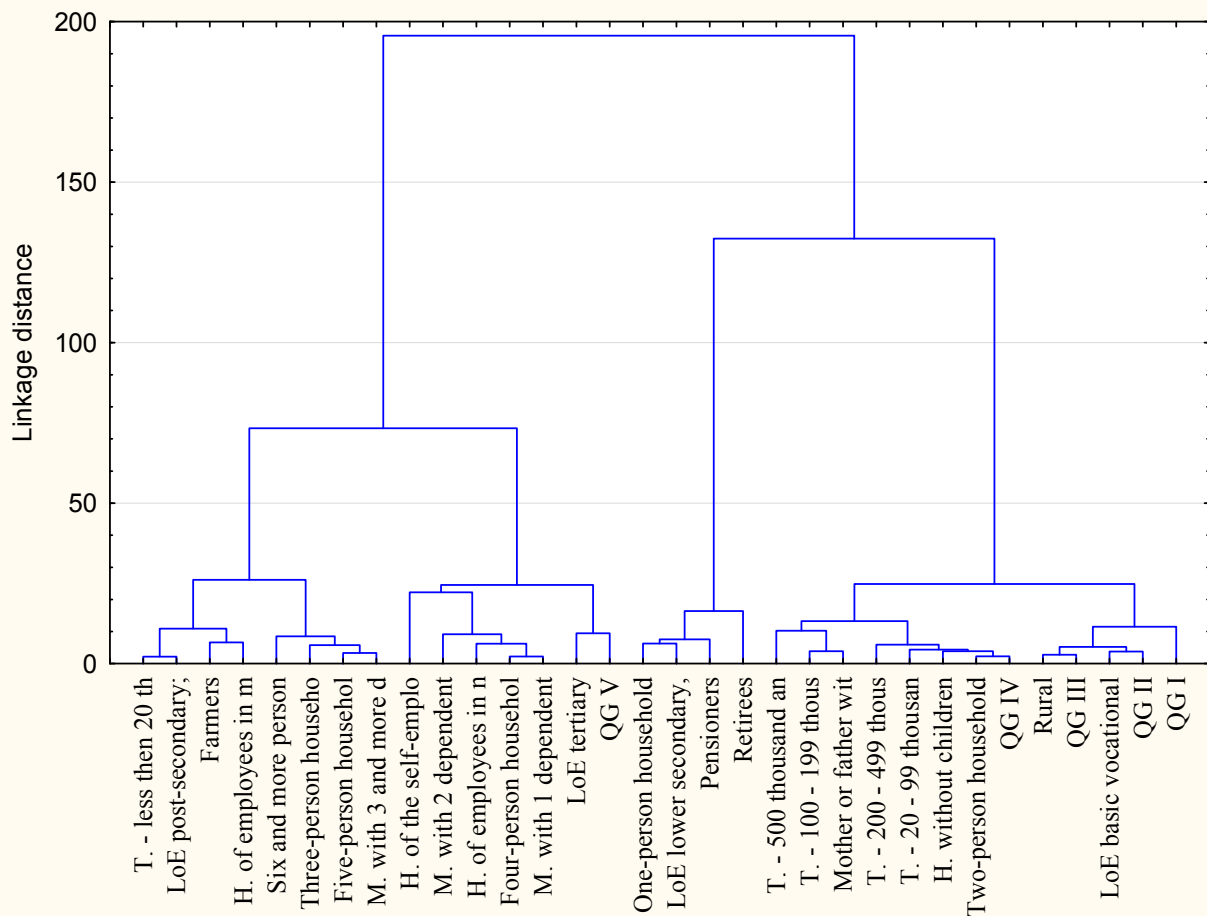
Figure 7. Groups of households distinguished with regard to equipment with household appliances
(*source: own work based on data from Eurostat*)
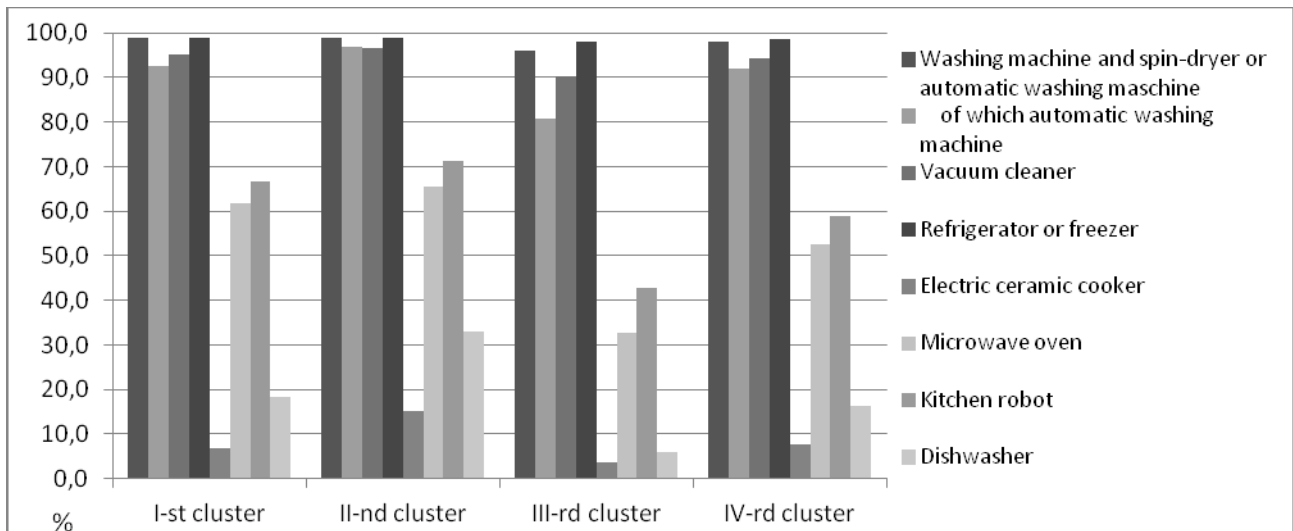
Figure 8. Average share of the households in subsequent clusters equipped with households appliances
(*source: own work based on data from Eurostat*)

9 Classification of Polish households with regard to equipment with computers and the Internet

Owing to the application of cluster analysis, six groups of households were distinguished with regard to the equipment level with computers, the Internet and printers. The dendrogram was cut at the level of 30 (see Fig. 9).

Cluster I contained households (see Fig. 10): three, six, and more person families and single mothers or fathers. In this cluster, a relatively high percentage of households was equipped with computers, the Internet and printers. The presence of children in a household confirms the need to own many goods, computers and the Internet, in particular.

Cluster II included households: couples with children, four- and five-person families, households whose source of income was self-employment and white-collar jobs, households whose head had a university degree. These were the households the greatest percentage of which was equipped with computers and printers as well as access to the Internet. The presence of children in the households and a relatively better financial situation compared to cluster I results in a better equipment level.

Households located on the right side of the dendrogram branch are characterized by a worse level of equipment with computers and access to the Internet than that of the same on the left side of the dendrogram branch.

Cluster III contains households of the retired people, single-person households and households of the lowest education level of the head. In the said households, the poorest equipment with computers, printers and access to the Internet was recorded. Elderly persons and people with a lower level of education still have difficulties using the computer or the Internet.

Compared to the rest, cluster III is characterized by an average level of equipment with computers and access to the Internet.

Cluster IV included households: located in cities with population above 99,000, whose source of income was blue-collar jobs and agriculture, households from the V quintile group and households whose head of the household had high-school education.

Cluster V included two types of households: two-person and childless households. Cluster VI included households qualified in the I to IV quintile group, located in cities with the population above 100,000 and households of basic vocational education of the head of the household.
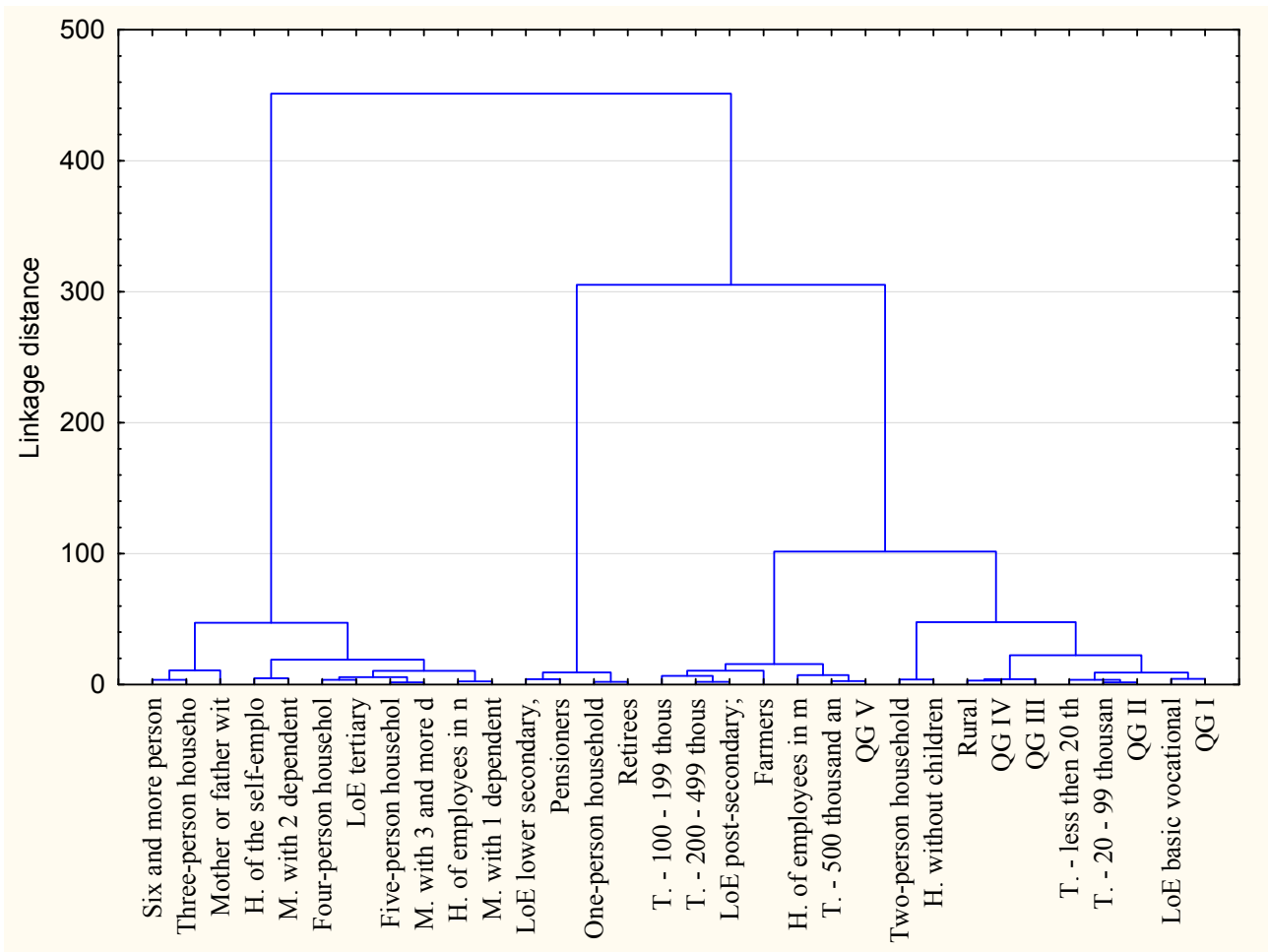
Figure 9. Household groups divided with regard to the level of equipment with computers, printers
and access to the Internet
(*source: own work based on data from Eurostat*)
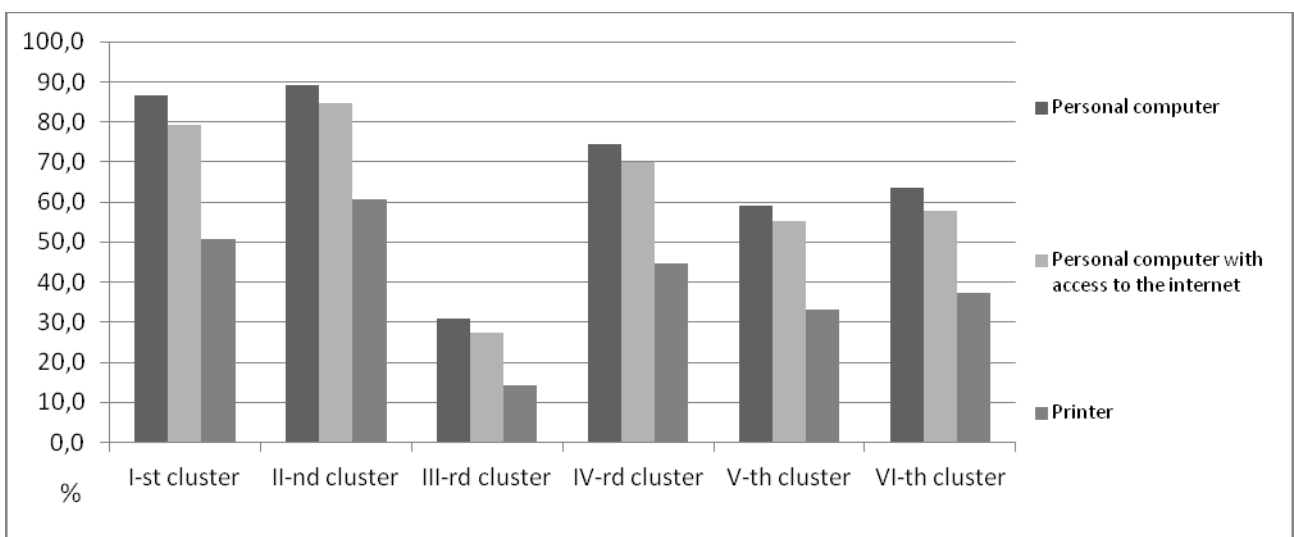
Figure 10. Average share of households in subsequent clusters in terms of computers,
printers and access to the Internet

10   Classification of Polish households with regard to mobile durables

The performed cluster analysis allowed distinguishing five groups of households with regard to mobile durables such as vehicles, motorcycles, scooters and bicycles (see Fig. 11). The dendrogram has been cut at the level of 50.

Cluster I included households of farmers, self-employed people, four and more person families, couples with two and more children (see Fig. 12). These were household types of the greatest level of equipment with vehicles. The rural location forces the possession of vehicles due to lack of public transit.

Cluster II included households whose head had a university degree, three-person families, white-collar workers and couples with one child. These were households where bicycles were present less frequently than in cluster I and V but passenger vehicles were relatively frequent.

Cluster III included single-person households, households of retired people, households whose head had the lowest level of education and "incomplete" families. These were households whose lowest share had bicycles and motor vehicles.

Cluster IV aggregated the households located in cities with the population of over 20,000, households from the III, IV and V quintile group, childless households, households with high-school education level of the head and two-person families. The households of the said cluster had a relatively poor level of equipment with vehicles.

The last cluster included households located in the rural areas and small towns, households from the quintile groups I and II, households whose main source of income was blue-collar jobs and the head of the household had a basic vocational education level. The said households had two-wheeled vehicles more frequently than in the households of clusters II, III, and IV.
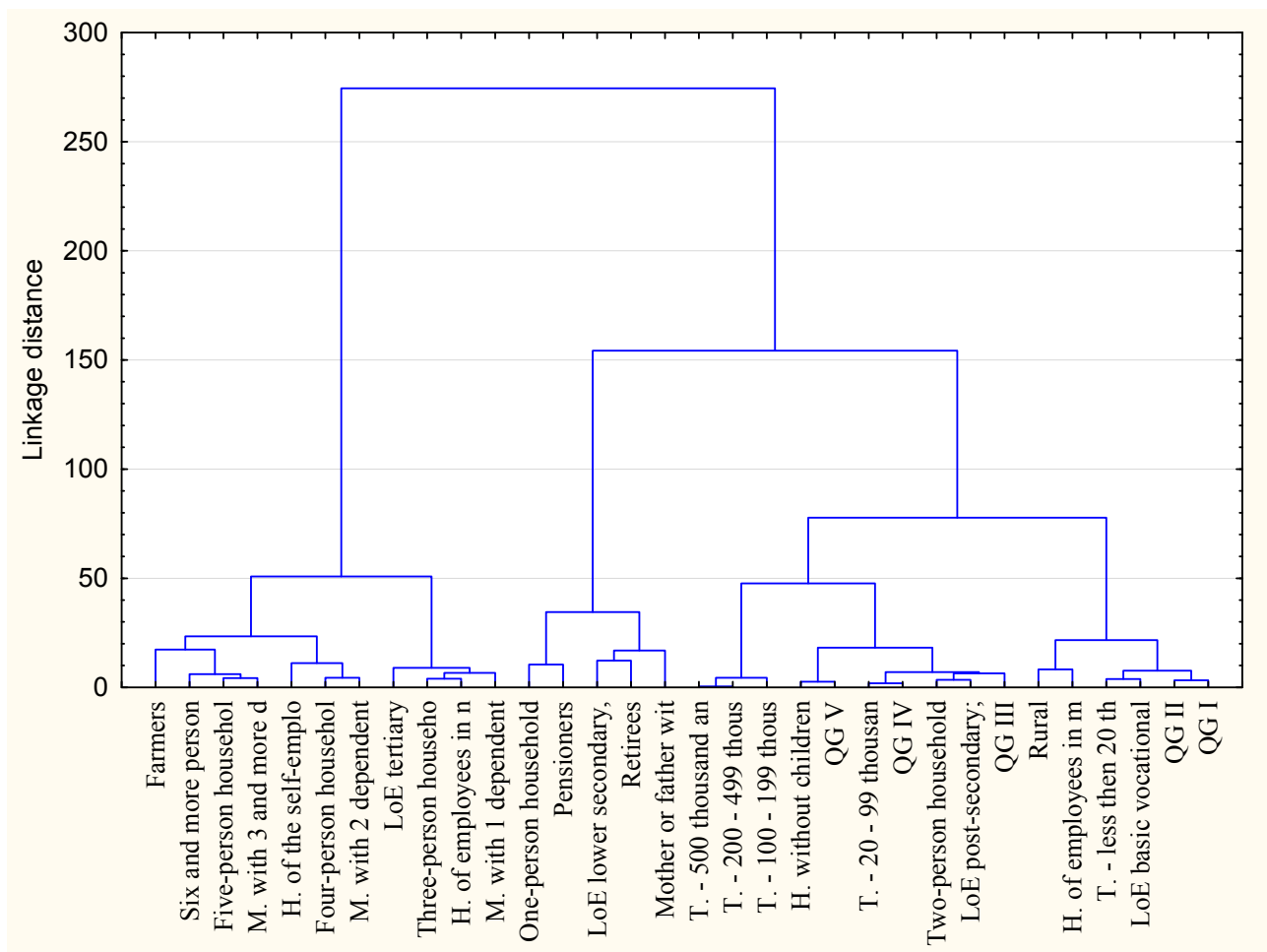
Figure 11. Household groups divided with regard to the level of equipment with mobile durables (*source: own work based on data from Eurostat*)
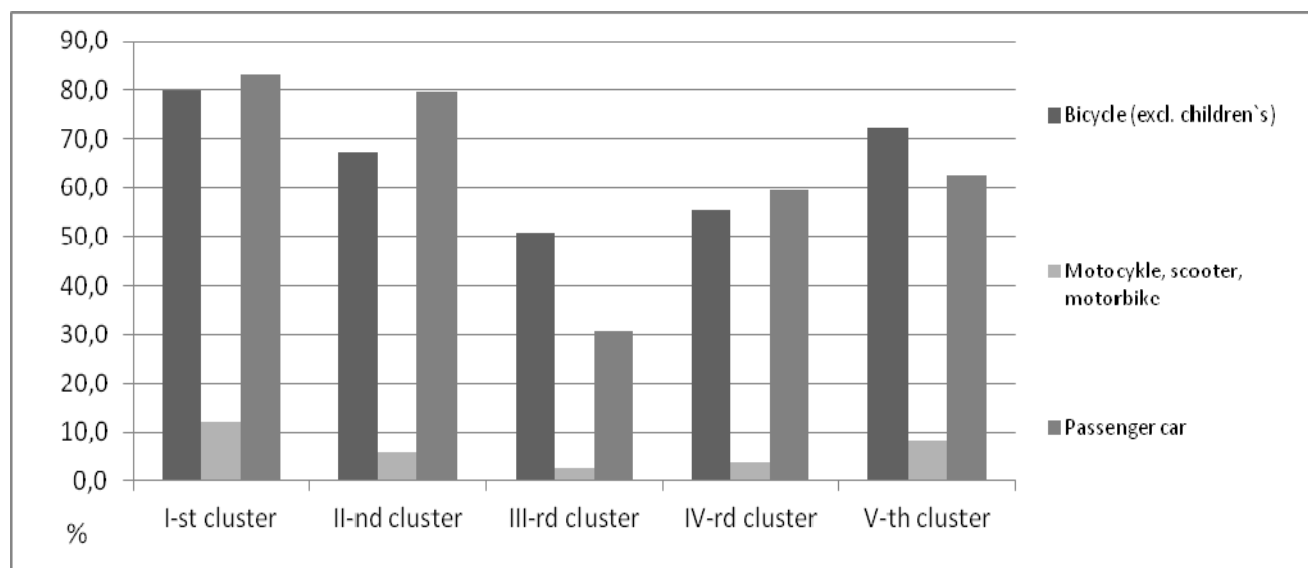
Figure 12. Average share of households in subsequent clusters in terms of mobile durables
(*source: own work based on data from Eurostat*)

11   Summary and conclusions

To conclude, if the level of life comfort is to be measured by the indicator of household equipment with durables, then, in recent years, an improvement in Poland is visible. Polish households are consequently getting better equipped with many appliances.

