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INNOVATIONS IN THE CONTEXT OF THE RISK MANAGEMENT

Anna Karmańska, Warsaw School of Economics, Poland
Email: akarman@sgh.waw.pl

Tomasz Michalski, Warsaw school of Economics, Poland
Email: tomich@sgh.waw.pl

Adam Śliwiński, Warsaw School of Economics, Poland
Email: asliwin@sgh.waw.pl

ABSTRACT

Modern companies seeking to increase in the value have to be innovative. This is because innovation is an attribute of a knowledge-based economy, the competitiveness of enterprises, the market value of the company's growth and the challenge for many industries, not just those who are exposed to rapid technological progress. Innovations are a necessity component in products, processes and business model of the organization, logistics, environment and marketing. Human capital is a key factor in that component which. The paper refers to risk management of the innovative company. The authors ask a question: What determines limits of innovation and what fields of management are key elements of success? Two fields are identified: cost management of innovation process and insurance connected to that process. Background for the deliberations undertaken is knowledge based management of innovative company.

INTRODUCTION

Business activity conducted in any place and at any time is risk related. What is characteristic of a "given place and time" is the specificity of the risk factors, the risk level as well as the availability of tools to manage this risk.

The era of knowledge based economy, which the world enters dynamically, reveals many new factors and necessities which a modern company needs to consider and cope with if it wishes to continue its activity. A significant area of factors which are significant here is the innovativeness of activity, in a broad meaning of the word. Innovativeness is a sign of the era of the knowledge based economy and what is characteristic of this era is the fact that its "soft" borders are marked only by business ethics. Holistically, one may ask about the borders of innovation introduced into business. Are they determined by:

- actual needs of end consumers and as a consequence needs (demand) of companies participating in the chain of value delivered to these customers or first of all
- actual "needs of earning" on investments in companies from the chain of value for customers?

This paper does not attempt to answer this question. It analyses the problem of management of innovation programmes and projects introduced by individual companies from the microeconomic perspective. Bearing this in mind, it is necessary to distinguish three areas to focus on in an innovative company:

A) knowledge management and diagnosis of innovation potential,
B) innovation cost management,
C) innovation management in the risk conditions.

Innovations, i.e. something new, with no standard set before or only to a certain extent based on well-known models and solutions in each of the aforementioned areas give rise to a specific **uncertainty** in business activity. Thus, the undertaking of the innovation activity should be preceded by an attempt to identify the risk factors, which may allow for its limitation once identified within this uncertainty. Knowing the risk factors one may undertake attempts to manage in risk conditions, which grossly simplified may be understood as the application of preventive instruments and solutions focused on identified risk factors and thanks to it preventing the potential implementation of risk with effects of the scale initially predicted or refunding the incurred losses as a result of the implementation of this risk.

I. Knowledge management and innovation potential diagnosis

Innovations always require a new ”knowledge” and high ”organisational efficiency.” Thus, they are stuck in the corporate ”intellectual capital” (human, organisational and relative). Innovations may occur only in those companies where this capital actually exists and is reflected in the competences of the managerial staff.

Presently, one of the innovation underlying skills is the so-called knowledge engineering or data mining. This skill consists in the ability to reveal the knowledge hidden 2 in different sources of scattered data, e.g. in databases and may have a great impact on the decision to undertake an innovation process and to determine the way of its implementation.

In the context of innovation, the acquisition of a broadly perceived new knowledge is only one of the aspects of the corporate knowledge management. Another aspect to be considered is the assessment efficiency skill: (1) its business usefulness, (2) risk related to its potential application, (3) advantages resulting from its application. The skill is a starting point for the launch of the innovation process. For this reason it is indispensable to **recognise the corporate innovation potential**, at least in these areas of competence. It is a prerequisite for the innovation process management when this process is accompanied by uncertainty and different risk factors, which is discussed later.

II. Innovation cost management

From the microeconomic perspective, disregarding the reason for innovation activities, it may be effortlessly stated that ”business success” measured for example with the growth in market value is achieved by the companies which accurately prepare their innovations. The very idea of innovation is not enough though it is a driving mechanism of the whole innovation project. The innovation, if it is to work, needs to be implemented, and this is connected with costs related to the innovation undertaking. At present, when it is generally claimed that a company is a source of costs not incomes, the **development of corporate competence within the innovation cost management is crucial**. The discussion below presents the authors’ self-designed approach to the problem of innovation cost management in an individual company.

In the area of innovation undertaking cost management the risk factors are found on two cost planes: *ex ante* (planned costs) and *ex post* (incurred costs). In order to identify these factors it is necessary to:

(1) define the cost object appropriate for the adopted notion of innovation,
(2) define the cost model which will determine the information structure of innovation undertaking costs,
(3) set the system of records of the incurred innovation costs and the system of controlling,
(4) set the method of monitoring of innovation undertaking cost effectiveness in the course of the whole period of the "innovation effect."

Re. 1)
The definition of the **cost object** is derived from: (1) the corporate perception of innovation, (2) the ability to classify innovations according to their kinds as well as (3) the identification of the innovation process stages and (4) activities conducted during these stages.
From the microeconomic perspective, **innovation is a solution suitable for business application and constituting a novelty, at least from the perspective of the company launching this solution.**[1]

The definition of the cost object does not need to consider classifications based on their importance. It is not significant whether it is a breakthrough, original or imitative innovation. What is important is the criterion of the field of innovation which may be the company's 3 product offer, a process conducted in the company or the organisation of selected activity and the process of reaching the introduction of changes within these innovation fields.

Bearing this in mind, the starting point in considerations of the innovation process cost may be the material presented below (Table 1), which is at the same time a demonstration of the features of (components) of the cost object under discussion.

[1]Innovation notional review according to among others: J.Schumpeter (early 20th century), Programme for better economic competitiveness of the EU member countries (called the Lisbon Strategy) (2000), S.Stern, M.Poter, J.L. Furman, Oslo methodology and the Polish Central Statistical Office, Guidelines of the Ministry for economy and Labour for the needs of the Polish Agency of Development of Competitiveness (PARP), see: M.Boniecki, R.Grabowski (2007), *Parametry charakteryzujące innowacje (Parameters characteristic of innovation)*, [in:] A.Karmańska (ed.) *Zarządzanie kosztami jakości, logistyki, innowacji, ochrony środowiska (Quality, logistics, innovation and evironmetal protection cost management)*, Difin 2007, pp. 120-129.

Table 1. Phases, stages and activities as drivers of costs in cost object implementation – innovation process

Cost drivers of a cost object – innovation process				
Kind of innovation: product – process – organisational	Phase	Stage	Cost characteristics	Activity
	FI. Research	EI.1. conceptualisation of research	the costs of activity implementation including the planning and organisation of the research process of innovation projects	D.I.1.1. D.I.1.2. (…) D.I.1.n.
		EI.2. research process implementation	the costs incurred in relation to research completing the existing state of knowledge important for innovation projects; costs of development of scientific idea to the practically useful form; the cost of creation of vision (of a project) of product, process of organisational innovation	D.I.2.1. D.I.2.2. (…) D.I.1.n.
	FII. Research work	EII.1. conceptualisation of re-engineering of innovation implementation conditions	the costs of setting the scope and method of reengineering of corporate conditions to the form suitable for the introduction of innovation solutions; the costs of technical and business documentation for the future phase of business application of innovation	D.II.1.1. D.II.1.2. (…) D.II.1.n.
		EII.2. implementation of re-engineering of innovation implementation conditions	the costs of work on the transition from the research phase to operational phase of the project; costs of launching the reengineering of conditions, e.g. the preparation of manufacturing space, retooling machines and equipment, reorganisation of work and staff training	D.II.2.1. D.II.2.2. (…) Dz.II.2.n.
	FIII. Operational activity with application of innovation	EIII.1. phase of business use of innovation	the costs incurred in relation to the newly manufactured product or commercial application of a new technological process or a new organisational solution	D.III.1.1. D.III.1.2. (…) D.III.1.n.
		EIII.2. innovation effectiveness monitoring during its business life rime	the costs of new solutions with regard to monitoring of innovation undertaking cost effectiveness during the whole period of "innovation effect" and controlling in the same scope.	D.III.2.1. D.III.2.2. (…) D.III.2.n.

Source: authors' own material.

Generic cost drivers in the process of innovation appear in the activities conducted at every stage of every phase of the innovation process. The drivers are identified as a stage or phase of innovation process are exclusively synergic aggregates of generic drivers. The presented concept of the structure of innovation undertaking cost drivers (implemented in the process of innovation) is a visualisation of the cost object, i.e. the innovation process and is a starting point for the cost management related to this process.

Re. 2)

Both on the plane *ex ante* and *ex post* it is important to determine the model of allocation and cost calculation, thanks to which it will be possible to subordinate the cost (*ex ante* and *ex post*) to the activities isolated in the innovation process. The conception to be seriously considered here is the time driven activity based costing (TD-ABC), which may be relatively easily introduced into the area of cost management. It is possible to: (1) identify detailed activities making use of the presented visualisation of the innovation process (see Table 1 for example D.II.2.n) and (2) effect cost allocations applying an understandable cost allocation key, which is a man-hour in the TD-ABC conception. Considering the issue of a cost model

appropriate for application with regard to the innovation process it also has to be decided whether the activities in the innovation process will be allocated with costs indirect for these activities, i.e. costs of other activities not occurring in the innovation process but the ones whose implementation determines the corporate potential to undertake the innovation process. In this place, taking into account the degree of complexity of cost calculations, the cost of conducting them as well as a doubtful information management value of the result of cost calculation, it is suggested that full-costing conception should be rejected and the **conception of activity costs directly connected with the innovation process**, i.e. direct-activity-costing should be applied instead.

Re. 3)

Innovation cost management requires, like cost management in other areas, the information not only about the innovation costs planned but also those incurred. Furthermore, this kind of management should be a permanent process with regard to all the detailed activities isolated within the innovation process. This means that, with regard to every individual activity, it is indispensable to:
1. classify, register and calculate the costs of activity,
2. report the costs incurred,
3. determine cost creating factors with no value added to the activity,
4. introduce reengineering focused on the elimination from the activity of the factors with no value added to it,
5. control the cost effectiveness management of the activity

The classification, registration and calculation of costs requires an appropriate structure of codes in the company allowing for the easy identification of the incurred costs and associating them with the place they come from, which in the case of innovation processes are the activities isolated in it. These codes are also useful in cost aggregate creation including cost values of, for example, a selected group of activities. The inclusion in the account books of the changes resulting from the application of TD-ABC as well as related detailed solutions will require special instructions and staff training but the advantage from the possession of cost information dedicated to the innovation process cannot be disputed. These costs abundant in extensive detailed classification obtained due to the accurate definition of the cost object and its internal activity classification, create a well-developed information base for cost controlling, which may use different models of causal analysis of deviations as well as the analysis of operation quality and as a consequence the whole process.

Re. 4)

Detailed attention should be paid to the information structure of the report on the innovation process costs. This report in indispensable for the cost controlling of this process.
Two managerially useful conceptions of the report structure may be offered. The first one is presented in Table 2.