This image is most likely influenced by the fact that many goods are getting cheaper, thus becoming increasingly available for a wider group of consumers. Some of the goods are losing popularity (home telephone lines, Hi-Fi stereo, CD players), but the reason for this is the technological advancement (cell phones, MP3 players). It is noteworthy that the level of equipment with durables is not a good indicator of the level of life.

A more important indicator is the opinion of the household members on their needs satisfied by these durables. It is also noteworthy that the GUS (National Office for Statistics) data give a quantitative status, not providing information on the conditions or obsolescence of the appliances. As Zalega stresses [24, p. 17], an improvement in the equipment level with durables has both a quantitative and qualitative nature.

An increase in the equipment level in ICT (Information and Communication Technology) media confirms the advancement of the consumption models and is far more visible in households of higher available income.

The conducted analysis allowed solving the research problems set forth in the beginning of this paper:

- The greatest amount of money from general expenses in European households was spent by Bulgarians and Italians and the least amount of money was spent by Latvians, Estonians, and Greeks. The increasing wealth of the societies, of Central and Eastern Europe in particular, should lead to an increase in the expenses for household equipment and development of this market;

- Expenses for durables in Poland are getting higher each year. The greatest amount of money was invested in households having the best financial situation and the least – in numerous families;

- Goods of high saturation in the Polish households are: television sets, vacuum cleaners, washing machines and cell phones. Many goods are phased out of the market (a VCR) by more modern appliances. In the years 2000–2012, a dynamic growth was observed in the household equipment with microwave ovens, computers and access to the Internet, cell phones as well as dishwashers, yet in the case of the dishwashers, we can still observe a low level of saturation in the Polish households;

- Cluster analysis allowed distinguishing groups of households of similar saturation with durables. The best-equipped households with most of the durables turned out to be the households with one or two children and a better education level of the household head. In less numerous households of a relatively worse financial situation and households of the elderly people, the lowest equipment level was observed.

The distinguished clusters of households are consumer segments. The presented analyses also indicate the trends of the Polish consumers in terms of the equipment with durables.

In many cases, the lack of a need results in the absence of a given durable that is, elderly persons are very likely not to need to own a computer with access to the Internet. The role of the marketing is, hence, to induce these needs.

We may expect that in the nearest future, in households of lower level of equipment with durables, we will observe a growing trend. Consequently, the expenses for durables will grow.

The adaptation of the market offer to individual types of households becomes a necessity. Also, the trends in the consumption are not to be neglected (society ageing, migration to cities, households of reduced number of family members) if we wish to properly design durable goods.

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A MODEL FOR INFORMATION SUPPORT FOR KNOWLEDGE WORKERS

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Abstract: This article aims to elaborate on a model of information support for knowledge workers in Polish enterprises. Earlier research has explored the use of Web 2.0 technology for information sharing. Nevertheless, relatively little information has been published that focuses on the impact of information sharing among knowledge workers within a company and its subsequent influence on a firm's effectiveness as identified via the number of new products created, number of completed research topics, or number of new patents. The author aims to analyze the effectiveness of information sharing in Polish enterprises based on the research results gained from the study described in this paper. In particular, this study pays attention to the likely consequences and results of information sharing by the use of employee web logs. This is followed by a discussion of the results of the empirical studies and of the supporting literature. The summary indicates potential directions for further work.

Keywords: knowledge workers, employee web logs, information sharing.

1   Introduction

The progress of information technology has made it feasible for firms in many industries to collect and process information like never before. Generally, information technology (IT) can be regarded as a natural medium for managing knowledge [1, 10]. Organizations usually use information technology to transfer tacit knowledge from individuals to a knowledge repository [4]. Moreover, the tacit knowledge transfer process could be focused on transferring a specific type of knowledge from one employee to another.

IT in enterprises has evolved from traditional information systems (IS) implementations (monolithic, centralized, and controlled) to implementations based on social media and collaborative sharing: Web 2.0, social media, online communities, etc. [13]. According to Von Krogh [26], Web 2.0 and social media have had an impact on the way knowledge is enabled. Huang, Chen, Kuo, and Jeng [9] state that most Web 2.0 technologies are usually free and have made it easy for users to create a personal space where they can share information immediately or transmit information more rapidly than by other more conventional means. Furthermore, Nonaka and Von Krogh [16] claimed that Web 2.0 technologies and social media have had an impact on the processes of knowledge creation, sharing, and capture. Information sharing using Web 2.0 can be carried out through technologies such as Voice over Internet Protocol (VoIP), e-mail, tagging, phone/video-conferencing, web logs, or wiki pages.

This paper focuses on the impact of information sharing among knowledge workers within a company and its subsequent influence on a firm's effectiveness as identified via the number of new products created, number of completed research topics, or number of new patents. Knowledge workers can be defined as the employee, who has the characteristics of deepening the knowledge.

This paper provides a study on the use of web logs by employees. The author of this paper agrees with Efimova and Grudin [6] that an employee web log is "action that is authorised, acknowledged, or in a formal way associated with an organization". It can be claimed that knowledge workers create, distribute, or apply knowledge within their working environments. Since the existence of a clear impact of information sharing among knowledge workers using Web 2.0 has not been yet verified in the literature, this study tries to answer the following research question: What are the effects on the company for sharing of information among knowledge workers through the use of employee web logs?

Liu and Phillips state that employee information or knowledge sharing enhances firm performance in areas such as absorptive capacity and innovation capability [12]. Understanding the purpose of information sharing among knowledge workers within an enterprise allows for a definition of its effects that might be obtained from the use of employee web logs.

The implications of tacit knowledge transfer focus on knowledge workers communication via web logs can be major knowledge medium by top management.

To achieve a more contextually-rooted discussion, this paper explores the perceptions of the potential of employee web logs among knowledge workers in Polish companies. This paper also explores the influences that impact the way Polish companies perceive employee web logs, and thereby how these influences may facilitate or inhibit thinking about employee web log use in information sharing within such companies.

The remainder of this paper is organized as follows: Section 2 presents the theoretical background of the study. Section 3 describes the research model and hypotheses. Section 4 explains the research methodology and examines the research results. Section 5 discusses the implications of the results and provides a conclusion and highlights the limitations of this research.

2   Theoretical background

• Information sharing

Von Hippel [25] defined the concept of information "stickiness" as "the incremental expenditure required to transfer a given unit of information to a specified locus in a form usable by a given information seeker". Park and Favrel [17] stated that information sharing is an integral component of enterprises, which are based on IT. Advances in IT are constantly increasing and enabling information availability [2], however, in many studies, it has been noted that the benefits of information sharing depends on the type of information, as well as on demand patterns and capacity constraints [3, 11]. While most papers have shown the benefits of information sharing, the role of innovation level in the company enhancing has been largely ignored in the literature. In this study, the effect of information sharing among knowledge workers who are supported by employee web logs is investigated via the simulation of a hypothetical model using the Group Method of Data Handling (GMDH).

• Firm's effectiveness

Zahra and George [27] stated that the qualifications of employees have an impact on their capabilities to generate new knowledge. Information sharing reflects the dynamic aspect of a higher level of organizational capability that protects firms against imitations [23]. IT is well accepted as a means to facilitate opera-

tions within a firm [5]. The development of open standards between firms can dramatically reduce communication costs [21], so the Internet (e.g. employee web logs) can be used in inter-firm communication. Firm's effectiveness has been defined as an increase in the innovation level of the company. Information sharing plays an important role in such innovation processes (e.g., new products, patents). Poland, together with Slovakia, Lithuania, Hungary, Romania, Latvia, and Bulgaria is among those countries that have a low share of innovative enterprises [(from 27 to 36%) Eurostat Statistics Database]. I try to clarify and analyze how knowledge sharing among knowledge workers in Polish companies via employee web logs is linked to firm's effectiveness in the context of an increase in the level of its innovation. So, I suggest the following outputs of firm's effectiveness:

(1) number of new products that have been implemented in a given year (for the last 5 years),

(2) number of completed research topics in a given year (for the last 5 years),

(3) number of patents in a given year (for the last 5 years).

Knowledge sharing between company employees is the critical issue to manage the creation of a new product within an organization. Worker can exchange data through a database built on the information and communication technology infrastructure [24]. Developing the new products in the company needs innovation ideas supported by knowledge management tools, for example, employee web logs.

• Employee web logs

Schoendienst *et al.*, [20] state that the existing studies do not highlight the use of web logs or blogs as a platform for information/knowledge sharing within organizations. However, they do not differentiate between organizational blogs, individual web logs, and employee web logs within organizations; all of which constitute a lightweight means of sharing of information. In agreement with Müller and Stocker [14], this paper provides a study of the adoption of employee web logs from a technological acceptance perspective, that is, how readily employees adopt such technologies, but furthermore, it is important to know the impact of information sharing between knowledge workers within a company on a firm's effectiveness. This paper proposes and tests a model for knowledge worker information support through the use of blogs.

Table 1. Research model

	Knowledge worker: W_1	Knowledge worker:…	Knowledge worker W_m; $m \in N$
Monthly number of blog entries. relating to client C_1	B_{W1C1}	$B_{W…C1}$	B_{WmC1}
Monthly number of blog entries relating to client $C_{…}$	$B_{W1C…}$	$B_{W…C…}$	$B_{WmC…}$
Monthly number of blog entries relating to client $C_n, n \in N$	B_{W1Cn}	$B_{W…Cn}$	B_{WmCn}

The aforementioned literature on web logs has highlighted the need to provide a better understanding of the factors underpinning information sharing from a technological perspective. The research model builds on the concepts of technology acceptance, information sharing between knowledge workers within a company, as well as on the resulting effects for a company, chiefly identified as the (1) number of new products that have been implemented in a given year (for the last 5 years), (2) the number of completed research topics in a given year (for the last 5 years), and (3) the number of patents in a given year (for the last 5 years).

• Research model

The aim of this study is to explore the impact of information sharing among knowledge workers within a company on a firm's effectiveness.

The impact of information sharing among knowledge workers is understood as the enhancing of the level of three defined factors. In agreement with Fabrizio [7], I state that collaboration between knowledge workers is critical for innovation development. Therefore, an attempt was made to examine the relative significance of such collaboration between knowledge workers on a firm's effectiveness, namely in those three factors.

Premkumar, Ramamurthy & Crum [19] stated that inter-firm IT is used to reduce operational costs and improve customer service. So, this study formulated the monthly number of blog entries relating to clients created by each knowledge worker in the sales department in company announcements of employee web log implementations (see Table 1). As presented in Fig. 1, the research model posits, from the preceding argument, that information sharing among knowledge workers within a company in employee web logs will have a positive influence on effectiveness in these firms.
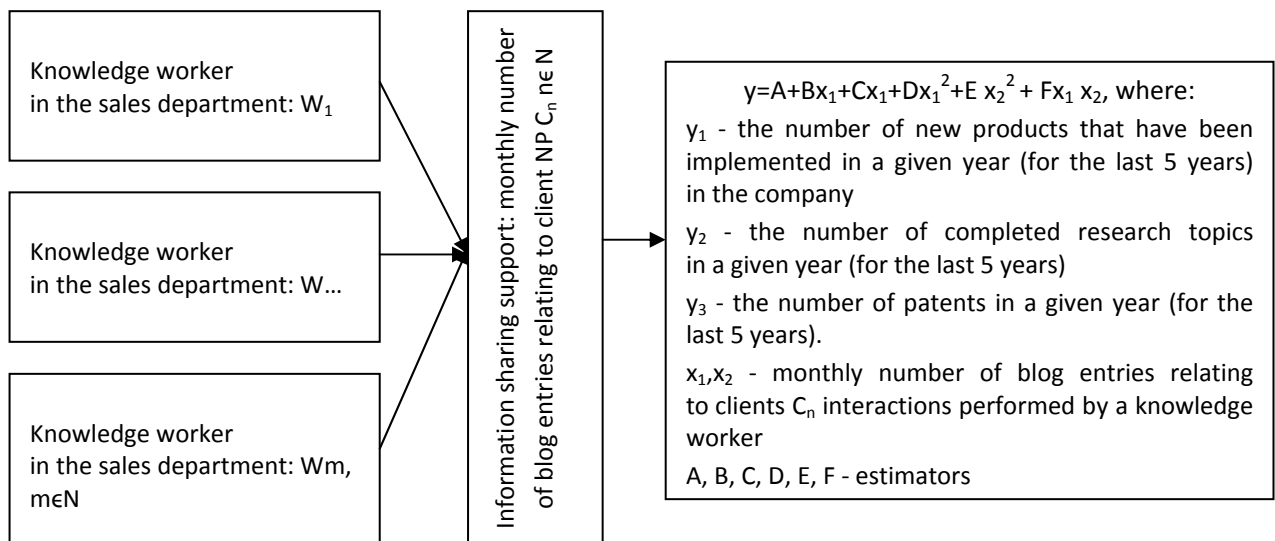

Figure 1. Research model

Knowledge worker in the sales department: product manager
• providing the sales team
• providing the technical expertise
• providing the product training
• reviewing product data
• preparing and reviewing of the promotional material
• conduct the design market research projects
• development of the annual marketing plan
• preparing product forecasts
• customer relationship management

Figure 2. Knowledge worker's activities in the sales department

This research proposes and tests a model to explicate the impact of information sharing in employee web logs. The subjects for this research were a number of Polish companies that have exploited information sharing through employee web logs.

A model for assessing the impact of information sharing between knowledge workers was built using the GMDH. The multilevel GMDH allows for an optimized synthesis of a mathematical model for a given class of regression functions, and it can be used in both evaluating criteria and in quality assessment [8, 18]. Both elements of the algorithm are defined arbitrarily by the author. In this study, there are:

- monthly number of blog entries relating to client C_n interactions performed by a knowledge worker by knowledge worker,
- the number of new products that have been implemented in a given year (for the last 5 years) in the company or the number of completed research topics in a given year (for the last 5 years) or the number of patents in a given year (for the last 5 years).

The following section describes the item measurement and data collection carried out in the research.

3 Measures and methods

Before the survey was carried out, it was assumed that those employees who took part in the research would realize at least 80% of the defined activities in the sales department (see Fig. 2) and use the defined employee web logs to support this work.

A survey was conducted in Poland to test the research model. The data for this study were collected from 40 knowledge workers from sales departments in five small and medium-sized enterprises (SMEs) that exploit the use of employee web logs. These data were collected between April and May 2013 through the use of direct interviews with respondents, who in this case were product managers of sales departments. The indicators (monthly numbers of blog entries relating to client $C_n, n \epsilon N$ created by knowledge workers) include measures to show the value of the impact of information sharing among knowledge workers within a company on a firm's effectiveness.

The firm's effectiveness level is defined as the degree to which the growth of the Polish firm's effectiveness level is affected from the information sharing through employee web logs among knowledge workers.

4 A model for knowledge worker information support using the GMDH method

This section extends the previous analysis by dealing with the question of whether or not the sharing of information between knowledge workers has an impact on the effectiveness of a firm. Formally, this section is characterized by the assumption that each knowledge worker's blog entry relating to clients should be shared with other knowledge workers and employees of the firm.

In order to obtain the relevant information, each employee was required to complete a questionnaire. It defined each product manager in the sales department as: W_1 – 0-2 years in a company; W_2 – 2-3 years in a company; W_3 – 3-5 years in a company, W_4 – 5-7 years in a company; W_5 – 7-10 years in a company; W_6 – 10-14 years in a company; W_7 – 14-20 years in a company, W_8 – more than 20 years in a company. The author received the data from each company for 2012 (see Table 2).

Table 2. Research results

SME		W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8
SME1	Monthly number of blog entries relating to client C_{SME11}	2	3	3	2	1	1	1	1
	Monthly number of blog entries relating to client C_2	4	3	3	3	2	2	1	1
	Monthly number of blog entries relating to client C_3	3	4	4	3	2	2	2	1
	Monthly number of blog entries relating to client C_4	2	4	4	4	1	1	1	1
	Monthly number of blog entries relating to client C_5	2	4	4	4	2	2	1	1
SME2	Monthly number of blog entries relating to client C_1	4	4	3	2	2	2	1	1
	Monthly number of blog entries relating to client C_2	3	3	2	2	2	2	2	2
	Monthly number of blog entries relating to client C_3	3	3	3	3	2	2	2	2
	Monthly number of blog entries relating to client C_4	4	5	5	4	3	3	3	3
	Monthly number of blog entries relating to client C_5	4	3	3	3	3	2	2	1
SME3	Monthly number of blog entries relating to client C_1	2	2	2	2	2	2	1	1
	Monthly number of blog entries relating to client C_2	1	1	2	2	1	1	1	3
	Monthly number of blog entries relating to client C_3	3	3	3	3	2	2	2	2
	Monthly number of blog entries relating to client C_4	2	2	2	2	1	1	1	1
	Monthly number of blog entries relating to client C_5	1	2	2	1	1	1	1	1
SME4	Monthly number of blog entries relating to client C_1	4	4	5	5	5	4	4	4
	Monthly number of blog entries relating to client C_2	4	5	5	5	4	4	4	4
	Monthly number of blog entries relating to client C_3	4	4	4	4	5	5	4	4
	Monthly number of blog entries relating to client C_4	5	5	5	4	4	4	4	4
	Monthly number of blog entries relating to client C_5	4	4	4	3	3	3	2	2
SME 5	Monthly number of blog entries relating to client C_1	3	3	4	3	2	2	1	1
	Monthly number of blog entries relating to client C_2	1	3	2	2	1	1	1	3
	Monthly number of blog entries relating to client C_3	2	2	3	3	2	2	1	1
	Monthly number of blog entries relating to client C_4	2	4	4	4	2	2	2	2
	Monthly number of blog entries relating to client C_5	2	2	3	3	3	3	1	1

The variables in the research model are 40 input variables defined as the monthly number of blog entries relating to client C carried out by a knowledge worker in the enterprise:

- if $x_1; x_2 \in \langle 0;100 \rangle$, it belongs to set 1,
- if $x_1; x_2 \in \langle 101;200 \rangle$, it belongs to set 2,
- if $x_1; x_2 \in \langle 201;300 \rangle$, it belongs to set 3,
- if $x_1; x_2 \in \langle 301;400 \rangle$, it belongs to set 4,
- if $x_1; x_2 \in \langle 401;\infty \rangle$, it belongs to set 5.