Cost pool codes			Activity	Costs ex ante t=1 (1)	Costs ex post t=1 (2)	Deviations t = 1 (2)-(1) (3)	Costs ex post t = -1 (4)	Change in % (2)-(4)/(4) (5)
FI	E1	D.I.1.1.	Analysis of needs …	x	x	x	x	%
		D.I.1.2.	Diagnosis of possibilities …	x	x	x	x	%
		(…)	Research visualisation …	x	x	x	x	%
		D.I.1.n.						
			Total	x	x	x	x	%
	E2	D.I.2.1.	Studying problem …	x	x	x	x	%
		D.I.2.2.	Simulating and modelling …	x	x	x	x	%
		(…)	Experimenting….	x	x	x	x	%
		Dz. I.1.n.						
			Total	x	x	x	x	%
			Total	x	x	x	x	%
FII	E1	D.II.1.1.	Reingeneering design…	x	x	x	x	%
		D.II.1.2.	Forecasting and scheduling…	x	x	x	x	%
		(…)	Documenting …	x	x	x	x	%
		D.II.1.n.						
			Total	x	x	x	x	%
	E2	D.II.2.1.	Restructuring…	x	x	x	x	%
		D.II.2.2.	Equipment…	x	x	x	x	%
		(…)	Training …	x	x	x	x	%
		Dz.II.2.n.						
To tal			Total	x	x	x	x	%
			Total	x	x	x	x	%
FIII	E1	D.III.1.1.	Manufacturing …	x	x	x	x	%
		D.III.1.2.	Application…	x	x	x	x	%
		(…)	Making use…	x	x	x	x	%
		D.III.1.n.						
			Total	x	x	x	x	%
	E2	D.III.2.1.	Reporting…	x	x	x	x	%
		D.III.2.2.	Analysing…	x	x	x	x	%
		(…)	Intervening….	x	x	x	x	%
		D.III.2.n.						
			Total	x	x	x	x	%
			Total	x	x	x	x	%

t = 1 – current period
t = -1 – analogous former period

Source: authors' own material.

new knowledge will be acquired. If it feasible, there is a question when and what it will include and whether it will be useful for the company. In every phase there is "uncertainty" specific to a given phase. In the innovation process management in the risk conditions, in all the phases there is a group of the same risk factors which appear in every phase. It is determined by the financial possibilities of activity implementation connected with the innovation undertaking in a given phase, the activity technical feasibility and the creative competence (creativity) of the staff conducting a given activity.

Re. 5)

Setting the method of monitoring the innovation undertaking cost effectiveness during the whole period of the "innovation effect" is the core of assessment of advantages resulting from the innovation process. It seems that an auxiliary indicator may be the formula based on the scrutiny on the dynamics of EVA (Economic Value Added) value set for the third phase of the innovation process at a given moment of analysis in connection with the sum of costs

value calculated *ex post* for the completed phases (1 and 2) of the innovation process and the accruing cost value of the third phase. The scrutiny should follow during the whole period of economic life of the third phase of the innovation process.
The conception of this authors' self-designed formula may be presented in the following way:

$$EI = EVA_{3rd\ phase} / \sum_{i=I}^{II} Cost_{phase\ i} + \sum_{t=1}^{n} Cost_{phase\ t}$$

where:
EI – innovation process effectiveness ratio
i – the 1st and 2nd phases completed, isolated in the cost object – innovation process
t – period of implementation of the 3rd phase, isolated in the cost object – innovation process

INNOVATION MANAGEMENT IN THE RISK CONDITIONS

The implementation of the assumptions and goals formulated earlier and connected with the use of human resources and material means poses, for the entity undertaking this sort of tasks, numerous problems related to decision making and activities which make up the process of management. It is worth noting that the decisions and activities in the management process are related to risk, which is an inherent quality of any activity. Hence, there is a term in the English language: Risk Management, which can be interpreted as management in the risk conditions. Implementing five basic functions of the management process (planning, organisation, chain of command, coordination and control), a business entity is exposed to the implementation of risk, both pure and speculative. The risk management procedure consists in working out and using instruments which would raise the effectiveness of the management process with regard to the formulated assumptions and goals. In the majority of considerations we are confined to the pejorative understanding of risk, i.e. we identify the implementation of risk with a loss, which does not fully correspond to the situation of entities interested in business activity. The innovation activity risk whose implementation may bring considerable profits may be a typical example. The innovation process requires support. The companies which implement innovations need support due to a special kind of activity connected with entering new unexplored areas and uncertainty related to it. The innovation process should be properly managed from the stage of planning to implementation to launching. We can see an

important role of risk management and insurance as a method of minimisation of the effects of implementation of a given risk. Through the minimisation of effects of undertaken activities (risk related to it), companies may be more willing to undertake innovation activities. There is an important question to be asked whether the implementation of risk causes an impulse to innovation activity or on the contrary the innovation activity causes a higher exposure to the implementation of a given risk. In this part of the article we will present the research results concerning the development of the insurance sector in Poland. These results constitute the basis for an attempt to answer the question: Does the insurance sector through an appropriate offer and other behaviours which may be perceived as elements of the risk management process support the development of corporate innovativeness or is it

rather passive focusing on risks already diagnosed (fire, flood, theft or accident). Due to quantitative limitations, the article presents only the most important research results and conclusions resulting from them.

3.1. Insurance sector – results of analysis

Methodology used

In this study two groups of measures are used: measuring the distance and measuring similarity. The measure μ describing the degree of similarity between dimension structures of the two objects is defined with the following equation:

$$\mu_{i,p} = \frac{z_i \circ z_p}{|z_i||z_p|}$$

Where: $z_i \circ z_p$ denotes the scalar multiple of vectors zi and zp containing all dimensions of the particular objects and the length of the vectors. This means that the value of the μ is between -1 and 1 as the scalar multiple is a cosine of the angle between the vectors.
The measure of similarity of objects' dimensions d*(i,p) is defined by the following equation:

$$d^*(i,p) = 1 - \frac{1}{2\sqrt{kn}} * d(i,p)$$

$$0 \le d^*(i,p) \le 1$$

Where: k denotes the number of objects and n, the number of dimensions, is a normalized version of the differentiation of objects' dimensions d(i,p).

$$d(i,p) = \sqrt{\left(\sum_{i=1}^{k} (z_{i,i} - z_{i,p})^2\right.}$$

Where: dip denotes the distance between the objects i and p and zijzpj the values of dimension j of object i and p respectively.
The research was conducted by means of the multidimensional statistical analysis. Because of the comparative procedures (comparison of the same entity in different periods) taxonomic 8

procedures were used. The comparison was made with regard to the development of the insurance sector consisting of four subsectors: *catastrophe insurance, life insurance, health insurance and financial insurance.* In each subsector there were three groups of diagnostic features. Before the beginning of research the database was created including the implementation of selected diagnostic features in the years 1991-2010 (the features are presented in Enclosure 1). Eventually, the number of features was decided after the analysis of correlations between them; whereas the length of observation series was determined by means of availability of implementations of features from all the groups.

The database includes the implementations of diagnostic features for the analysed period. Initially it was planned to conduct the analysis of the years 1991 – 2010. However, the gathered data allowed for the full comparisons for the period 2000 -2010 (due to the availability of the feature implementations from all the groups). The period of the last 10 years may be regarded as interesting from the perspective of economic changes. In this time there was a period of good economic situation as well as a slowdown (the 2007 crisis).

The construction of the database was based on the information from reliable statistical sources published by the following institutions: the National Bank of Poland, the Central Statistical Office, the Financial Supervision Authority, IMGW and the Ministry of Health.

The analysis of the obtained correlation coefficients justifies the use of all diagnostic features. We remained with the expert selection, although we discern correlations which as a consequence of the use of statistical methods of selection of diagnostic features would cause the elimination of some features.

Next, the assessment was made of the sector development directions in the selected years of the analysed period. For comparison, the benchmark was set. In our case the benchmark was set in the group of experts based on algorithms presented by well-known statisticians (Z. Hellwig), separately for individual kinds of diagnostic features. In the case of stimulants the benchmark was calculated as a diagnostic feature of maximum value in the analysed period increased by a standard deviation for the whole time series. In the case of destimulants the benchmark value is 0 or minimum value decreased by a standard deviation, depending on which of the two values is higher. For nominants the benchmark value was set as an average value increased by a standard deviation or median depending on the character of the feature and the number of available observations. In order to maintain the clarity of the presentation the radar charts weren used. The chart axes are the analysed subsectors (in the case of sector analysis) or feature group (in the case of subsector analysis). Thus, Subsector 1 stands for catastrophe risk; Subsector 2 for life insurance; Subsector 3 for health insurance and Subsector 4 for financial insurance. The results of calculation for the measure of differentiation of levels d^* and structure similarity μ^* are presented in the charts below respectively.

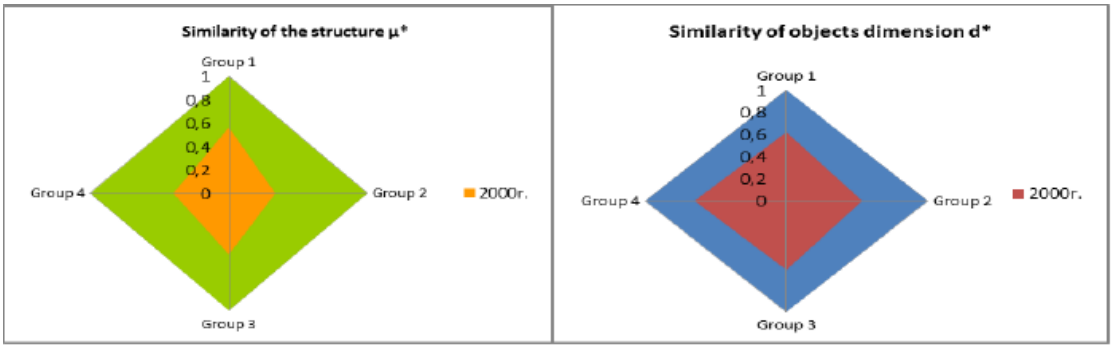

Figure. 1. Similarity of the structure and similarity of objects dimension in 2000 in comparison to reference object. (Reference object is market yellow and blue colour).
Source: author's own materials.

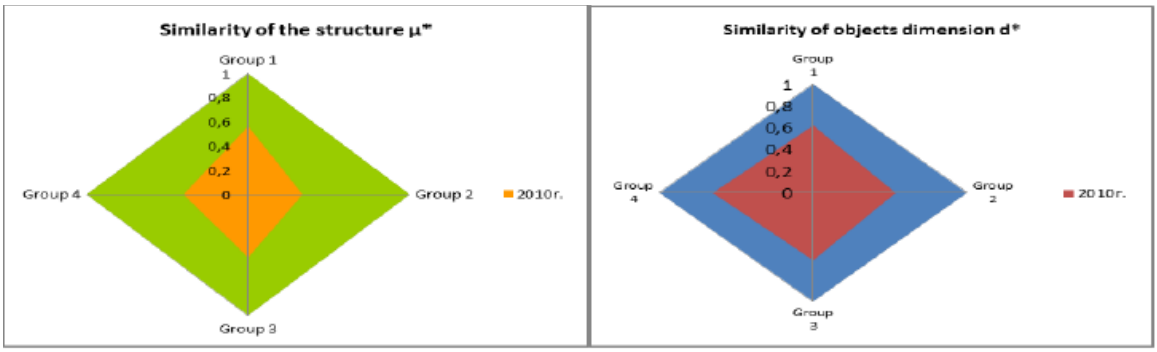

Figure. 2. Similarity of the structure and similarity of objects dimension in 2010 in comparison to reference object. (Reference object is market yellow and blue colour).
Source: authors'own material.

In the analysed period there were important changes in the insurance sector. The presented calculations on the basis of comparison of similarity measures in the years 2000-2010 in the insurance sector indicate a definite improvement in the life insurance subsector in 2005 and the stabilisation since then. As far as the health and financial subsectors are concerned, the period 2000-2010 is characterised by a constant improvement of the structure features (close to the benchmark). In the case of catastrophe insurance the applied measures reflect the occurrence of natural catastrophic phenomena.

The second stage of research makes a comparison of the development insurance subsectors. Like in the case of the comparison of the whole sector at the first stage the correlations between features were examined. Next, the calculation of the structure similarity measure and differentiation of feature levels was conducted. The results are graphically presented in radar graphs in Enclosure 2 to the present article.