The factors of the examination of the monthly number of blog entries relating to each defined client were based on feedback surveys and their sources are listed here (Table 2):

The output variables (Table 3) in the research model will be the vector of values of three factors: (y_1) the number of new products that have been implemented in a given year (for the last 5 years):

- if $y_1 \in \langle 0;50 \rangle$, it belongs to set 1,
- if $y_1 \in \langle 51;100 \rangle$, it belongs to set 2,
- if $y_1 \in \langle 101;200 \rangle$, it belongs to set 3,
- if $y_1 \in \langle 201;300 \rangle$, it belongs to set 4,
- if $y_1 \in \langle 301;\infty \rangle$, it belongs to set 5 [18].

(y_2) the number of completed research topics in a given year (for the last 5 years):

- if $y_2 \in \langle 0;5 \rangle$, it belongs to set 1,

- if $y_2 \in \langle 6;10 \rangle$, it belongs to set 2,
- if $y_2 \in \langle 11;20 \rangle$, it belongs to set 3,
- if $y_2 \in \langle 21;30 \rangle$, it belongs to set 4,
- if $y_2 \in \langle 31;\infty \rangle$, it belongs to set 5 [18].

(y_3) and the number of patents in a given year (for the last 5 years):

- if $y_3 \in \langle 0;5 \rangle$, it belongs to set 1,
- if $y_3 \in \langle 6;10 \rangle$, it belongs to set 2,
- if $y_3 \in \langle 11;20 \rangle$, it belongs to set 3,
- if $y_3 \in \langle 21;30 \rangle$, it belongs to set 4,
- if $y_3 \in \langle 31;\infty \rangle$, it belongs to set 5 [18].

The factors of the examination of the monthly number of blog entries relating to each defined client were based on feedback surveys and their sources are listed here (Table 3).

This study presents the possibility of defining a model for knowledge worker information support using the GMDH method. This enables the monthly number of blog entries relating to clients that were created by each knowledge worker and those of the values of firm effectiveness to be determined. In accordance with the data included in Table 2 and Table 3, all the variations of the GMDH algorithms were investigated in the consulting IT computer software system [18].

Table 3. Research results

	(1) Number of new products that have been implemented in a given year (for the last 5 years)	(2) Number of completed research topics in a given year (for the last 5 years)	(3) Number of patents in a given year (for the last 5 years)
SME1	1	3	1
SME2	2	5	1
SME3	1	1	1
SME4	4	5	1
SME5	1	4	1

Figure 3. The variations of the GMDH algorithms in the consulting IT computer software system

As a result of the implementation of the algorithm, the best possible polynomial was obtained; this was characterized by the lowest value criteria for regularity assigned to the pair object. The algorithm evolution process was completed on the second iteration.

In this way, the best polynomials are chosen; which is the one with the smallest error of modeling:

- Model 1

$$y_1(B_{W2}B_{W6}) = 2.89 + 2.29B_{W2} - 7.37B_{W6} - 0.67B_{W2}^2 + 5.05B_{W6}^2 - 1.06B_{W2}B_{W6}$$

where:

B_{W2} − monthly number of blog entries relating to clients that were created by knowledge worker W_2

B_{W6} − monthly number of blog entries relating to clients that were created by knowledge worker W_6

y_1 − number of new products that have been implemented in a given year (for the last 5 years)

- Model 2

$$y_1(B_{W3}B_{W8}) = -0.01 + 1.04B_{W3} - 0.02B_{W8} - 0.07B_{W3}^2 + 0.01B_{W8}^2 + 0.06B_{W3}B_{W8}$$

where:

B_{W3} − monthly number of blog entries relating to clients that were created by knowledge worker W_3

B_{W8} − monthly number of blog entries relating to clients that were created by knowledge worker W_8

y_2 − number of completed research topics in a given year (for the last 5 years).

- Model 3

$$y_3(B_{W3}B_{W5}) = 0.69 + 0.01B_{W3} + 0.31B_{W5}$$
$$+ 0.04B_{W3}^2 - 0.00B_{W5}^2 - 0.18B_{W3}B_{W5}$$

where:

B_{W3} − monthly number of blog entries relating to clients that were created by knowledge worker W_3

B_{W5} − monthly number of blog entries relating to clients that were created by knowledge worker W_5

y_3 − number of patents in a given year (for the last 5 years).

It should be noted, that the monthly number of blog entries relating to clients, which were created by knowledge workers defined as W_2 and W_6 are critical for new product development in the company, those created by knowledge workers defined as W_3 and W_8 for completed research project development, and those created by knowledge workers defined as W_3 and W_5 for patent development.

Knowledge worker W_2 is one who has worked in the company for max. 3 years, W_3 max. 5 years, W_5 max. 10 years, and W_6 max. 14 years. According to Fabrizio [7], personal knowledge relationships are critical for innovation development. Therefore, I maintain that a firm needs a specific mix of knowledge worker collaboration in different developmental phases; and this collaboration increases the number of new product/research projects and patent development within a firm.

To illustrate the use of the determined models, I will consider a manufacturing company that produces parts for the multifamily housing construction. The company decides that it needs to maintain its level of innovation. In the sales department of this company, the web logs are used by product managers.

So, it can be simulated the number of new products in a company/year according to Model 1:

$$y_1(B_{W2}B_{W6}) = 2.89 + 2.29B_{W2} - 7.37B_{W6}$$
$$- 0.67B_{W2}^2 + 5.05B_{W6}^2 - 1.06B_{W2}B_{W6}$$

where:

B_{W2} − monthly number of blog entries relating to clients that were created by knowledge worker W_2

B_{W6} − monthly number of blog entries relating to clients that were created by knowledge worker W_6

y_1 − number of new products that have been implemented in a given year (for the last 5 years)

So, if a product manger in the sales department works in a company for 2-3 years and enters 100 monthly blogs relating to the client, and the second employee (a product manager) works in a company for 10-14 years and increases the monthly use of the blog related to the client, then the number of new products in a company will be:

- 1.13 new products/year, if the second employee works in a company for 10-14 years and enters 100 monthly blogs related to the client,
- 7.85 new products/year, if the second employee works in a company for 10-14 years and enters 200 monthly blogs related to the client,
- 24.67 new products/year, if the second employee works in a company for 10-14 years and enters 300 monthly blogs related to the client,
- 51.59 new products/year, if the second employee works in a company for 10-14 years and enters 400 monthly blogs related to the client,
- 88.61 new products/year, if the second employee works in a company for 10-14 years and enters more than 400 monthly blogs related to the client.

If a product manger in the sales department works in a company for 2-3 years and enters 200 monthly blogs relating to client, and the second employee (a product manager) works in a company for 10-14 years increases the monthly use of the blog related to the client, the number of new products in a company will be:

- 0.35 new products/year, if the second employee works in a company for 10-14 years and enters 100 blogs related to the client,
- 6.01 new products/year, if the second employee works in a company for 10-14 years and enters 200 monthly blogs related to the client,
- 21.77 new products/year, if the second employee works in a company for 10-14 years and enters 300 monthly blogs related to the client,
- 47.63 new products/year, if the second employee works in a company for 10-14 years and enters 400 monthly blogs related to the client,
- 83.59 new products/year, if the second employee works in a company for 10-14 years and enters more than 400 monthly blogs related to the client.
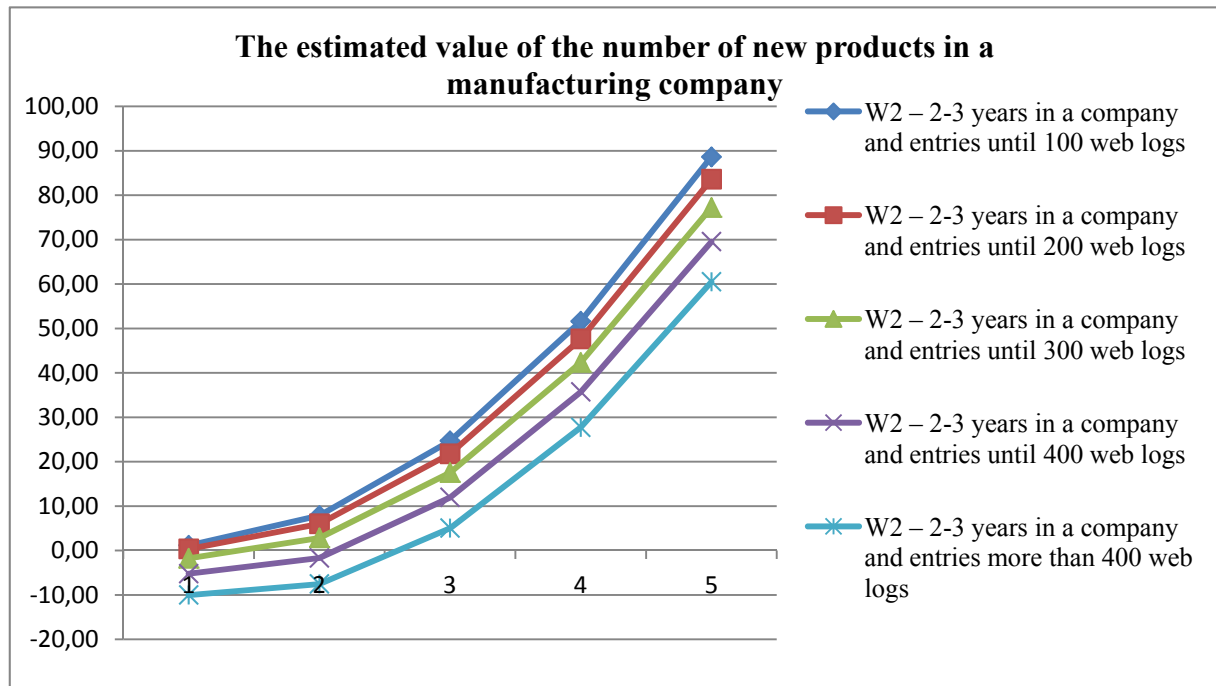
Figure 4. The estimated value of the number of new products in a manufacturing company

If a product manager in the sales department works in a company for 2-3 years and enters 300 monthly blogs related to the client, and the second employee (a product manager) works in a company for 10-14 years and increases the monthly use of the blogs related to the client, the number of new products in a company will be:

- unfortunately –1.77 new products/year, if the second employee works in a company for 10-14 years and enters 100 monthly blogs related to the client,
- 2.83 new products/year, if the second employee works in a company for 10-14 years and enters 200 monthly blogs related to the client,
- 17.53 new products/year, if the second employee works in a company for 10-14 years and enters 300 monthly blogs related to the client,
- 42.33 new products/year, if the second employee works in a company for 10-14 years and enters 400 monthly blogs related to the client,
- 77.23 new products/year, if the second employee works in a company for 10-14 years and enters more than 400 monthly blogs related to the client.

If a product manager in the sales department works in a company for 2-3 years and enters 400 monthly blogs related to client, and the second employee (a product manager) works in a company for 10-14 years and increases the monthly use of the blogs related to the client, the number of new products in a company will be:

- unfortunately −5.23 new products/year, if the second employee works in a company for 10-14 years and enters 100 monthly blogs related to the client,
- unfortunately −1.69 new products/year, if the second employee works in a company for 10-14 years and enters 200 monthly blogs related to the client,
- 11.95 new products/year, if the second employee works in a company for 10-14 years and enters 300 monthly blogs related to the client,
- 35.69 new products/year, if the second employee works in a company for 10-14 years and enters 400 monthly blogs related to the client,
- 69.53 new products/year, if the second employee works in a company for 10-14 years and enters more than 400 monthly blogs related to the client.

And finally, if both employees enter more than 400 monthly blogs related to the client, the number of new products in a company will be:

- −10.03 new products/year, if the second employee works in a company for 10-14 years and enters 100 monthly blogs related to the client,
- −7.55 new products/year, if the second employee works in a company for 10-14 years and enters 200 monthly blogs related to the client,
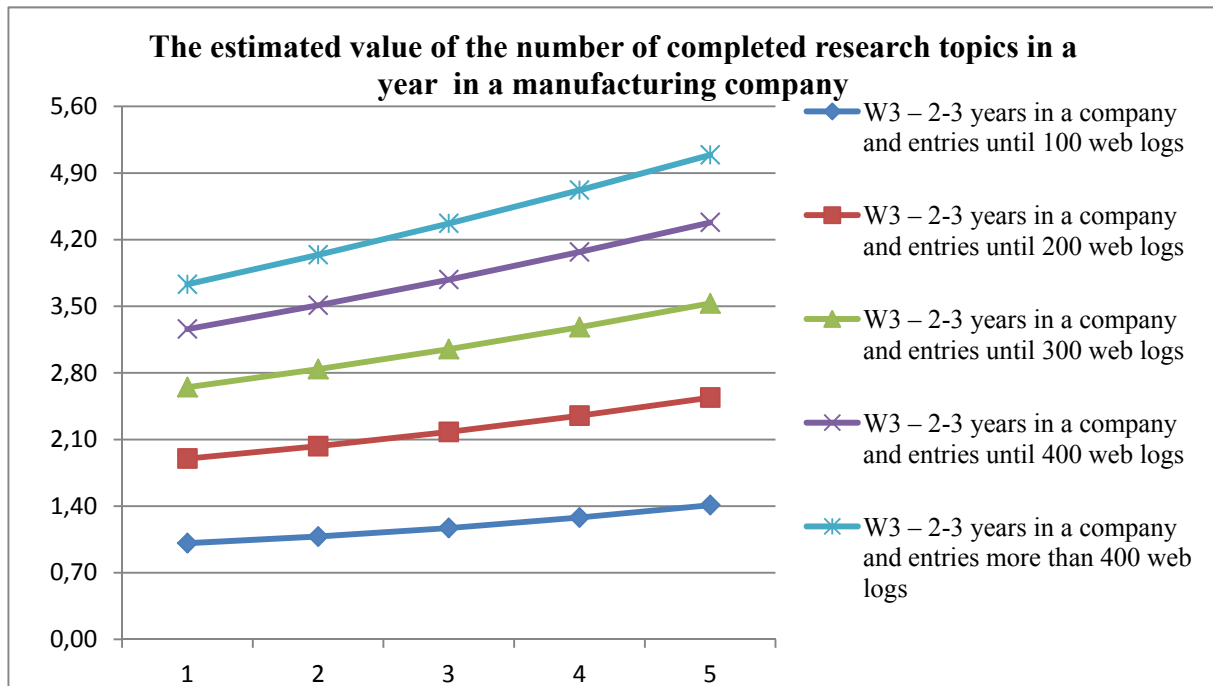
Figure 5. The estimated value of the number of completed research topics
in a year in a manufacturing company

- 5.03 new products/year, if the second employee works in a company for 10-14 years and enters 300 monthly blogs related to the client,
- 27.71 new products/year, if the second employee works in a company for 10-14 years and enters 400 monthly blogs related to the client,
- 60.49 new products/year, if the second employee works in a company for 10-14 years and enters more than 400 monthly blogs related to the client.

The estimated value of the number of new products in a manufacturing company is presented in Fig. 4.

It is noted, on the basis of the presented simulations that, the higher the frequency of the information sharing via web logs among employees, the higher the number of new products in the company. The different frequency of the use of web logs among employees unfortunately leads to a decrease in the number of new products.

In the same way, it can be simulated the number of completed research topics in a year in a manufacturing company according to Model 2 (see Fig. 5):

$$y_2(B_{W3}B_{W8}) = -0.01 + 1.04B_{W3} - 0.02B_{W8}$$
$$- 0.07B_{W3}^2 + 0.01B_{W8}^2 + 0.06B_{W3}B_{W8}$$

where:

B_{W3} − monthly number of blog entries relating to clients that were created by knowledge worker W_3

B_{W8} − monthly number of blog entries relating to clients that were created by knowledge worker W_8

y_2 − number of completed research topics in a given year (for the last 5 years).

It is noted, on the basis of the presented simulations, that the higher frequency of the information sharing via web logos among employee that the higher number of completed research topics in a year.

And it can be simulated the number of patents in a year in a manufacturing company according to Model 3 (see Fig. 6):

$$y_3(B_{W3}B_{W5}) = 0.69 + 0.01B_{W3} + 0.31B_{W5}$$
$$+ 0.04B_{W3}^2 - 0.00B_{W5}^2 - 0.18B_{W3}B_{W5}$$

where:

B_{W3} − monthly number of blog entries relating to clients that were created by knowledge worker W_3

B_{W5} − monthly number of blog entries relating to clients that were created by knowledge worker W_5

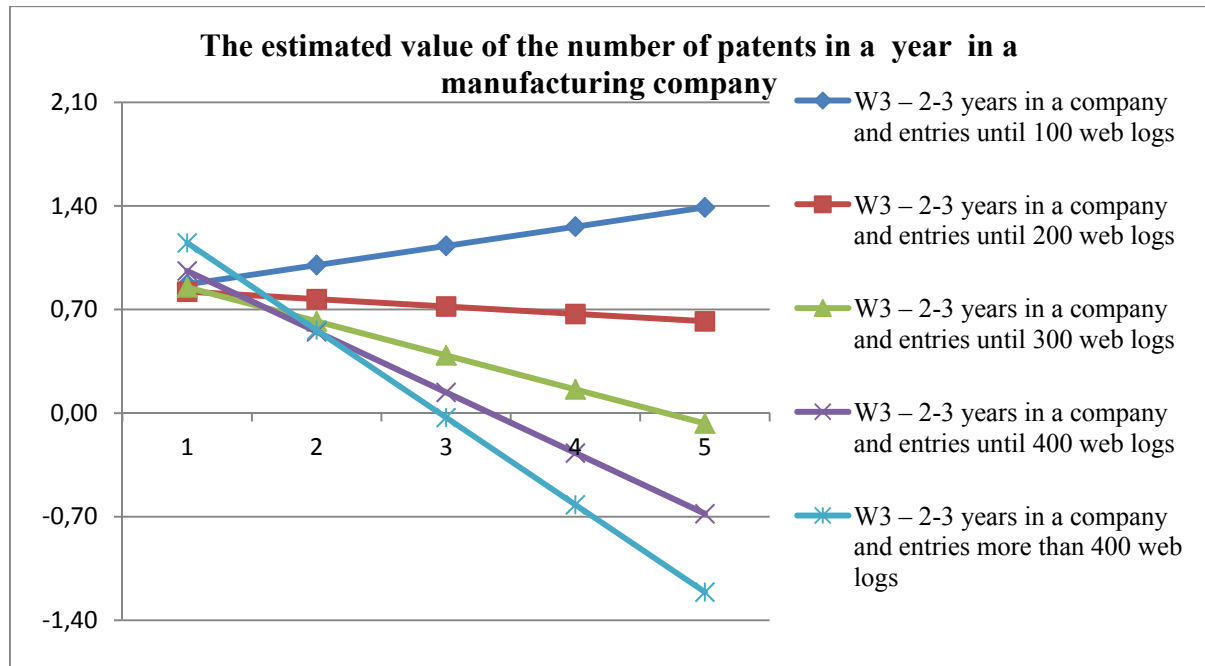y_3 − number of patents in a given year (for the last 5 years).

Figure 6. The estimated value of the number of patents in a year in a manufacturing company

Unfortunately, it is noted, on the basis of the presented simulations, that the higher frequency of the information sharing via web logs among employee leads to a decrease in the number of patents in a year in a manufacturing company.

The results of this study validate the existence of a direct effect on the effectiveness of a firm in the context of information sharing among knowledge workers who are supported by employee web logs. The literature commonly points out that IT affects the performance of a firm, but the effects are sometimes dependent upon the particular alignment of such IT with a firm's strategy, structure, and environment [15, 22]. However, it seems that information sharing among knowledge workers supported by employee web logs has a clear impact on the effectiveness of a firm.

5 Conclusions

This section of the paper summarizes the new findings of this study and discusses the related implications. The results of this study demonstrate the clear and measurable existence of a positive effect of information sharing among knowledge workers supported by web logs on the effectiveness of a firm. Specifically, the results reveal these effects on the number of a firm's new product/research topics and patent developments. Transparency in customer information flow supported by employee web logs may facilitate the information needed to enhance innovation at the company level. This is even more important in Poland, as well as in other developing economies, where the external environment of the market changes rapidly.

Like all studies, this one has certain limitations that further research should aim to overcome. First, because the intention is to analyze Polish companies, this study focuses on Polish knowledge workers. It would be unwise to generalize the findings too broadly to other countries. Furthermore, all the variables were measured at the same moment in time. So, it would be useful to provide such research over a longer time period and at different stages. These conclusions and limitations suggest proposals for future research directions, such as exploring additional factors that could improve the effect of the collaboration of knowledge workers on the effectiveness of a firm.

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LOGISTIC FUNCTION AS A TOOL OF PLANNING

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Abstract: In the present paper, we propose a new approach to investigate the logistic function, which is commonly used in mathematical models in economics and management. The approach is based on indicating in a given time series, having a logistic trend, some characteristic points corresponding to zeroes of successive derivatives of the logistic function. We also give examples of application of this method.

Keywords: Logistic equation, logistic function, time series, Eulerian numbers, Riccati's differential equation, mathematical models.

1   Introduction

The logistic equation is defined as

$$u'(t) = c_1 u(u_{max} - u), \quad u(0) = u_0 > 0, \qquad (1)$$

where:

t is time,

$u = u(t)$ is an unknown function,

c_1, u_{max} are constants.

The constant u_{max} is called the saturation level. The integral curve $u = u(t)$ of the equation (1), fulfilling the condition $0 < u(t) < u_{max}$ is known as the logistic function.

Many of economic phenomena, also related to the management follows equation (1) (see papers [3, 4, 5, 9, 10, and 11]).

A phenomenon described by equation (1) and function $u(t)$ has an important property that the rate of growth $u'(t)$ is proportional to the level already achieved, i.e. $u(t)$.

On the other hand, if $u(t)$ is sufficiently large, then the factor $(u_{max} - u)$ is more and more significant and its influence inhibits further growth of the function $u(t)$.

Mathematically equation (1) is the first order ordinary differential equation, which is easily solved by the method of the separation of variables.

The main idea of the present paper is to look, among the data of a given time series, for some characteristic points, which correspond to zeroes of derivatives of the logistic function. One of these points is clearly the point corresponding to the inflection point (i.e. the zero of u'') of the logistic curve at which, as is well known, the logistic function takes the value $u_{max}/2$. For a sufficiently long time series, the point corresponding to the inflection point is easy to locate, even from the graph. If the data were collected for the time points spaced equally, then, instead of estimating the values of the first derivative, it is sufficient to calculate successive differences and seek the maximum for them.

What we can do, however, when the time series is not long enough, and we expect that the investigated phenomenon follows the logistic curve? When the phenomenon is on early stage of growth and the data is available only in a relatively short time interval? Statistical methods for estimating the parameters of the logistic function based, for example, on the method of the nonlinear least squares may be unreliable, because functions having significantly different values of the saturation level may produce only slightly differing error values. A way to explanation of the situation seems in seeking, in the time series, points corresponding to zeroes of successive derivatives of the logistic function. For equally spaced time points, this is equivalent to calculating successive differences. For example, as we will see in Section 3, the zero of the third derivative u''' (i.e., the extreme (maximum) of the second derivative u'') occurs at the point where the value of the logistic function is approximately $0.211 u_{max}$.

2   Logistic equation and logistic function

We rewrite the logistic equation (1) into the following, more convenient form, where the constant c_1, for computational reasons, is written as $c_1 = c/u_{max}$:

$$u'(t) = \frac{c}{u_{max}} u(u_{max} - u), \quad u(0) = u_0. \tag{2}$$

After solving equation (2), we get the logistic function in the following form

$$u(t) = \frac{u_{max}}{1 + ae^{-ct}}, \tag{3}$$

where constant a appears in the integration process and is connected with the initial condition $u(0) = u_0 = \dfrac{u_{max}}{1 + a}$, therefore $a = \dfrac{u_{max} - u_0}{u_0}$.

Fig. 1 shows the graph of an exemplary logistic function with parameters $u_{max} = 7$, $a = 17$ and $c = 1.5$.
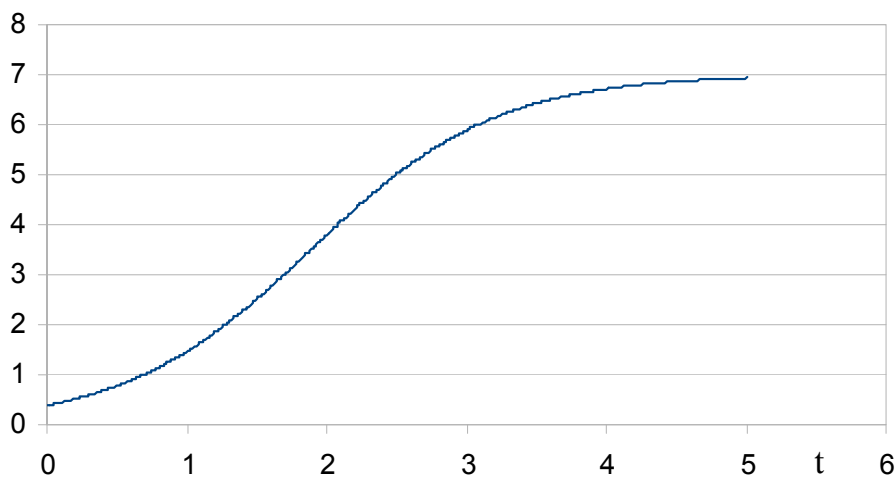
Figure 1. Logistic function with parameters: $u_{max} = 7$, $a = 17$ and $c = 1.5$

In order to understand the further reasoning, we have to introduce the so-called Eulerian numbers (see for instance Graham et al. [2]). Let $\{a_1, a_2, ..., a_n\}$ be a permutation of the set $\{1, 2, ..., n\}$. Then $\{a_j, a_{j+1}\}$ is an ascent of the permutation, if $a_j < a_{j+1}$. The Eulerian number denoted by $\left\langle {n \atop k} \right\rangle$ is defined as the number of permutations of the set $\{1, 2, ..., n\}$ having k ascents $(k = 0, 1, 2, ..., n-1)$. For example, for $n = 3$ the identity permutation $\{1, 2, 3\}$ has two ascents, namely $\{1, 2\}$ and $\{2, 3\}$, and $\{3, 2, 1\}$ has no ascents. Each of the other four permutations of the set has exactly one ascent. Thus,

$$\left\langle {3 \atop 0} \right\rangle = 1, \ \left\langle {3 \atop 1} \right\rangle = 4 \text{ and } \left\langle {3 \atop 2} \right\rangle = 1.$$

The first few Eulerian numbers are given in the Table 1. It is well known that Eulerian numbers satisfy the following relations:

$$\left\langle {n \atop k} \right\rangle = \left\langle {n \atop n-k-1} \right\rangle,$$

$$\left\langle {n+1 \atop k} \right\rangle = (k+1)\left\langle {n \atop k} \right\rangle + (n-k+1)\left\langle {n \atop k-1} \right\rangle,$$

$$\left\langle {n \atop k} \right\rangle = \sum_{j=0}^{k} (-1)^j \binom{n+1}{j} (k-j+1)^n.$$

Table 1. Eulerian numbers

n	$\left\langle\begin{matrix}n\\0\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\1\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\2\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\3\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\4\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\5\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\6\end{matrix}\right\rangle$	$\left\langle\begin{matrix}n\\7\end{matrix}\right\rangle$
0	1							
1	1	0						
2	1	1	0					
3	1	4	1	0				
4	1	11	11	1	0			
5	1	26	66	26	1	0		
6	1	57	302	302	57	1	0	
7	1	120	1191	2416	1191	120	1	0

Equation (2) is a particular case of the following Riccati differential equation with constant coefficients

$$u'(t) = r(u - u_1)(u - u_2). \tag{4}$$

On the right hand side of equation (4) is a quadratic function of the variable u with coefficient r of u^2 and having roots u_1, u_2. The constants $r \neq 0, u_1, u_2$ can be generally the real or complex numbers.

If $u(t)$ is a solution of equation (4), then there is known a formula for the n th derivative $u^{(n)}(t)$, ($n = 2, 3, 4,...$) of $u(t)$, expressing it as a polynomial of the function $u(t)$ itself:

$$u^{(n)}(t) = r^n\left(\left\langle\begin{matrix}n\\0\end{matrix}\right\rangle(u - u_1)(u - u_2)^n + \left\langle\begin{matrix}n\\1\end{matrix}\right\rangle(u - u_1)^2(u - u_2)^{n-1} \right.$$
$$\left. + \left\langle\begin{matrix}n\\2\end{matrix}\right\rangle(u - u_1)^3(u - u_2)^{n-2} + ... + \left\langle\begin{matrix}n\\n-1\end{matrix}\right\rangle(u - u_1)^n(u - u_2) \right) \tag{5}$$
$$= r^n \sum_{k=0}^{n-1} \left\langle\begin{matrix}n\\k\end{matrix}\right\rangle(u - u_1)^{k+1}(u - u_2)^{n-k}$$

where $n = 2, 3,...$.

The above formula (5) has been discussed during the Conference ICNAAM 2006 (September 2006) held in Greece and it appeared, with an inductive proof, in paper [6] (see also [7]). Independently, the formula has been considered and proved, with a proof based on generating functions, by Franssens [1].

The polynomial, of order $(n+1)$ of the variable u, appearing on the right hand side of equation (5) is known in the literature as the derivative polynomial. It can be proved (see [8]) that all $(n+1)$ roots of the polynomial are simple and lie in the interval $[u_1, u_2]$. The derivative polynomials were intensively studied recently.

3 Further properties of the logistic function and its derivatives

Formula (5) applied to the particular form (2) of the logistic equation is as follows:

$$u^{(n)}(t) = \left(-\frac{c}{u_{max}} \right)^n \cdot \sum_{k=0}^{n-1} \left\langle\begin{matrix}n\\k\end{matrix}\right\rangle u^{k+1}(u - u_{max})^{n-k}. \tag{6}$$

The polynomial of the variable u, of order $(n+1)$ on the right hand side of (6) is uniform in the sense of the following remark.

Remark 1. If a number u_0 is the root of the polynomial on the right hand side of (6) i.e.,

$$\sum_{k=0}^{n-1} \left\langle {n \atop k} \right\rangle u_0^{k+1} (u_0 - u_{max})^{n-k} = 0, \qquad (7)$$

then dividing both sides of (7) by u_{max}^{n+1} we get

$$\sum_{k=0}^{n-1} \left\langle {n \atop k} \right\rangle \left(\frac{u_0}{u_{max}} \right)^{k+1} \left(\frac{u_0}{u_{max}} - 1 \right)^{n-k} = 0.$$

Thus, u_0 is a root of the derivative polynomial on the right hand side of (6), if u_0/u_{max} is the root of the polynomial

$$P_{n+1}(u) := (-1)^n \sum_{k=0}^{n-1} \left\langle {n \atop k} \right\rangle u^{k+1} (u-1)^{n-k}. \qquad (8)$$

Let us write down, using formula (6) and the notation of (8) the first few derivatives of the logistic function, which fulfills equation (2).

By Remark 1 we can assume, without loss of the generality, that $u_{max} = 1$ and $c = 1$.

We obtain successively:

$$u'(t) = u(1-u) = -u(u-1) = P_2(u),$$

$$u''(t) = u(u-1)^2 + u^2(u-1) = P_3(u),$$

$$u'''(t) = -u(u-1)^3 - 4u^2(u-1)^2 - u^3(u-1) = P_4(u),$$

$$u^{(4)}(t) = u(u-1)^4 + 11u^2(u-1)^3 + 11u^3(u-1)^2 + u^4(u-1) = P_5(u),$$

$$u^{(5)}(t) = -u(u-1)^5 - 26u^2(u-1)^4 - 66u^3(u-1)^3 - 26u^4(u-1)^2$$
$$- u^5(u-1) = P_6(u).$$

All roots of the polynomials $P_k(u)$, $(k = 3,4,5,6)$ can be calculated explicitely, so the polynomials can be factored and we get

$$P_3(u) = 2u(u-1)\left(u - \frac{1}{2} \right),$$

$$P_4(u) = -6u(u-1)\left(u - \frac{1}{2} - \frac{\sqrt{3}}{6} \right)\left(u - \frac{1}{2} + \frac{\sqrt{3}}{6} \right),$$

$$P_5(u) = 24u(u-1)\left(u - \frac{1}{2} \right)\left(u - \frac{1}{2} - \frac{\sqrt{6}}{6} \right)\left(u - \frac{1}{2} + \frac{\sqrt{6}}{6} \right),$$

$$P_6(u) = -120u(u-1)\left(u - \frac{1}{2} - \frac{\sqrt{30(15 - \sqrt{105})}}{60} \right)\left(u - \frac{1}{2} - \frac{\sqrt{30(15 + \sqrt{105})}}{60} \right)$$

$$\left(u - \frac{1}{2} + \frac{\sqrt{30(15 - \sqrt{105})}}{60} \right)\left(u - \frac{1}{2} + \frac{\sqrt{30(15 + \sqrt{105})}}{60} \right).$$

Therefore, the least positive roots of the polynomials are

$$P_4(u): \quad \frac{1}{2} - \frac{\sqrt{3}}{6} \approx 0,211,$$

$$P_5(u): \quad \frac{1}{2} - \frac{\sqrt{6}}{6} \approx 0,0917,$$

$$P_6(u): \quad \frac{1}{2} - \frac{\sqrt{30(15 + \sqrt{105})}}{60} \approx 0,0413.$$

Thus, by using Remark 1 we see that, for example, if at some point of time t_0 (the least possible) $u'''(t_0) = 0$ ($u''(t_0)$ is a local maximum), then the value of the logistic function at this point is $u(t_0) = 0{,}211 u_{max}$.

In Fig. 7, we see two characteristic points of the exemplary logistic curve (with the same parameters as on Fig. 1) the inflection point (zero of the second derivative $u''(t)$) and the zero of the third derivative $u'''(t)$.

Similar conclusions can be drawn for the least zeroes of the $u^{(4)}(t)$ (the polynomial $P_5(u)$ is used in this case) or $u^{(5)}(t)$ ($P_6(u)$) with the constants given above.