Analysing the subsectors it should be underlined that within the subsector of catastrophe insurance, there is a dangerous phenomenon of negligence of preventive actions connected with the implementation of the risk of flood (diagnostic features in group 3 concerned this risk). Besides, it should be pointed to the sensitivity of the applied measures to the weather factors (group1). In the sector of life insurance there was a considerable increase in economic features (group 1). There was a change in the significance of financial and social features in the analysed period. In 2005 group 3, i.e. social feature, approached the benchmark the closest, financial features also became more important. However, already in 2010 the

significance of these groups decreased. In the sector of health insurance there is a perceptible rise in activity of households (group 2) and decline in the significance of the state policy (group 1). The signals of the activeness of the market in this sector are weak. Within the sector of financial insurance the biggest changes occurred in the third group (microeconomic features) and group 2 (operations of insurance companies and banks).

CONCLUSIONS

In many literature titles the problems of risk management are considerably simplified or oversimplified through the inaccurate interpretation of the phrase Risk Management. In numerous works the dominating perception of this notion is ”risk management” in the literal meaning. As a result complex problems derived from the disciplines of the management Science and the Risk Theory have been grossly limited, instead due to the needs of the financial market sectors, the problems of risk are being consistently developed. The management instruments so important for the effectiveness of the Risk Management procedure have been pushed into the background. This complicated procedure requires a 10

comprehensive approach combining the problems of risk with efficiency and effectiveness of the instruments applied in the course of implementation of the aforementioned functions of management. Only the joint consideration of the process of risk with distinguishing such categories as: *the subject of risk, risk implementation, probability of risk implementation* or *risk implementation effects*, which occur as the components of the risk process with the management instruments and tools allows for the full comprehension of the idea and goals of this procedure. The main goal of risk management is the improved effectiveness of the entity’s operation through an appropriate reaction to the risk connected the entity’s activity. The example to be quoted may be innovation activities, where the management of knowledge, cost and the whole process in the risk conditions should be coherent and mutually complementary. Innovative companies apart from the application of knowledge as well as an appropriate analysis and budgeting (allocation) of costs within algorithms of behaviour compliant with the risk procedure management should be supported by the insurance sector. However, the examination of the sector shows that in Poland in the analysed period the insurance market was not innovative and it did not create innovation supporting services (and it is where the insurance risk appears due to the financial aspects of innovation). Simultaneously, insurance did not encourage investment in research and development. An essential function of insurance as a specific financial market sector is to encourage economic growth through the redistribution of gathered capitals. Insurance as one of the basic financial tools of the Risk Management procedure should play an important role in the process of development of innovation and as a consequence the economic growth.

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Attachment 1

Diagnostic features

#	Mark	Feature	Kind of influence
1	X1	Average yearly rainfall level	Positive
2	X2	Maximum rainfall level	Positive
3	X3	Average wind speed - annul	Positive
4	X4	Medium temperature	Neutral
5	X5	Absolut minimum temperature	Neutral
6	X6	Absolute maximum temperature	Neutral
7	X7	Flood shafts long	Negative
8	X8	Flood area protected	Negative
9	X9	Capacity of flood shafts	Negative
10	Z1	Changes of GDP	Positive
11	Z2	Financial development	Positive
12	Z3	WIG index	Positive
13	Z4	Average monthly salary	Positive
14	Z5	Gross written premium	Neutral
15	Z6	Profitability of technical accounts	Positive
16	Z7	Return on equity	Positive
17	Z8	Claims ratio	Negative
18	Z9	Changes of structure of gross written premium	Positive
19	Z10	Education level	Positive
20	Z11	Dependency ratio	Positive
21	Y1	State of health care	Positive
22	Y2	Share of state spending in total healthcare spending	Negative
23	Y3	State policy ion terms of health care	Negative
24	Y4	Share of health care spending in budget of households	Positive
25	Y5	Change of number of private health care costumers	Positive
26	Y6	Monthly average salary	Positive
27	Y7	Households health spending	Positive
28	Y8	Change of health insurance gross written premium	Positive
29	Y9	Healthcare insurance offer	Positive
30	Y10	Price of healthcare insurance polices	Positive
31	F1	Changes of GDP	Positive
32	F2	Changes of GDP - trade	Positive
33	F3	Changes of GDP - industry	Positive
34	F4	Changes of GDP - construction	Positive
35	F5	Changes of domestic investment	Positive
36	F6	Changes of FDI	Positive
37	F7	PLN/Euro – exchange rate	Neutral
38	F8	PLN/USD – exchange rate	Neutral
39	F9	Export [mln PLN]	Positive
40	F10	Gross written premium in financial insurance	Positive
41	F11	Level of claims in financial insurance	Negative
42	F12	Number of polices of financial insurance	Positive
43	F13	Insurance premium	Neutral
44	F14	Capacity of insurance guarantees market	Negative
45	F15	Level of expired debts	Negative
46	F16	Number of bankrupt companies	Negative

* Feature marked by different colors were chosen for the analysis of different insurance sector. $X_1 - X_9$ – describescatastroficinsurance, $Z_1 - Z_{11}$ – Life insurance, $Y_1 - Y_{10}$ – Health insurance, $F_1 - F_{16}$ – Financial insurance

Attachment 2

Catastrophic insurance

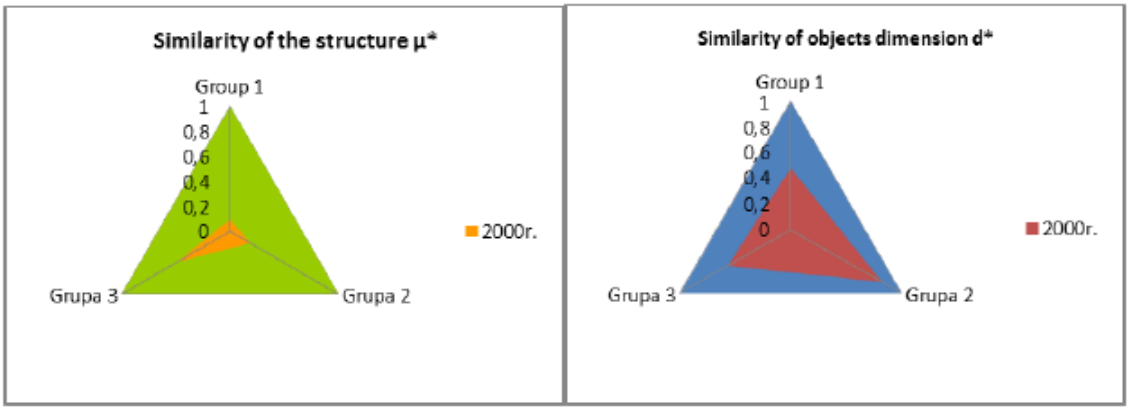

Figure.1. Similarity of the structure and similarity of objects dimension in 2000 in comparison to reference object. (Reference object is market yellow and blue colour).