In Fig. 2–6 below, we can see graphs of the derivative polynomials $P_k(u)$ for $k = 2, 3, 4, 5, 6$ respectively, for $u \in [0,1]$. The polynomials are symmetric (even or odd) with respect to the point $u = 1/2$.
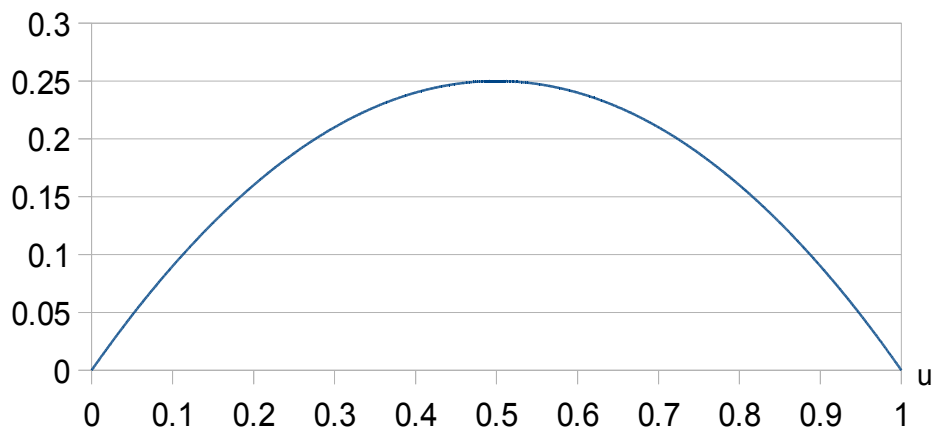
Figure 2. Polynomial P$_2$(u)
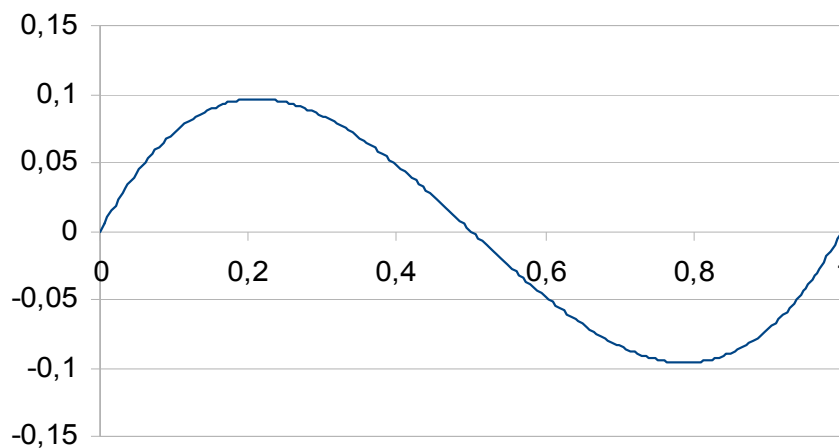
Figure 3. Polynomial P$_3$(u)
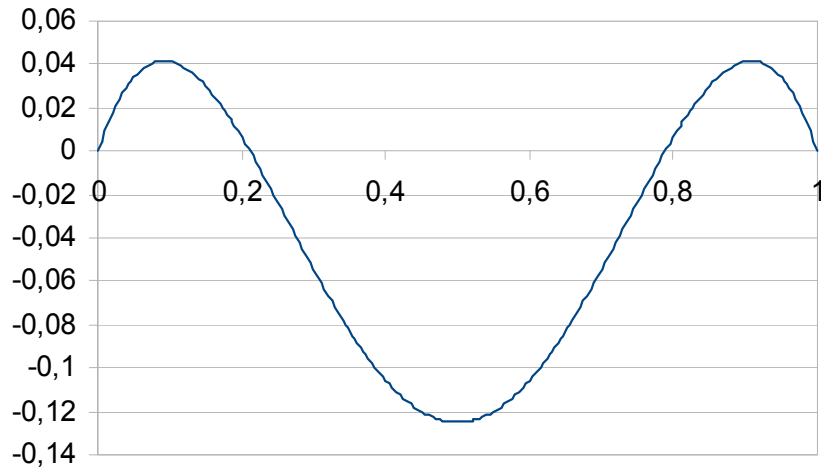
Figure 4. Polynomial $P_4(u)$
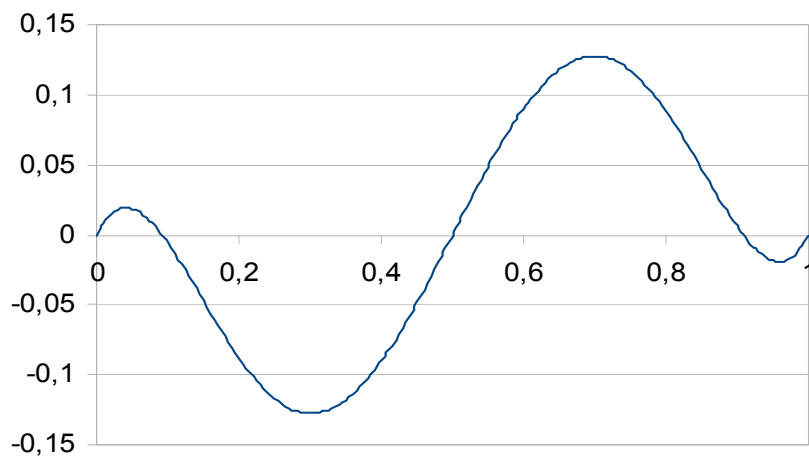
Figure. 5. Polynomial $P_5(u)$
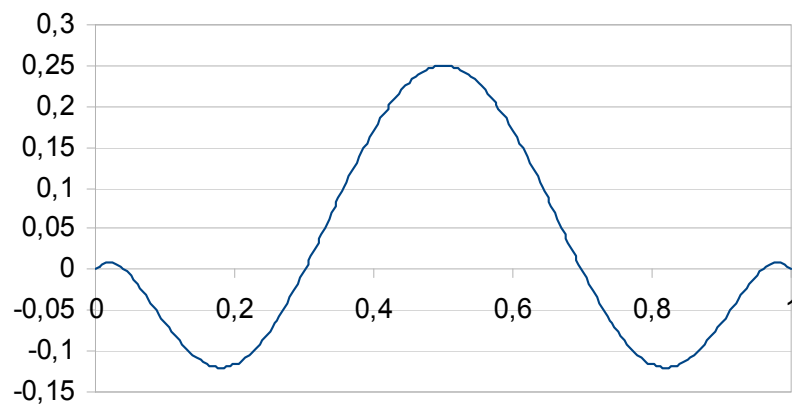
Figure 6. Polynomial $P_6(u)$
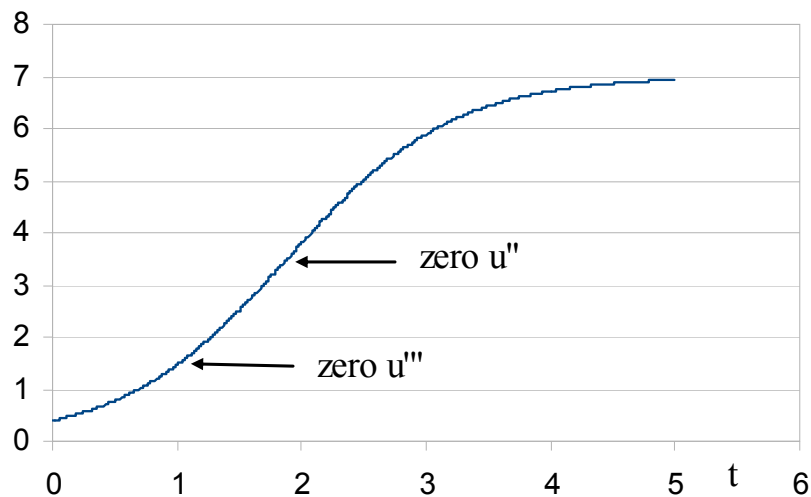
Figure 7. Two characteristic points of the logistic curve

4   Some applications of the method

4.1   Loyalty cards in a chain of stores

The data in the Table 2 represent the number of loyalty cards (NLC) issued in a large chain of stores in Poland. The observations relate to the period December 2011–November 2013 (e.g., 47/12 means forty-seventh week of the year 2012).

In the initial period of time, covering the first 2 or 3 months, the phenomenon was a fairly rapid process, due to Christmas, New Year and a big promotional campaign. Then the situation stabilised and in the next weeks the total number of loyalty cards (Total NLC) proceeded according to a logistic curve. Fig. 8 shows the total number of issued cards starting from the tenth week of all observations.
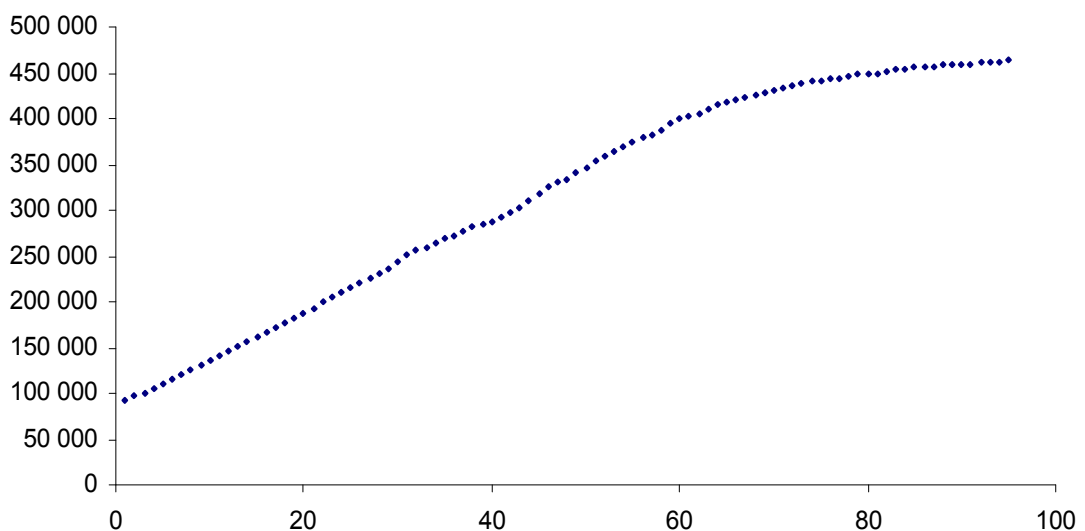
Figure 8. The total number of loyalty cards issued (Total NLC)

Table 2. The number of loyalty cards issued (NLC)

Week	NLC	Week	NLC	Week	NLC	Week	NLC
48/11	7236	23/12	4307	50/12	7741	25/13	2077
49/11	11904	24/12	5776	51/12	8950	26/13	1889
50/11	12887	25/12	5561	52/12	3447	27/13	1686
51/11	10665	26/12	5521	01/13	3510	28/13	1651
52/11	5616	27/12	5525	02/13	6334	29/13	1402
01/12	7133	28/12	5625	03/13	6793	30/13	1247
02/12	8428	29/12	5393	04/13	6846	31/13	2026
03/12	7263	30/12	5132	05/13	5764	32/13	1847
04/12	7135	31/12	5768	06/13	5803	33/13	899
05/12	7038	32/12	5826	07/13	5121	34/13	1132
06/12	6173	33/12	4683	08/13	4223	35/13	1920
07/12	5061	34/12	5337	09/13	4955	36/13	1551
08/12	4237	35/12	7216	10/13	3939	37/13	1172
09/12	4953	36/12	6396	11/13	3566	38/13	935
10/12	5536	37/12	5325	12/13	7844	39/13	903
11/12	5387	38/12	4421	13/13	5085	40/13	826
12/12	4868	39/12	4111	14/13	3158	41/13	619
13/12	4673	40/12	4343	15/13	3550	42/13	840
14/12	3496	41/12	4462	16/13	4468	43/13	701
15/12	5474	42/12	3780	17/13	3498	44/13	601
16/12	5576	43/12	4048	18/13	3726	45/13	882
17/12	5245	44/12	3708	19/13	2339	46/13	775
18/12	5196	45/12	3474	20/13	2628	47/13	849
19/12	5563	46/12	4462	21/13	2708	48/13	1238
20/12	5252	47/12	3957	22/13	3482		
21/12	4616	48/12	5405	23/13	2142		
22/12	5690	49/12	7913	24/13	2710		
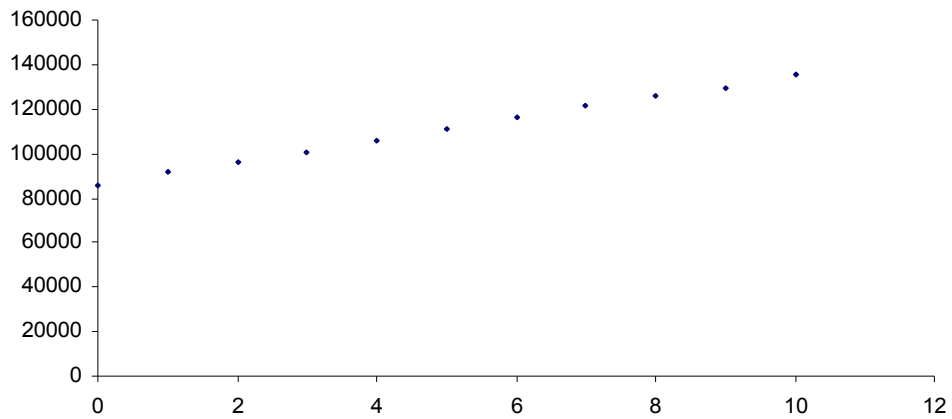
Figure 9. Initial data

We will try to use, to the above data, our theory described in the earlier sections. Let us take into account the first ten observations from the Fig. 8 (see the second and third columns of the Table 3 and Fig. 9). We calculate the successive differences for the data. By the second central difference (SCD) at time t of an equally spaced time series $\{y_t\}$, ($t = 0,1,2,3,...,n$), we mean the number given by the formula

$$(y_{t+1} - 2y_t + y_{t-1})/2 .$$

The calculations are shown in Table 3. Instead of using SCD, we could use the second left differences (SLD) at time t given by the formula:

$$(y_t - 2y_{t-1} + y_{t-2})/2$$

We see that the first local maximal value of the second central difference, 358, is taken for $t = 3$ where the total number of issued loyalty cards is 100,776. Therefore, using comments from Section 3, we can estimate the saturation level as:

$$u_{max} = 100,776/0.211 = 477,611$$

Because the value of SCD at point t is equal to the value of SLD at $t + 1$, then using in the decision the last one, leads to the estimation:

$$u_{max} = 105,729/0.211 = 501,085$$

Table 3. Second central differences (SCD) for the initial observations

Week	No (t)	Total NLC	SCD
05/12	0	85305	
06/12	1	91478	−556
07/12	2	96539	−412
08/12	3	100776	358
09/12	4	105729	291.5
10/12	5	111265	−74.5
11/12	6	116652	−259.5
12/12	7	121520	−9.5
13/12	8	126193	−588.5
14/12	9	129689	

Table 4. Diffusion of mobile telephony for Germany and Slovak Republic

Year	Germany	SCD	Slovak Republic	SCD
1995	0.05		0.01	
1996	0.07	0.005	0.01	0.015
1997	0.1	0.02	0.04	0.01
1998	0.17	0.02	0.09	–0.01
1999	0.28	0.095	0.12	0.04
2000	0.58	–0.105	0.23	0.03
2001	0.67	–0.025	0.4	–0.015
2002	0.71	0.01	0.54	0
2003	0.77	0.01	0.68	–0.015
2004	0.85	0.01	0.79	–0.03
2005	0.95	–0.015	0.84	0.01
2006	1.02	0.03	0.91	0.07
2007	1.15	–0.005	1.12	–0.155
2008	1.27	–0.065	1.02	0.045
2009	1.26	–0.095	1.01	0.045
2010	1.06	0.12	1.09	–0.035
2011	1.1	–0.01	1.1	0.005
2012	1.12		1.12	

Otherwise, we could find a polynomial, which best fits the data in the sense of the least square method and then investigate its second derivative for a maximum. Such polynomial, e.g. of order four, is as follows

$$f(x) = -1.6807\, x^4 + 30.515\, x^3$$
$$- 206.23\, x^2 + 5610.1x + 85584$$

and its second derivative

$$f''(x) = -20,16\, x^2 + 183,09\, x - 412,46$$

has a maximum at the point $x = 4.5$. The value of $f(x)$ at this point is $f(4.5) = 108,745$. Thus, we can estimate by starting a project to introduce a loyalty card, e.g. in a chain of stores, we could use the logistic curve to determine the increase in the number of loyal customers. At the same time, we could develop a promotion plan for the recruited persons, so that the budget of a given period of time (e.g., for a year) had a chance to be in a real way achieved.

During the project, the model created by the logistic curve allows us to monitor the effectiveness of the project, to draw conclusions and make appropriate decisions if there were derogations from our previous assumptions.

4.2   Diffusion of mobile telephones in two countries

Recently many papers have been published, which were devoted to mathematical modelling of the percentage diffusion over the population of mobile telephone for different countries (see [3, 5, 10 and 11]).

Consider two European countries, one with a stable and well-developed economy – Germany and the second, relatively recently accepted into the European Union – Slovak Republic, which transformed from a centrally planned to a market-driven economy. Table 4 shows the rate of mobile telephone subscriptions per one inhabitant in the two countries (see also Fig. 10 and 11).
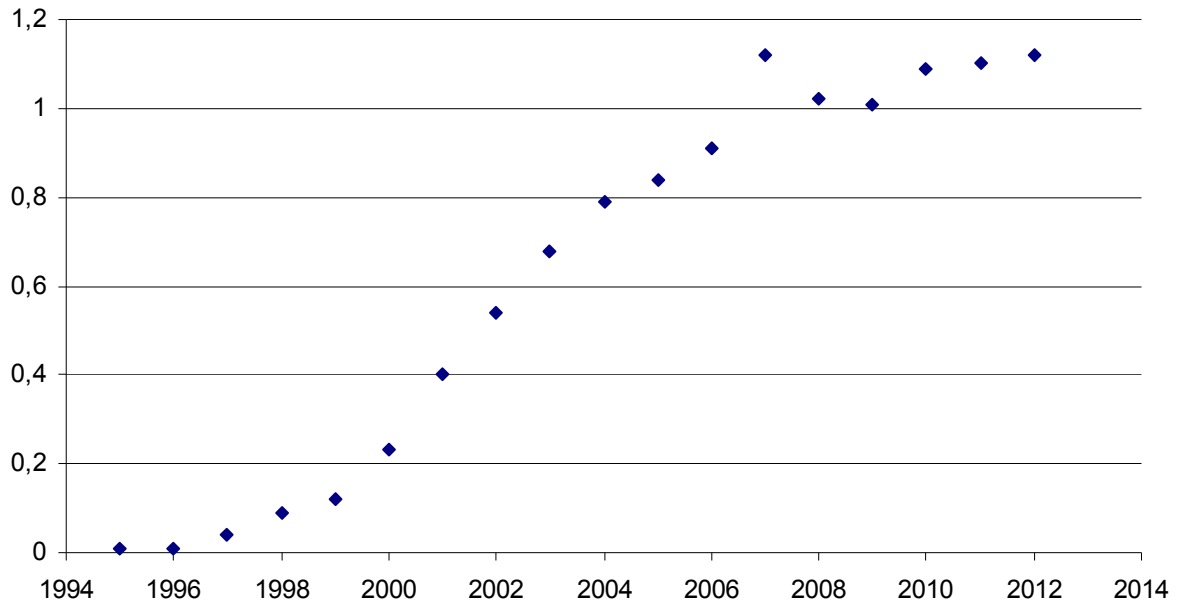
Figure 10. Rate of mobile telephone subscriptions per one inhabitant in Slovak Republic
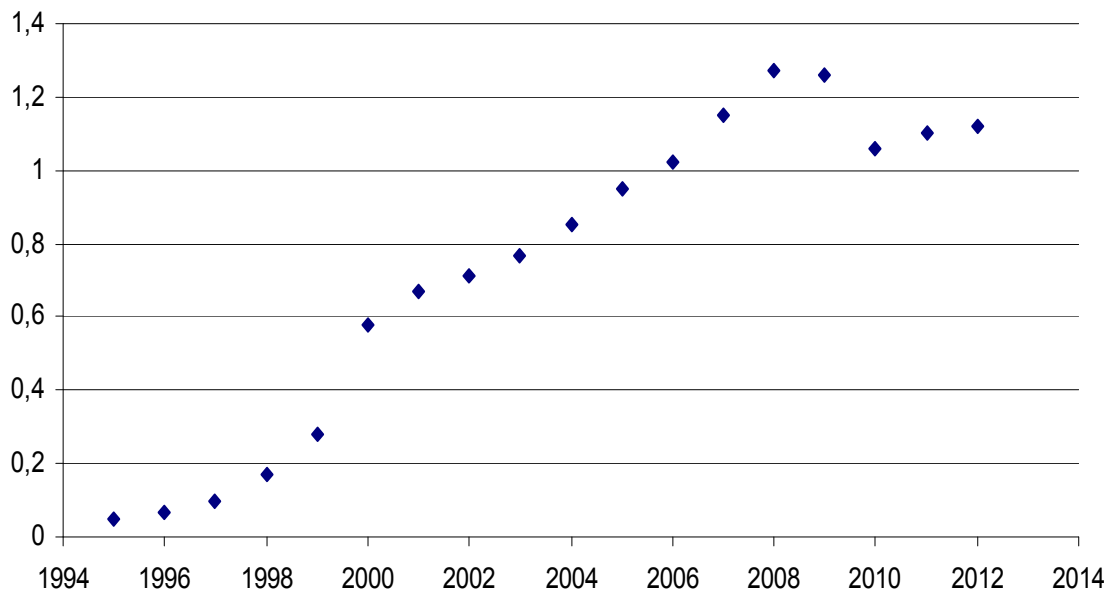
Figure 11. Rate of mobile telephone subscriptions per one inhabitant in Germany

Table 5. The quantity of medical devices purchased (QMD)

Month	QMD	Month	QMD	Month	QMD	Month	QMD
06/09	3	03/10	23	12/10	15	09/11	16
07/09	12	04/10	8	01/11	4	10/11	17
08/09	8	05/10	20	02/11	11	11/11	25
09/09	17	06/10	11	03/11	8	12/11	12
10/09	22	07/10	10	04/11	8	01/12	8
11/09	30	08/10	15	05/11	5	02/12	5
12/09	15	09/10	10	06/11	9	03/12	5
01/10	11	10/10	17	07/11	12		
02/10	4	11/10	16	08/11	11		

The data, corresponding to the period from 2000 to 2012, were collected from the International Telecommunication Union (ITU, http://www.itu.int) and these corresponding to the period 1995–1999 were extracted from the paper C. Michalakelis, T. Sphicopoulos [5].

On the graph for Germany (see Fig. 11) are seen two perturbations and changes in the trend. They were probably caused by early 2000s recession, which mainly occurred in developed countries and financial crisis of 2007–2008, which led to the 2008–2012 global recession. However in years 1995–2000, the shape well fits the logistic curve and we see from Table 4 that SCD clearly takes its maximal value at the point 0.28.

Thus, the estimated saturation level is $u_{max} = 0.28/0.211 = 1.327$. It seems interesting to note that, despite of the perturbations described above, a similar level has been reached in 2013, and was equal 1,301. [1]

For fast-growing economy of Slovak Republic, the crises have not had much impact on the level of diffusion. Maximum of SCD, for the initial observations, is not as explicit as previously and should be fixed somewhere in the interval [0.12, 0.23]. Therefore, the estimated level of saturation is from 0.12/0.211 = 0.57 to 0.23/0.211 = 0.109.

Let us note that SLD indicator would give us, in this case, the value of saturation level in the interval from 0.23/0.211 = 1.09 to 0.4/0.211 = 1.89.

4.3 Purchases of certain medical devices

The data in Table 5 relate to some specific medical devices used in the diagnosis and treatment of patients. These products are used in public and private medical institutions.

The main users are public institutions, which buy these products using public funds in accordance with the 'Public Procurement Law'.

The average lifetime of the product is about 3 years. After this period, the device is subjected to a major renovation restoring its full functionality or is exchanged for a new one. The specificity of purchases from the budget indicates that purchases of these products are usually made in the fourth quarter of the calendar year. Increasing demand for these products contribute to periodic health programs implemented under

Fig. 12 shows the total quantity of purchases (on the horizontal axis the first month denotes 06/09 i.e., June 2009).

We see that only the initial data fit a logistic curve and then the phenomenon is no longer of such a nature. However, the maximum of SLD is reached in November 2009, where the total purchases are 92 devices. The estimated saturation level is

$$u_{max} = 92/0.211 = 436$$

and it seems to be a quite good forecast of its real value.

[1] 'Research and Markets Adds Report: Germany - Telecoms, IP Networks and Digital Media'. TMC News, 12 June 2013. (retrieved 5.11.2013).
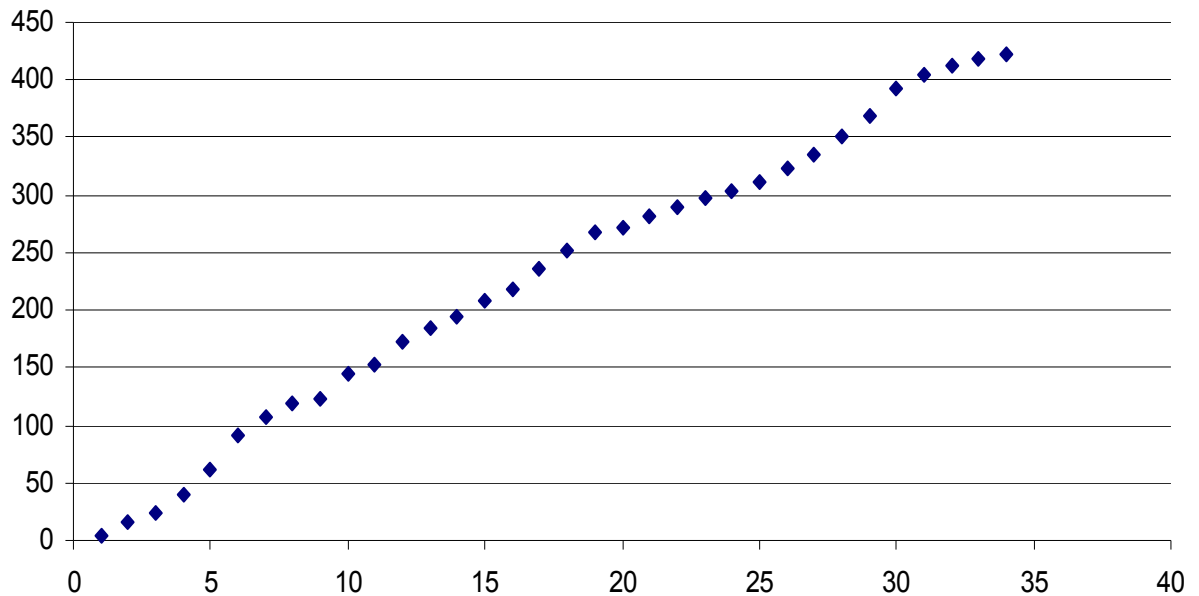
Figure 12. Total quantity of medical devices purchased

5   Conclusions and future works

In this paper, we have presented a method to study time series having the logistic trend. The approach is based on indicating some characteristic points corresponding to zeroes of successive derivatives of the logistic function in the data. We gave a general formula for the nth derivative of the logistic function, expressing it in terms of the derivative polynomials and Eulerian numbers. Then, we have computed first few derivatives and calculated zeroes of the corresponding derivative polynomials. It seems that from a practical point of view, especially with relatively small number of initial data, particularly significant is the leading zero of the third derivative, where the logistic function takes value $0.211u_{max}$.

We have shown the usefulness of our method with examples related to economics and management. We have demonstrated that when a phenomenon is at its early stages of development, then the saturation level may be effectively predicted.

We believe that this approach should be used together with existing methods, e.g. the nonlinear least squares method.

In our next research works, we will apply a similar idea for other mathematical models used in economics and management as Gompertz and Bass curves.

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THE INFLUENCE OF THE MANAGEMENT (MOTIVATIONAL) FUNCTION ON THE IMPLEMENTATION OF NEW CONCEPTS OF MANAGEMENT IN BUSINESS PRACTICES

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Abstract: The aim of the article is to discuss the results of a study about the influence of one of the management functions, the motivational function, on the implementation of new concepts in enterprises. The research includes such issues as the use of new concepts in accomplishing objectives as well as factors, which make companies work more effectively once these concepts have been introduced. This presentation and the detailed analysis of the empirical research conducted gives insight into how new concepts of management are used in practice.

Keywords: motivation, motivational factors, motivational function and tools, management concepts, management methods, effective functioning of businesses.

1   Introduction

In the subject literature, it is underlined that motivation is a set of many single motives, which influence humans to various degrees [2, p. 167]. It is a force that drives people to take action and directs human pursuit of goals. The basis of these motives can be found in the needs that determine certain human behaviors meant to fulfill those needs, as well as the aims individuals either set for themselves or are externally imposed upon them. The needs indicated are understood as a state of the organism caused by a certain lack, which triggers internal imbalance of the organism and impedes the process of life and development. A need has a dynamic nature and its appearance can produce or start a process, which will direct an individual into undertaking certain actions in order to satisfy it. A need becomes a motive once it has been driven to a certain degree of intensity and thus prompts one to take action.

While drawing up motivational schemes, managers should be aware that, as regards employees, the work process touches not only the issue of remuneration, but also the opportunity to establish interpersonal relationships, improve self-esteem, be praised, develop and feel contentment and satisfaction. This is why the system of motivators should be selected according to the individual needs of the employees, showing them which behaviors and actions are promoted, and which ones should be avoided in the workplace.

2   Empirical research analysis

The question whether a company having introduced new management methods has met with reluctance on the part of its employees (SEE Diagram 1) has been answered by 101 respondents, 43% of whom (43 people surveyed) answered affirmatively. Any introduction of changes in organizations provokes anxiety within the working personnel. A company, which is unable to implement innovative management methods and communicate these changes to the outside world, no longer counts in the modern world economy.

Employees are afraid of changes as they are sure that they might lose something of special value to them. Another reason for the reluctance towards change is the difference in the employees' and the employer's analysis of the situation. Some employees oppose change as they fear they might have to acquire necessary new skills and improve their qualifications. Yet another reason might be leaving a team of friendly employees.
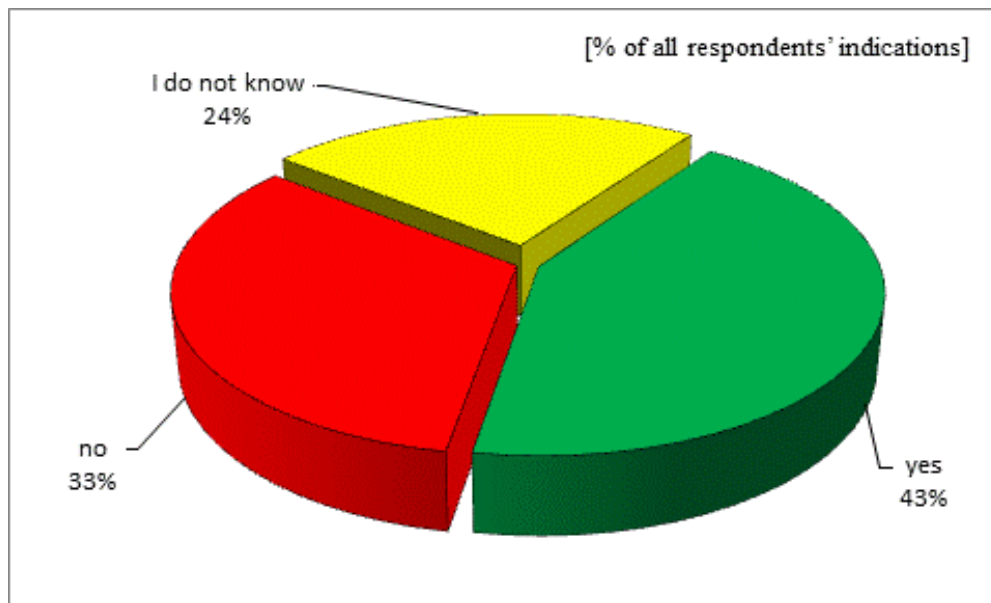
Diagram 1. The range of employees' opposition with regard to the implementation
of new management methods in a company
(*source: the authors' own study based on empirical research - the research included 216 respondents*)

On the other hand, 33% of the respondents (33 people surveyed) answered negatively. This attitude indicates the respondents' understanding of new management methods, acceptance of what is consciously being introduced, organized and controlled by the company's managing personnel. It is necessary that employees accept the process of change as it is they who determine the success of the change project in an organization.

Twenty-four percent of the respondents answered that they did not know. This figure may indicate that the respondents in question are not interested in what is happening in the enterprise or that they do not identify with the company, because either they are employed on the basis of casual contracts or they do not plan to work in the company in the future.

Looking at Diagram 1, it has to be pointed out that the proper use of the opposition might bring more desirable effects than confrontation or not taking the case into consideration.

Opposition derives from the fear of the unknown or of failure, from lack of information, threat of losing the current status, lack of perceptible benefits, mistrust, negative reactions and threats, fear of losing informal relationships, as well as from a high level of anxiety and stress. Knowing the source of the opposition

and anticipating it may open the door to using this situation effectively. The reluctance of employees stems from the fear that they will have to face various situations, which might be the consequence of the restructuring of the company or its production scheme. In companies where informal relationships are wrongly structured, managing staff and employees working in different functional departments hate one another. If the employees and the managing personnel are focused on their own interest rather than their company's aims, the opposition will be exceptionally large and impossible to overcome.

The data in Diagram 2 shows that as many as 56 respondents (16% of the overall number of those surveyed) stated that some of the most important factors that motivate managerial staff and regular employees to implement new management methods in a company are financial means and the company's success. Fewer respondents (53 people, 15% of the total number of those surveyed), indicated that the motivating factor was career advancement. Some employees will be satisfied when their basic material needs are fulfilled, other will need more complex professional challenges. Improving competences guarantees success of employees on the labor market. A crucial motivator prompting workers to act in the best interest of the company is the opportunity for self-development [7, p. 213].

[% of all respondents' indications]

Factor	%
financial means	16%
achieving success	16%
professional development	15%
company and personal prestige	12%
recognition by superiors and subordinates	9%
praise	8%
high self-esteem	8%
security	7 %
position in company hierarchy	6%
work-life balance	1%
I do not know	1%
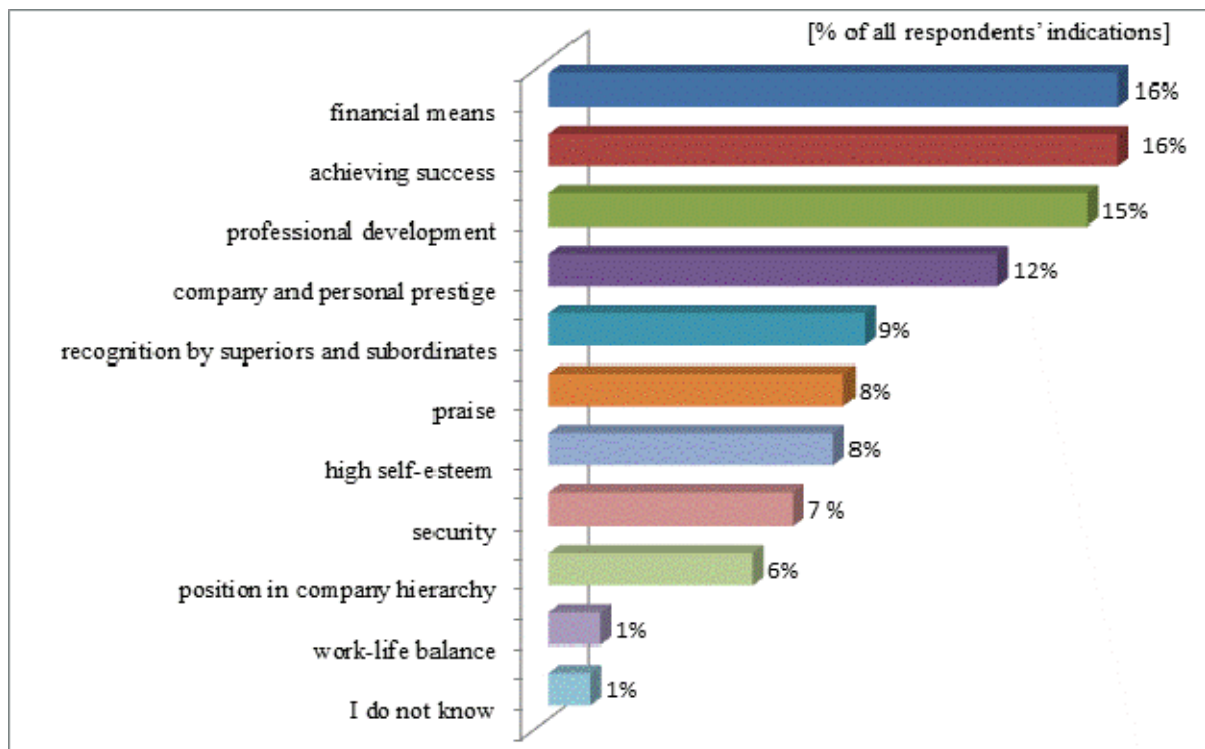
Diagram 2. Factors motivating managerial staff and employees to implement new management methods
(*source: the authors' own study based on empirical research - the research included 216 respondents*)

As many as 44 respondents (12% of those surveyed) were in favor of enhancing the company's and their own prestige with the introduction of new management methods, whereas 29 respondents (8% of those surveyed) declared that praise and high self-esteem are some of the most motivating factors. Praise ought to be concrete and clear, based on the effects observed and effort made by the employee. Managers should praise their employees before they complete their task, at different stages of the task completion, as this is how the employees strengthen their motivation and stamina. Respondents know that their smallest success contributes to the overall prosperity of the company. Twenty-four respondents (7% of those surveyed) stated that it was the feeling of job security, which was crucial. These days, it is necessary that enterprises, operating in uncertainty and chaos, ensure that this basic need is fulfilled.

Job security influences the quality of life of the workers and their development. It can be deduced that when job security is ensured, the employees are more motivated to do their work and are not afraid of changes in the company, which makes them work more effectively, and thus helps the company accomplish its objectives. Improving their position in the company structure was

signaled as important by 20 respondents (6% of those surveyed). The authors of the article are not surprised by this fact, as 96% of the respondents (70 people) declared to have completed higher education and as many as 39% of those surveyed hold the position of specialist or chief expert. This matter was subject of the research conducted by the authors on the issues of enhancing new concepts of managing business development. The presentation of the research scope is presented in another article [3, pp. 157-161]. The subject of the analysis is results of a survey conducted in the months of January and February 2013 in public and private enterprises of different sizes. Two hundred and sixteen questionnaires were distributed and completed. From the questionnaires returned, 101 were completed correctly. The survey was anonymous. It can be inferred from the data obtained that introducing new concepts of management in a company will contribute to employees' promotion to higher positions. As few as 5 respondents (1% of the total number) indicated work-life balance, whereas 4 respondents (1%) claimed that they did not know the factors that motivated managerial staff as well as employees to implement new management methods.
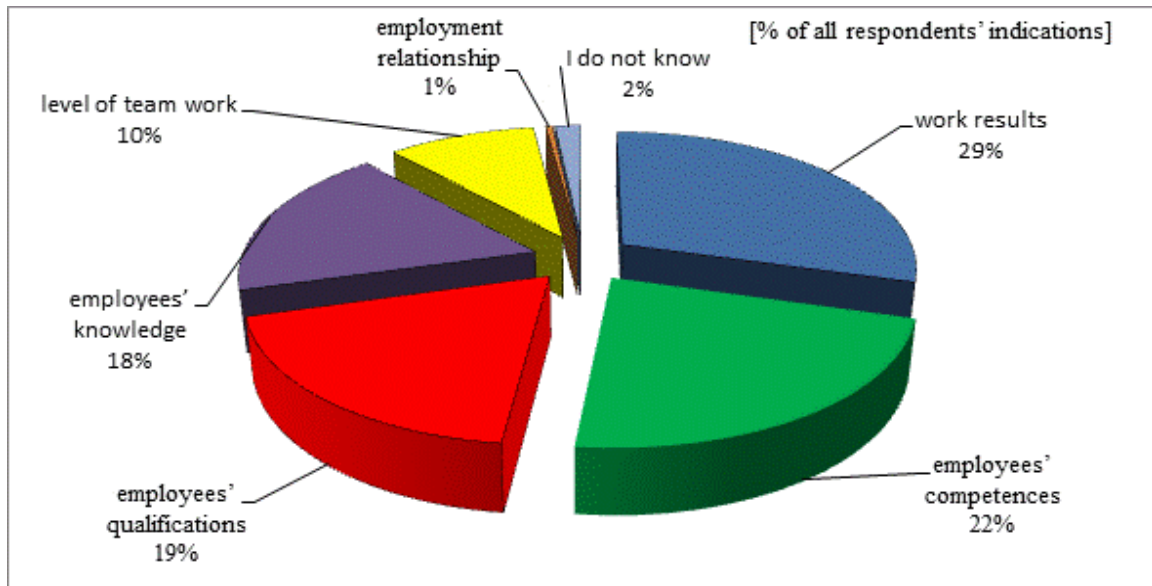
Diagram 3. Factors determining the introduction of new management methods in businesses (motivational function)
(*source: the authors' own study based on empirical research - the research included 216 respondents*)

It can be understood that such a response was given by employees who have worked for the company for a relatively short period of time and do not yet know motivational factors occurring in businesses.

The visualization of the responses in Diagram 2 with regard to the factors that motivate employees and managerial staff to use new methods of management needs to be constantly assessed and revised. Introducing novelties implies the necessity to understand organizational behaviors towards them, which is why objectives and measures facilitating the process need to be determined carefully. In addition, a map of changes leading to the accomplishment of these objectives needs to be drawn up, and factors influencing the success of the approach chosen need to be identified. Introducing new management methods requires monitoring the map as well as making corrections if necessary, which will make the use of new management methods possible. The philosophy adopted ought to guarantee the following:

- a vision of survival, development and expansion in a turbulent environment,
- identification of employees and managerial staff with the company's vision, strategy and goals,
- predictable influence on the change process necessary for the completion of the vision.