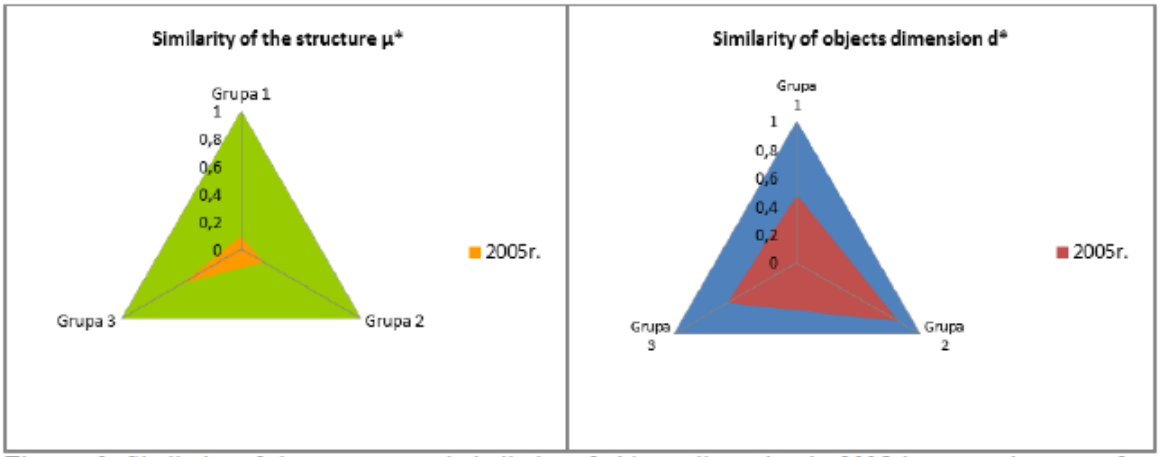

Figure. 2. Similarity of the structure and similarity of objects dimension in 2005 in comparison to reference object. (Reference object is market yellow and blue colour).

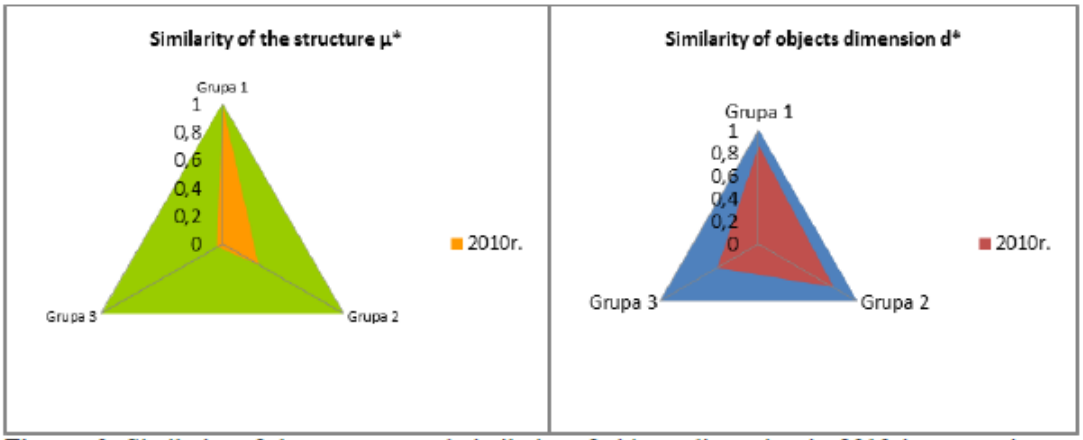

Figure. 3. Similarity of the structure and similarity of objects dimension in 2010 in comparison to reference object. (Reference object is market yellow and blue colour).

Life Insurance

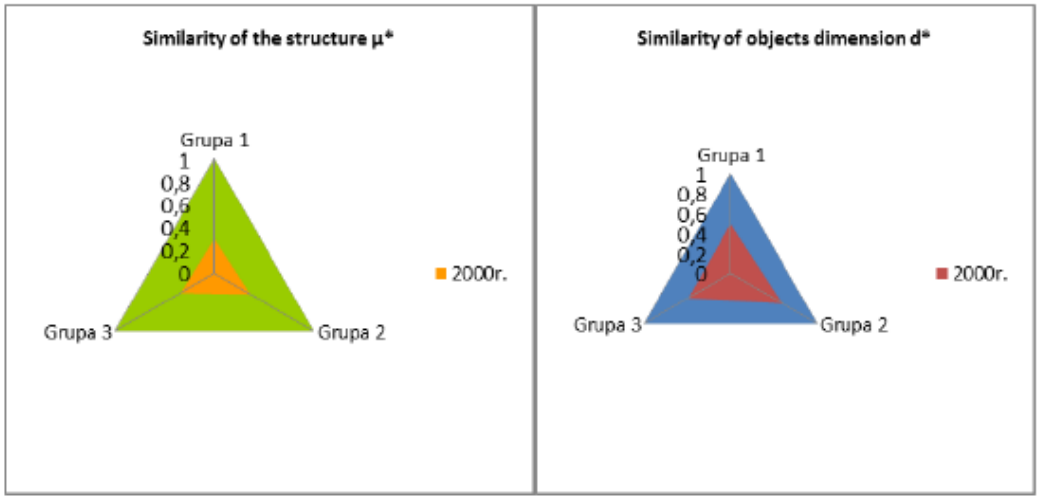

Figure. 1a. Similarity of the structure and similarity of objects dimension in 2000 in comparison to reference object. (Reference object is market yellow and blue colour).