Diagram 3 illustrates the responses to the question what the introduction of new management methods in businesses depends on as far as motivational factors are concerned.

The analysis of the data indicates that the most frequent determinant was work results (29%, 71 respondents). The second element was workers' competences (22%, 54 respondents). Competences of employees in businesses are understood as skills, experience as well as qualifications to take decisions on different positions, which is why this factor was indicated by such a big number of respondents, as it is a factor determining success for a given enterprise. Workers' competences are crucial for the completion of tasks on given positions and for proper functioning of the company. It is the employees' competences that are a measure of the economic, organizational and social performance of the business. Another determinant was employees' qualifications (19%, 45 respondents). It is qualifications, which are subject knowledge, expert knowledge and expertise, which can be verified, measured and estimated. A qualified employee is one who has completed full-time education and has acquired knowledge and practice in a given area of study and who is legally authorized to work on a given post. This is why this indication is so important with regard to respondents who know their colleagues, as it is them, their competences and qualifications that the success of the company will depend on once new management methods are introduced. As many as 43 respondents (18% of those surveyed) indicated knowledge of employees. "Knowledge workers" is a new category of workers in businesses.

Their task is the productive use and exchange of knowledge. It is their responsibility to create and implement new ideas, thanks to which businesses will adapt their strategies to the quickly changing turbulent environment.

Their basic tasks are to search, exchange, link and make use of knowledge inside and outside the company. The level of teamwork was indicated by 10% of the respondents (23 people surveyed). Only 1 person indicated employment relationship (1% of the surveyed), and 4 respondents (2% of the surveyed) said they did not know what the introduction of new methods in a business (motivational function) depended on.

The determinants of the introduction of new management methods in completing the motivational function (Diagram 3), in particular employees' qualifications, competences and knowledge as well as the results of their work, allow the chief staff to specify strategic areas of activity and focus in the fulfilling of business models for the company. Workers' knowledge and competences make it easier to establish a company policy and its game rules, which in consequence help to take important decisions. It is necessary here that one is aware of the importance of employees' knowledge and competences in the designing and redesigning of the architecture of managing a business, and that managerial staff and regular workers constantly need to improve their qualifications.

To answer which of the pay functions are used in the fulfillment of the motivational function in improving new management methods, 35% of the respondents indicated the motivational aspect (62 workers surveyed). The instrumental function of motivation has a psychological or economic aspect, or the two at a time. The first of these aspects is understood as a system of measures, which provoke emotional reactions and human attitudes [6, pp. 59–61]. The elements of the so-called psychological environment are the worker's duties, working conditions and position he/she takes in the society, thanks to the position held [9, p. 139]. The most important function of the economic aspect is using mechanisms that regulate the supply of salaries and bonuses. However, it has to be stressed that the economic aspect has a motivational function when it is based on rational management. In the case it

expresses only 'obligation motivation', the influence will be purely directive.

As many as 28% (49 respondents) indicated the income function. The income function means that the salary of employees is the main or quite often the only source of income for them and their families. Earning a salary is the deciding motive for undertaking work. This function underlines that income should be enough for the worker to regain his/her ability to work and to regenerate physical and mental powers by providing the necessary money to satisfy his/her elementary needs of life.

Only 33 respondents (19% of those surveyed) indicated the cost function. The cost function is based on the company's costs related to paying employees salaries, which are the company's biggest cost. They are comprised of salaries and other employment-related costs, both financial and in kind as well as social insurance schemes [1, p. 19]. It needs to be underlined, however, that the level and variety of salaries determine the quality and structure of the personnel, their professional development and continuity of employment. Both the level and the diversity of salaries should be adapted to the system of values and expectations in a given country, community, professional group, as societies are very sensitive about salary issues. The social function was indicated by a slightly smaller number of respondents (as many as 26, which is 15% of those surveyed).

Remuneration system in a business determines social relationships. It can be asserted that salaries have this function "because they are a sign of prestige, recognition and values of given employees and professional groups". The level and variety of salaries determine one's position in the society, influence interpersonal relationships and job satisfaction, as well as the occurrence of conflicts and strikes [8, p. 179]. Work that can be considered difficult and requiring high qualifications and skills as well as considerable dedication ought to be remunerated fairly and properly, otherwise the rank of some professions loses its importance.

Only 6 respondents (3% of those surveyed) stated they did know the functions that were used in their company.
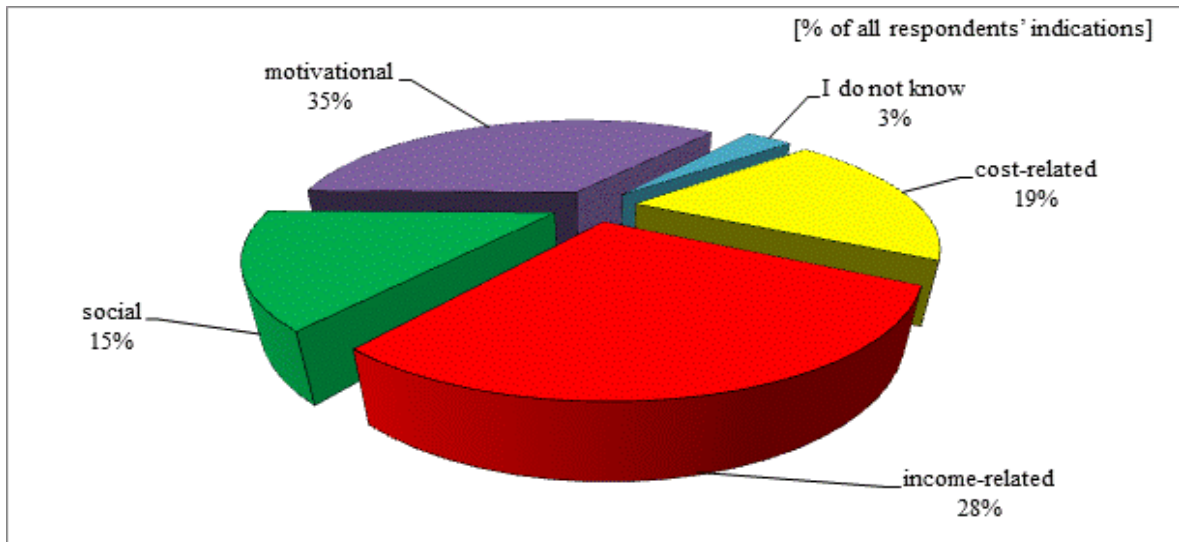
Diagram 4. The functions of salaries used in the fulfillment of the motivational function
in enhancing new management methods
(*source: the authors' own study based on empirical research - the research included 216 respondents*)

Presented in Diagram 4, the functions of salaries used in the implementation of new management methods make it easier for employees and managerial staff to identify and accept their company's strategies in the times of risk and uncertainty. These functions also make for the integration and coordination of material and non-material resources, allowing the company to accomplish its goals, strategies, mission, and vision. The attractiveness of the salary function lies in the possibility of avoiding dysfunction and organizational chaos in the business. The risk this philosophy presents

is the competition that occurs between the managerial staff and the employees for influence and the resources the company has to survive, develop, and expand. Uncertainty and the dynamic nature of the environment may trigger conflict and crisis in the functioning of the enterprise.

Diagram 5 illustrates the respondents' answers to the question which motivational tools are used in the company during the implementation of new management methods.
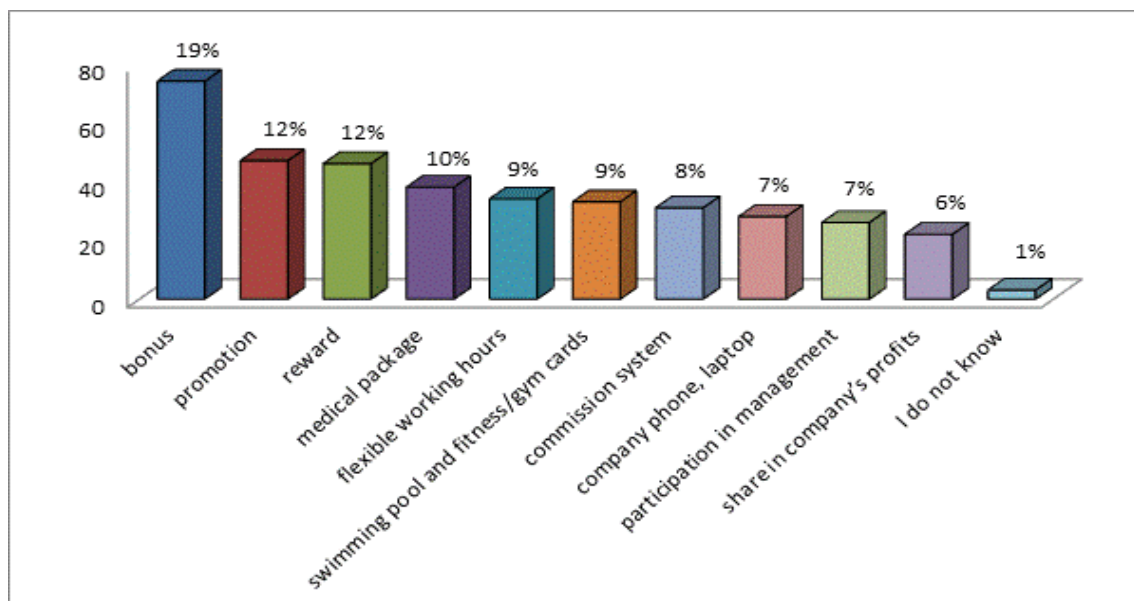

Diagram 5. Motivational tools used in companies during the introduction of new management methods
(*source: the authors' own study based on empirical research - the research included 216 respondents*)

The analysis of the data illustrates that the most frequently indicated motivational tool are bonuses, which were selected by 19% of all those surveyed (74 people), and rewards, which were selected by 12% of those surveyed (46 people). This shows that bonuses and rewards are of special motivational importance in the rewarding of employees. Relating them to work results encourages employees to ameliorate effects, which determines how often bonuses and rewards are given and what their level is. As bonuses are paid for the effects of work, they should be changed according to the changes in the effects of work in time.

One of the most important motivational tools indicated by 12% of the respondents was promotion (46 people surveyed). Promotion is one of the main functions that motivates employees to expand their knowledge, acquire new skills, try hard and be committed. Not only does it satisfy the need for recognition and high self-esteem, but it also allows employees to improve their standards of life and to gain access to higher values. Promotion carries enormous motivational force and it determines workers' behaviors.

Other motivational tools specified by respondents were medical package, flexible working hours and fitness/gym and swimming pool cards. They were indicated by 10% of the respondents (38 people), 9% (34 people), and 9% (33 people) accordingly.

Fewer respondents (8% of those surveyed, 31 people) indicated commission and a slightly smaller number (7% of those surveyed, 28 people) a company phone and laptop as well as participation in the management process. Having a share in the company's profit was indicated by 6% of the respondents (26 people).

Only 1% of the surveyed (3 people) said that they did not know what motivational tools were used in their company during the introduction of new management methods.

Judging by the respondents' indications in Diagram 5, it has to be asserted that businesses functioning in the times of risk and uncertainty make employees accept, in the spirit of ethics and cooperation, the prevailing rules through bonuses, promotion and flexible working hours. Such an approach implies trust, which is the philosophy adopted by employees, which expresses itself in their faith and commitment towards the employer. Promoting trust in the use of new management methods provokes quick reactions and encourages creativity and initiative, as well as quick exchange of information within the employees' and managerial staff's

activity. As a consequence, the situation brings the business competitive advantage, which is based on flexibility and quick reaction.

3   Conclusions

The article presents analysis of the respondents' indications pertaining to new management concepts in the fulfillment of motivational function in business practices. Based on the empirical research, the following conclusions can be drawn:

1) One of the biggest problems managers face today is the opposition of employees to change. It can lead to the worsening of work results, conflicts, intentional slowing down the pace of work and thinking that the changes will not bring expected results, but dismissal. This is why managerial staff should inform employees about intended restructuring. Appropriate flow of information will convince employees that changes are necessary and will discourage them from opposing them. Participation of employees in deciding on the direction the restructuring takes will inspire them to work more effectively and efficiently, and thus will contribute to the increased productivity of the business.

2) Participation of employees in management understood as tactics of change implies that managers will allow employees who oppose or might oppose change to decide on the direction the designing and implementing of change will take in the company.

3) Financial means are a very effective tool, which is used to motivate employees. Managers should understand the power of rewards. Intuitively, employers resort to rewards to influence behavior of employees, but their effort does not always bring desired results as they use improper strategies for rewarding their subordinates. In order for pay to motivate employees to work well, develop professionally, be promoted and act as expected by the employer, the following conditions need to be met [1, page 22]:

- the remuneration system needs to be known by all employees and taken as logical, fair and used consistently by the employer,

- the remuneration should be equitable and based on the results obtained by the employees for the employer,

- part of the remuneration should be performance-related and based on the attitudes and behaviors of employees,
- the time span between executing a task and being rewarded for it should not be too long to erase the connection between work and pay,
- the influence of employees on the work effects that are rewarded should be made visible.

4) If managers want to have influence on their subordinates' behaviors, they need to determine what consequences of the behaviors have desirable value to them and they need to be able to manipulate the consequences of those behaviors.

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CSR AS A TOOL OF BUILDING THE COMPETITIVENESS OF BUSINESSES

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Abstract: In this article, author analyzes the application of CSR as a tool of building the competitiveness of business. She assumes that corporate social responsibility (CSR) could be a useful tool in giving a competitive edge to an enterprise.

The idea of CSR as a part of the tool creating the position of the company in the market is explored by the author. Besides, an attempt to define and comprehend CSR is undertaken. The author explains the necessary requirements that must be fulfilled for CSR to play the role of a useful tool for creating the competitive edge and spheres of activity for the individual, which should be taken into consideration while creating strategic CSR.

Keywords: CSR, strategy of CSR, competitiveness of enterprise, area CSR.

1 Introduction

Globalization has caused significant changes in business activities. Today a competing enterprise does not mean a company that produces useful and innovative goods at an expected price level and required quality. In the 21st century, enterprises must face new challenges apart from traditional requirements. A contemporary determinant of how the enterprise performs in the market is having positive contacts with clients and creating a positive image of the brand. CSR is a useful tool for that purpose.

Numerous research studies show that more and more consumers pay attention to how the company is involved in the aspect of business performance. A good example is Research Global CEO Study conducted by IBM Institute for Business Value. A total of 1130 members of senior staff of many global enterprises were asked about consumers' behavior. Findings indicated that consumer's expectations for the role that companies play in aspects such as pro-social activities and the environment are increasing steadily. The research indicates that enterprises have a significant role in pro-social action with regard to the competitiveness of businesses [1, p. 11].

An instrument that shapes the social sensitivity of companies and builds their competitiveness in the market is CSR. Although the concept of CSR seems to be relatively new, this concept has been a subject of public debate from the beginning of the last century. The literature on the subject does not show the ambiguous CSR definition. Authors have provided various definitions and have implicated many roles for CSR. Irrespective of authors, all CSR definitions concern the problem of companies benefiting from social actions taken.

A growth of innovation and adaptation, reducing cost, increased motivation and satisfaction of employees are benefits to enterprises that come from implementing the idea of social responsibility. Research studies evaluating the effectiveness of CSR were conducted in Poland by the Institute for Private Enterprise and Democracy. According to the results, companies that use CSR have a higher financial liquidity, make better use of their capital assets and human capitals, attain higher profitability and more often invest in employees.

The second and third subsections of the study describes the literature on the source of comprehending the CSR as a tool, which improves competitiveness of companies in the market. These subsections also explain comprehending the competitiveness of businesses. In the remaining part of the article, the author presents conditions that must be fulfilled in order for CSR to fulfill the function presented in the title of the study. This part is based on examples taken from the economic reality and other numerous literatures on the subject.

2 Comprehending the competitiveness of businesses

According to W. Glabiszewski, in universal meaning, the word CSR is associated with the positive feature, which distinguishes companies in the market. It is identified with the state of superiority of a business entity in relation to its competitors. It is a state which they are aspiring in the economic reality. One should emphasize

that it is the feature desired by market participants, which is worthwhile having [7, p. 31].

In the literature analyzed on the subject, a diversity of comprehending the definition of competitiveness was noticed. This diversity results from the varied use of this idea in different fields. It is possible to observe a deeper interest in this phenomenon among others in economics, but also in the social and economic sphere and numerous macro and microanalysis.

Competitiveness is a crucial issue that is being considered with reference to every economic entity, their groups, layouts of individual units and factors, which have an influence on them.

The definition of competitiveness is most often to get to the macroscale [7, p. 32].

This type of definition of competitiveness was introduced in the report of international competitiveness of the economy. This document explains this notion as an ability to create larger wealth than other competitors in the world market [7, p. 32]. Such an understanding of the theme was presented in deliberations by M. Porter. The author shows certain relations, which points to the existence of this phenomenon in international markets. According to the author, if enterprises of one country, more often than enterprises of other country, gain an advantage as a result of competing, it is possible, and one should deal with the matter of the competitiveness of national economies [6, p. 11].

A definition of competitiveness referring to both total economies and local economies was presented by B. Winiarski. The author explains this notion as an ability to achieve success in economic rivalry [25, p. 9].

A European Commission presents the general definition of the competitiveness. According to that institution: "the competitiveness reflects a position of one business entity (for example: country, company or household) towards other business entities through comparing the quality of action and results in categories of the superiority/inferiority" [10].

The subject is presented differently by P. Krugman. The scientist claims that only enterprises can compete with themselves that is why it is not possible to talk about competing of economies in international markets [6, p. 11].

The competitiveness of the region is measured with the competitiveness of businesses located in the region

and it is "an ability of struggle with the international competition enterprises […] to draw relatively high-level incomes and employing" [17, p. 21].

Companies that develop these elements create their own competitive edge in the market. By creating immaterial factors of competitiveness, these companies build in the process the competitive edge of the region. The competitiveness of the company in the market is a result of the influence of many mechanisms and internal factors and extrinsic factors.

The definition of the competitiveness of the enterprise including the product and service aspects was presented by D. Korenik. The author writes that comprehending the competitiveness is "an ability to design, produce and sell goods and services which prices quality and other advantages that are more attractive than appropriate goods offered by competitors…" [11, p. 13].

A notion that competitiveness refers to the purposes of the company was introduced by M.J. Stankiewicz. The author claims that the notion describes "an ability to efficiently carry out purposes in the market arena of the competition" [21, p. 36].

The possibility of comprehending the competitiveness in dynamic and static presentations is an important fact [7, p. 34]. The first perspective is an evaluation of the competitiveness on based on the analysis of factors determining the long-term ability to compete. It must be underlined that it includes the analysis of changes happening in the time; however, the static take reflects the evaluation at that particular moment. The greater practical significance of including competitiveness in the long term should be stressed.

W. Glabiszewski noticed rightly that such a type of division was presented by J. A. Stoner. The author defined competitiveness as "readiness of the given country to take competitive action in the future" or "a measure of the effectiveness of acting in the past" [7, p. 33].

To sum up, it is possible to state that the competitiveness of the enterprise is an ability to fight off competition in the market. A step of competitiveness of the individual depends on step of his or her progression in the sector. In other words, an enterprise, which is able to meet the action of other operators on the market, is a competing enterprise.
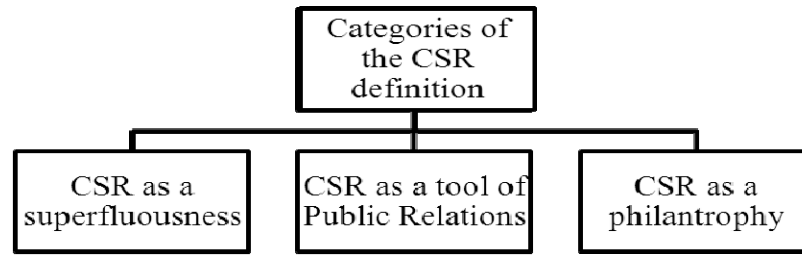
Figure 1. Categories of defining the CSR notion in the analyzed literature on the subject
(*sources: based on [27]*)

3   Approaches of authors towards CSR as tool of creating the competitive edge of enterprises

It has been already recalled earlier how the approaches of authors towards analyzing literature on the subject of profiting from CSR and consequently understanding CSR as a tool for creating competitive edge of enterprises are ambiguous and come from all manners of categories defining this notion. The following approaches to this problem were distinguished [27, p. 32].

The first approach towards the subject presented in Fig. 1 does not take into account the need to apply the practice of being socially responsible. Supporters of this theory claim that an improvement in performance of the company is the basic aim of the enterprise. According to the authors, an action that often leads to grave financial losses is a distinctive feature of this aspect of the CSR perception. Representatives of this point of view do not notice potential advantages that come from the business of being socially responsible. It means that the authors do not notice a chance in creating competitiveness of the individual by applying social and environment-friendly action. M. Friedman is the promoter of such a definition of the CSR.

A second type of understanding of the CSR notion presents social responsibility in the broader aspect of the subject. Representatives of this theory propagate a disinterest of action taken in social responsibility.

They treat this kind of action as a need of someone's heart and a public obligation [22, p. 304]. It should be underlined that supporters of such an understanding of CSR do not take responsible social action in order to gain benefits. According to them, it is not possible to implement social action with force in order to provide competitiveness for the individual in the market.

The last approach towards CSR presents social responsibility as a tool of public relations. It assumes that socially responsible action simultaneously expects the reimbursement of costs carried during this action and as a result obtaining profits. Representatives of this theory can see in CSR a financial benefit and promotion of a corporate's image [22, p. 304]. Growth in sales or generating additional earnings is ranked among financial benefits. The image benefits are an improvement in the image, building the reputation, or improving the competitiveness in the market.

The CSR theory as a tool of public relations is the source of all further analyses. CSR is an effective strategy, which contributes to increasing the competitiveness of businesses on the global level by leading a social dialogue on the local level. This way of understanding the CSR is an achievement of commercial success by taking into consideration ethical values, employee entitlements, development of the community and protection of the natural environment.

4   CSR, in the context of tool, shapes the competitive edge of enterprises

M. Bieńkiewicz undertakes the attempt to define CSR as a tool that shapes the competitive edge. The author determines conditions, which must be fulfilled in order that social responsibility of enterprises could be considered in this aspect. The author begins his deliberations with the definition of the social responsibility presented by R. Szarfenberg. The definition describes CSR as "a concept assumes voluntary including in the activity of companies social objectives which lead to satisfying existential needs and developmental wide social layers and protection issue of a preservation of environment. This activity goes beyond obligations result from legal norms." [1, p. 5].

In this study, CSR is a concept, which is not isolated and independent of surroundings. CSR is an instrument for satisfying the need of people connected with the enterprise and is a tool that builds the competitiveness of the enterprise in the market.

Figure 2. Model CSR by A.B. Carroll
(*source: based on [20, p. 56]*)

This way CSR is understood as an integral part of a long-term corporate strategy. What is more, it is a point of reference with regard to all current decisions and reflects in all current business decisions, as well as in all aspects of the business activity of the enterprise.

A few fundamentals must be fulfilled in order that CSR could bring a real benefit in the form of the structure of the competitive edge in the market. We should note a strategy, a long-term nature, a defining of expectations and purposes, an identification of crucial groups of clients and a correct choice of CSR instruments [1, p. 11].

A.B. Carroll described the interesting attempt to join the matter of competitiveness of the individual and its social responsibility. The researcher is an author of the model CSR presented in Fig 2.

According to the author, if a company carries its economical obligations out first then we can judge its performance on social responsibility. Carroll's model shows that a business activity should be led in order to bring essential profit to further functioning of the company. It means that an economic responsibility should be the priority of the enterprise. Carroll claims that such a system of values guarantees that legal liability preserves a social order [27, p. 33].

It seems that, according to the theory of Carroll, there are three levels of social responsibility. The first con-

tains demanded aspects, which ranks among economic and legal responsibility. The next level presents expected values, which reflects the ethical responsibility. The last level is a desired state, which reflects the philanthropic responsibility [27, p. 33].

This structure presents a pyramid of needs of the enterprise. According to the opinion of the author actions that aim to provide the company with a desired profit should be taken first. Following the responsibility of business economics, companies should care among others for keeping their competitiveness [8, p. 35]. In this respect it is possible to tying together the theory A.B. Carroll and the issue of building the competitiveness of the individual socially responsible. This conclusion confirms the fact of making economic aspects the priority activity of the company.

5   Process of formation strategy of CSR serves creating competitiveness of the company on the market

CSR strategy is a tool that defines long-term directions and the range of activities that a company uses for the realization of market plans and coping with expectations of chosen groups of people. All had resources of the unit are used for that purpose. The process of formation of CSR strategy should take place in stages [24].
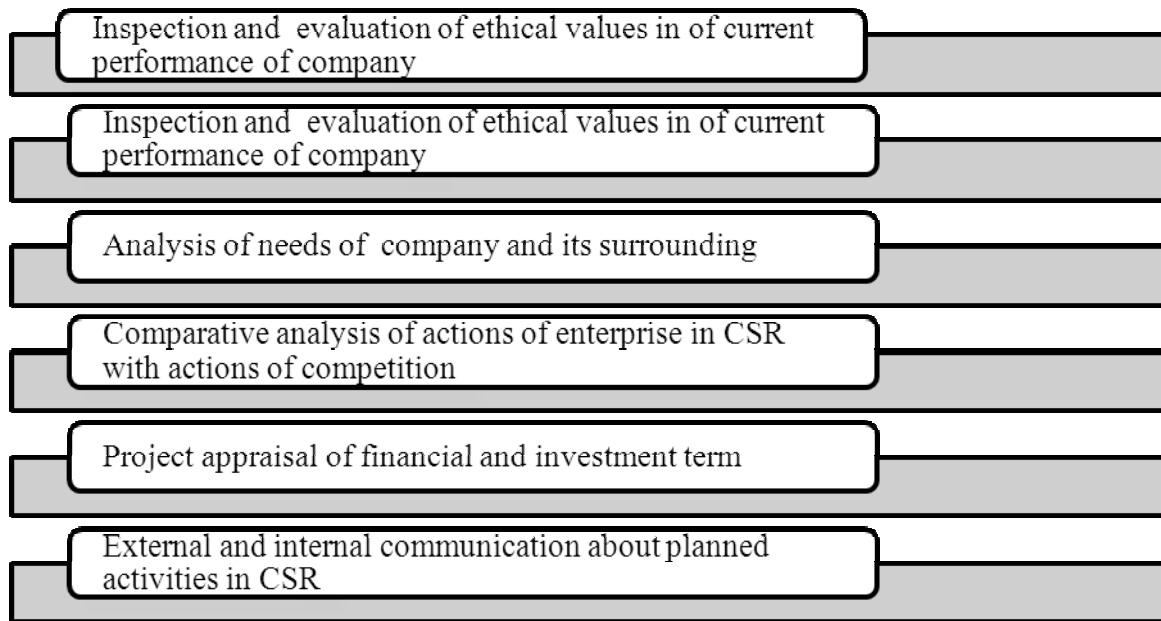
Figure 3. Stages of creating the CSR strategy
(*source: based on:* [4, pp. 28-29])

The senior staff should give problems prominence shown in Fig. 3.

The first step in creating a CSR strategy should be an inspection and assessment of the degree of exploiting social values so far applied in the enterprise. All present initiatives taken in this respect in all stages of the operations of the unit should be assessed. It is necessary to analyze how acting socially responsible is taken on the stage of manufacturing, distribution and relation with employees, scope of protection of the environment or relations with the local community.

This analysis helps to define areas of CSR, which have or can affect the company. Indicating crucial recipients and their expectations regarding the enterprise is also important. The last step seems to be analysis of strong and weak points of the individual in regard to implementation of CSR.

The next stage is the analysis of needs of the company and its surroundings. It is important to discover unconverted spaces in social operations of the enterprise and integrate them with requirements of surrounding towards the individual. Knowledge collected at this stage should constitute a basis for conducting comparative analysis with regard to the competition. It will help in expressing conclusions, which, if used properly, will cause that enterprise to become unrivalled in the market.

The created strategy must undergo the process of approval. Actions socially responsible must be accepted not only on account of their functionalities, usefulness and benefits, which they will generate for the company, but also in financial terms and investment. The reason is that the activity of CSR is connected to expenses.

Internal and external communication is the last stage. Internal communication is the process of creating new awareness inside the company, which is a perfect match for the adopted strategy. It is necessary to get to know new values by employees, accepting and incorporating them into their professional and private life. The external communication consists of informing surroundings of the adopted strategy.

This process takes place by using such tools as: the Internet, the radio or television. Information shows the operations of the unit and is given by spokesmen of enterprises' departments the public relations, or reports of the social responsibility. This information should be systematized and given according to adopted universally norms and guidelines [2, p. 60].

It should be emphasized that this way of constructing CSR only gives a chance for generating the benefit. In this context, the CSR strategy becomes an investment that gives expected profits.
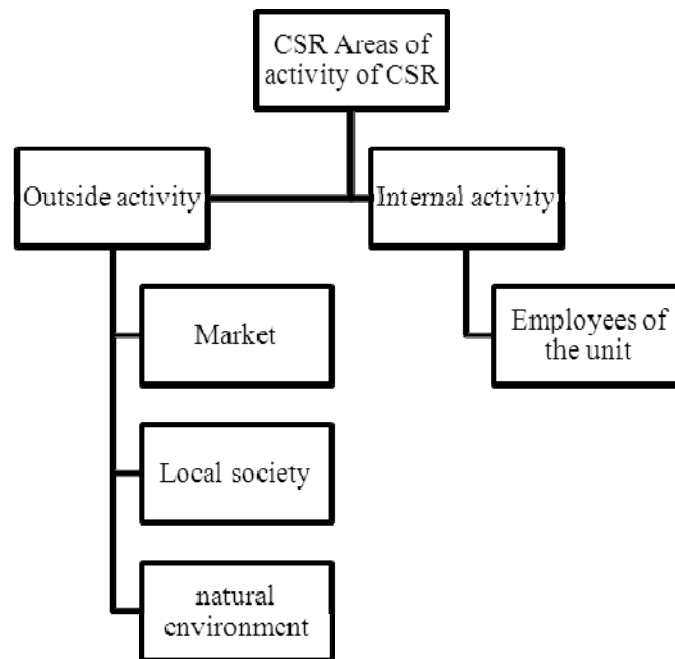
Figure 4. Areas of activity of the CSR
(*source: based on: [1, p. 5; 12, p. 57]*)

It should be recalled that the most essential stage of the structure of CSR strategy for creating competitiveness of the individual is the correct analysis of needs of the company and its surrounding. This stage leads to an understanding of the needs of recipients of products or services and their requirements. Company becomes a more attractive individual with regard to competition existing in the market by satisfying their needs and expectations. What is more, it helps to make correct choice and prevents from implementing mistakes at the very beginning of building the strategy.

6   Areas of the CSR activity taken in order to build the competitive edge of enterprises

The activity of the enterprise on field of CSR should contain a lot of areas of activity of the company. These spheres are presented in Fig. 4.

Among the basic forms of CSR, internal and outside activity is distinguished. First among them is the employee aspect, an internal group of people associated with the company. To rank among this sphere, we should take care of the prosperity of employees, working conditions, planning assignments and following ethics, as well as take care of professional development of employees, satisfaction from the work, and fair treatment.

The prosperity of employees is above all care of the medical needs of employees, helping in paying the debt off, payment of sick leaves. The next aspect relates to conditions and standards of the work and possible benefits, which are guaranteed by the employer. This element is very essential as it affects productivity and its results. The last two aspects concern increasing the satisfaction of employees and ethics of the work.

According to Łukasiewicz-Kamińska, an ethical code is a crucial element of ethical programs [13, p. 25]. They are substantiated principles of the value and action for compliance to which, in writing, employees and the senior staff commit themselves. This document has the function of indicating internal values and principles of operation of the company. What is more, applying the code of ethics contributes to the reduction in the number of cases of lies, corruption and embezzlement, and other bad practices. It curbs the possibility of conflicts of interest, increases credibility of the staff, as well as the loyalty of employees.

The following types of ethical codes applied in enterprises are distinguished: code of aspiration, education and control. The first kind of documents shows ideals to which an individual should aspire for.

Education codes are provided with comments; however, control codes are a set of rules along with sanctions behind the non-observance of the rules [9, p. 149].

P. Fobel and D. Fobelowa claim that the ethical code should refer to the following aspects [5, pp. 61-62].

- dignity, equality, freedom
- observance of the law
- protection of health and safety on-the-job
- conflict of interest
- methods of hiring and dismissing
- marketing practices
- negotiating and entering into agreements
- corruption and recruiting and using information
- political activity
- environmental protection
- protection of the intellectual capital
- source of finances
- protection of the interests of the organization
- enforcing the code.

In CSR, companies concentrate on the construction of the human capital by education. Employees are one of the more important groups of people involved in the enterprise. That is why improving their ability is so important. It widens the knowledge and practical skills of the staff, which are difficult to copy, and they are crucial competences of the company.

Trainings and other forms of the teaching shape the human capital, which can also be used by other economic operators in the market in the future. Orlen should be mentioned as a good example of a company that takes numerous steps in favor of employees. Conducting trainings and conferences improves employees' performance and improves their knowledge, experience and competences.

In this aspect, the important actions are those that develop the entrepreneurship of employees. We rank among them the benefits given to employees who finish work for the company, including active techniques of job-hunt or setting up their own company [26].

BRE Bank organizes internal MBA college dedicated to its employees. Alcatel-Lucent carries programs aimed at encouraging the innovation and development of competences of employees [19, p. 24].

An internal business process in CSR performs a significant function for forming competitiveness of the individual by maintaining positive relations with

employees of the unit. They inform their acquaintances about the social performance of the company and convince potential customers of the company about its attraction. They also build reputations and create a positive image of the individual.

The outside form is the next CSR form. Following factors were ranked among this group: a natural environment and activity devoted to the local community. Actions in favor of the environmental protection should be assumed by enterprises at every stage. Starting with supplies department where rank belongs among others: purchase of raw materials and of semi-finished products produced with the respect of the natural environment whether elimination of elements or the substances dangerous to the health.

In the production phase and packing the product, it is necessary to pay attention to reducing the consumption of electricity and water, reducing noise level and emissions of harmful substances, correct management of waste and health and safety at work.

In this respect, the policy of quality of the company is really important. The area of storing and transport creates the possibility of improving activity for the natural environment. We rank among them: choice of means of transport with a limited emission of greenhouse gases, optimization of the storage space, elimination of losses and the creation of waste during storing [15, p. 153].

It must be underlined that the implementation of environment-friendly action to the strategy of the individual leads to creating competitiveness of the individual by profiting from the following operations [9, p. 152]:

- cost-cutting,
- thaw in relations between company and people involved,
- raising of work output,
- saving of time,
- facilitation in receiving permissions.

The reduction in costs by limiting power or water consumption leads to increasing profits. Profit is a tool that lets taking the activity and action that distinguishes the company from its competitors. Thanks to it, the basic task of the enterprise is fulfilled and what is more, it is possible to take numerous investments, which leads to increasing the goodwill, innovation and attraction for current and potential clients and competitors in the market. Information of ecological activities of the company has a positive effect

on contacts between a unit and its clients and employees.

Information about the operations of the unit in the environmental protection, which is passed to outside agencies who publish this information through CSR reports or media, also singles the company out from the competition and causes it to become more attractive according to recipients. Closely named conditions increase the productivity and save time. An advantage of environment-friendly action, which increases the competitiveness of the individual, is increasing the confidence and credibility of the company rapidly with public institutions and customers. As a result, there is facilitation in receiving permissions. This fact eliminates restrictions barriers that make further business progress impossible.

The market is the next outside CSR aspect. Responsible proceedings socially in this area are equal to not selling certain products in certain markets, following of standards of fair advertisement and solid cooperation with suppliers and recipients of products or services. Responsibility towards them includes following honest commercial principles and compiling a list of suppliers, which should not be taken into account in business action. The timely regulation of obligations and improvement of the quality and safety of offered products are extremely important. This action also builds the competitiveness of the individual by creating a positive image, which is noticed by present and potential users.

The last factor is the activity for the local community. This aspect is associated most strongly with CSR. It is related to sponsoring local undertakings (infrastructure) or supporting community actions [12, p. 57] or material or financial support of local institutions of the public utility. Activities that serve the integration of the local community are really important too [1, p. 11].

These operations are possible, thanks to applying such instruments as CSR, socially employed marketing (CRM) or community actions.

7 Summary

To sum up, it should be underlined that permanently building the image and positive relations with surroundings is essential for a company. Based on these actions, a company is able to compete in the market.

Competing should be understood as the process of rivalry between units that aspire for the same benefits, at the same time and the same rules, and completion of business one threatens the completion others [18, p. 33].

The tool that enables achieving such a result is implying to the strategy of individuals the CSR. This way perceived CSR should be prepared and actually implemented.

Additionally, it is possible to back the thesis up by results of research conducted on 128 companies of a branch of industry. It proves that CSR brings one more advantage. Programs based on it can increase the innovation of the organization. The CSR concept seen with this prospect stops being a marginal issue and becomes an important factor of competitiveness and increases the potential of the company [14].

One should underline that only CSR that is appropriately prepared and checked in every respect could bring expected benefits. We should plan all actions according to the principle "inch-by-inch" which bring long-term effects [16, p. 87].

The strategies of social action and their long-term nature are an essential condition to meet these demands. It is also important to imply social actions with greater precision and accuracy. Also, completeness of action is a relevant aspect as far as CSR is concerned. The CSR should be reflected on every level of operations of the company. Moreover, important feature of social actions that should bring an increase in the competitiveness of the company is perseverance in pursuing a goal. Making a promise by the individual that would not find cover can lead to adverse effects in the form of loss of credibility of the company.

However, actions in CSR are implemented occasionally as one-off event and their scope are regarded only as sponsorship of sports and cultural events or the completion of public campaigns. It should be underlined that the scope should be treated as an element of CSR strategy but not as the main goal.

The next important notion is aspect, which shows the impact of actions in CSR on competitive position of the company. It indicates that creating competitive edge by CSR is not the direct result of conducting social operations. M. Bienkiewicz claims that benefits come directly from the improving image of the individual, greater loyalty of customers or better relations between employer and employee [1, p. 21].

In this study, the rise in the competitive position of the enterprise in the market is the consequence of mentioned advantages. In this respect, the notion that CSR is a tool is justified and it should be emphasized that CSR creates the competitive edge in the market not directly but after analyzing and taking into account relations in the CSR strategy.

In conclusion, CSR is a tool for effective business strategy. The importance of CSR is emphasized for building the competitive edge of individuals. A. Pienias indicates that simply formulated CSR strategy can be one of the ways that helps an enterprise to build effectively its position in the market [16, p. 86].

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