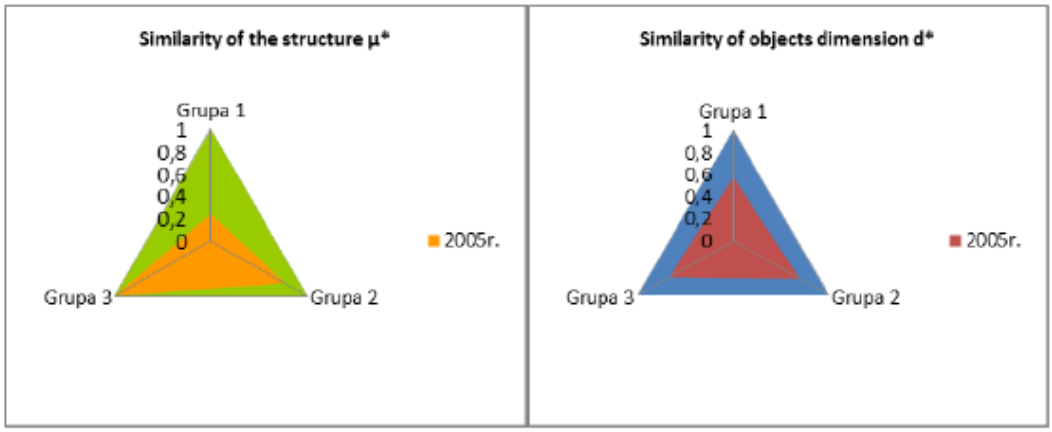

Figure. 2a. Similarity of the structure and similarity of objects dimension in 2005 in comparison to reference object. (Reference object is market yellow and blue colour).

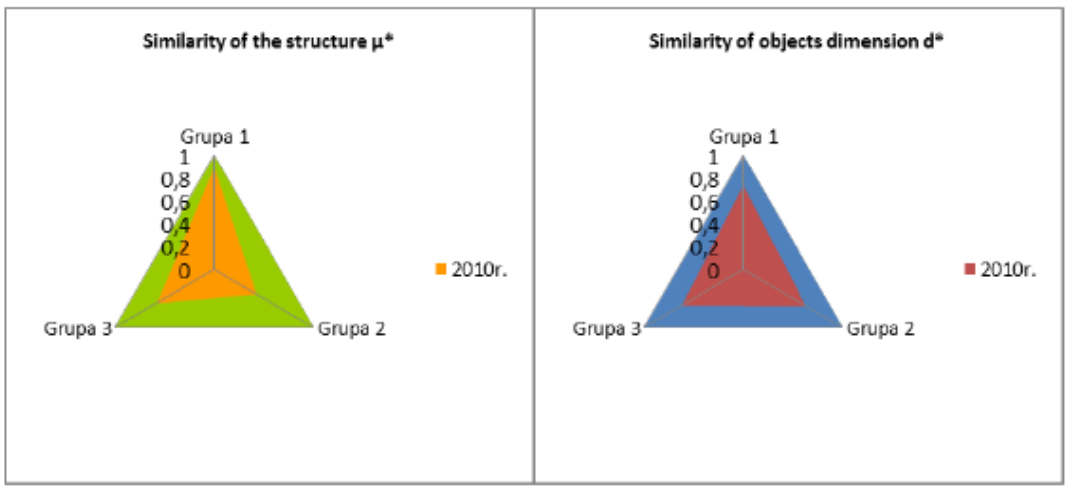

Figure. 3a. Similarity of the structure and similarity of objects dimension in 2010 in comparison to reference object. (Reference object is market yellow and blue colour).

Health Insurance

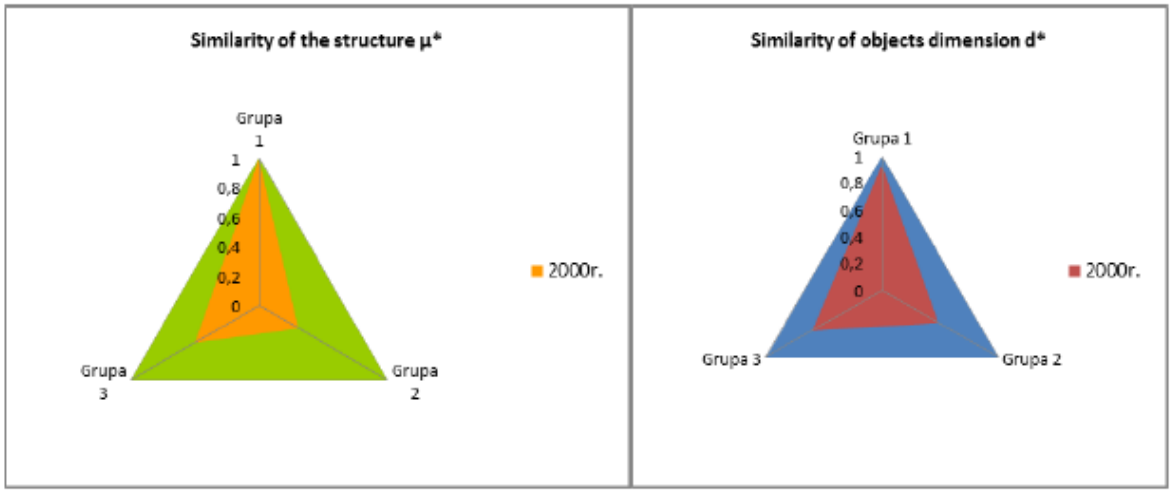

Figure. 1b. Similarity of the structure and similarity of objects dimension in 2000 in comparison to reference object. (Reference object is market yellow and blue colour).

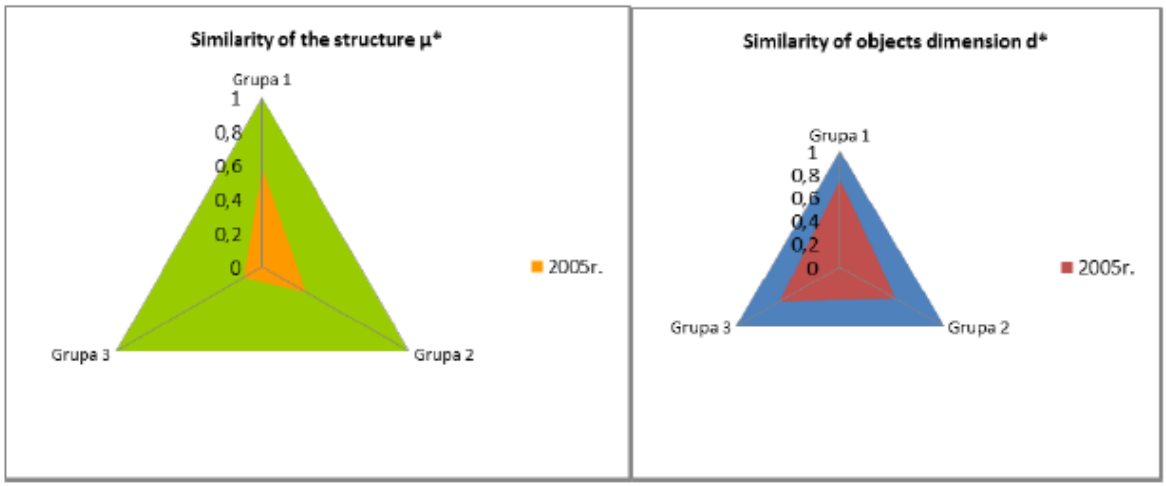

Figure. 2b. Similarity of the structure and similarity of objects dimension in 2005 in comparison to reference object. (Reference object is market yellow and blue colour).

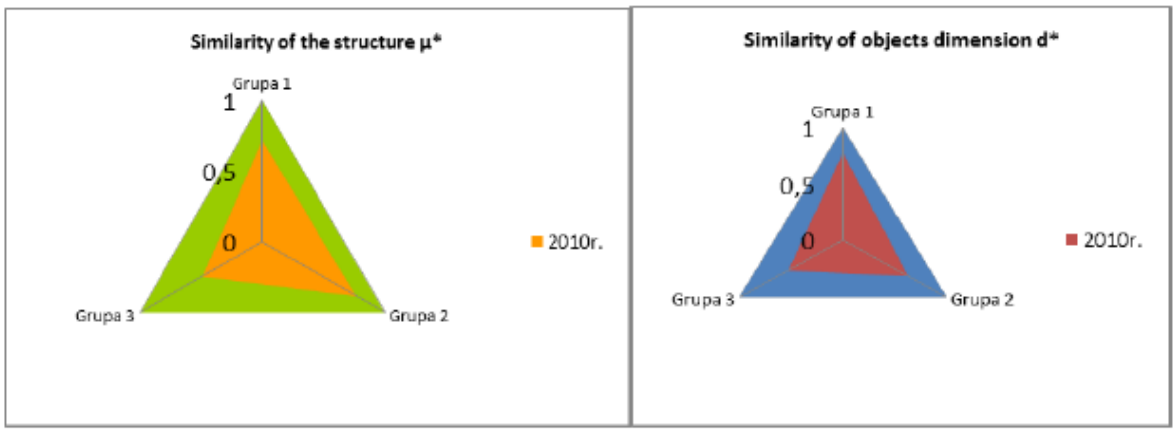

Figure. 3c. Similarity of the structure and similarity of objects dimension in 2010 in comparison to reference object. (Reference object is market yellow and blue colour).

Financial Insurance

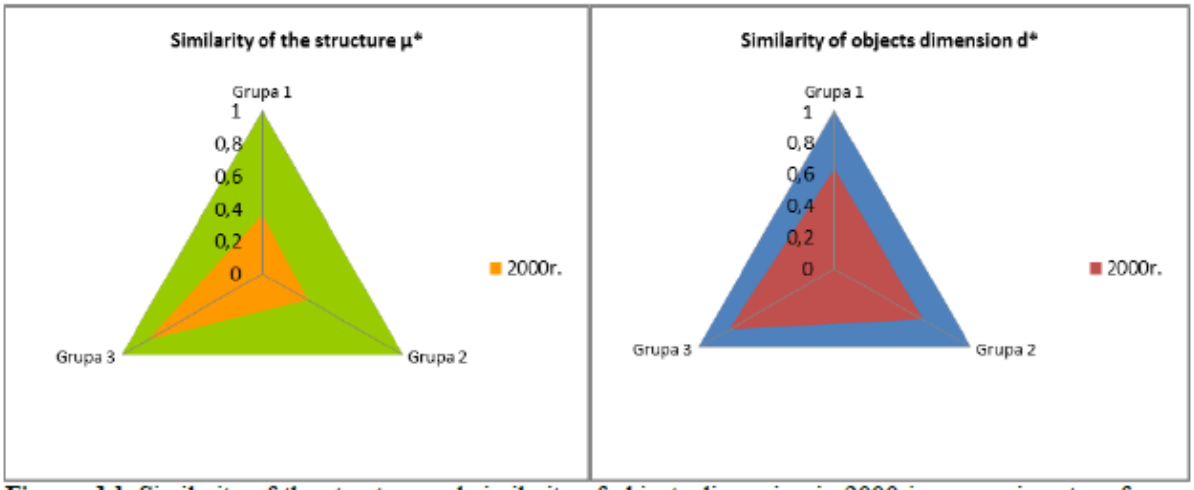

Figure. 1d. Similarity of the structure and similarity of objects dimension in 2000 in comparison to reference object. (Reference object is market yellow and blue colour).

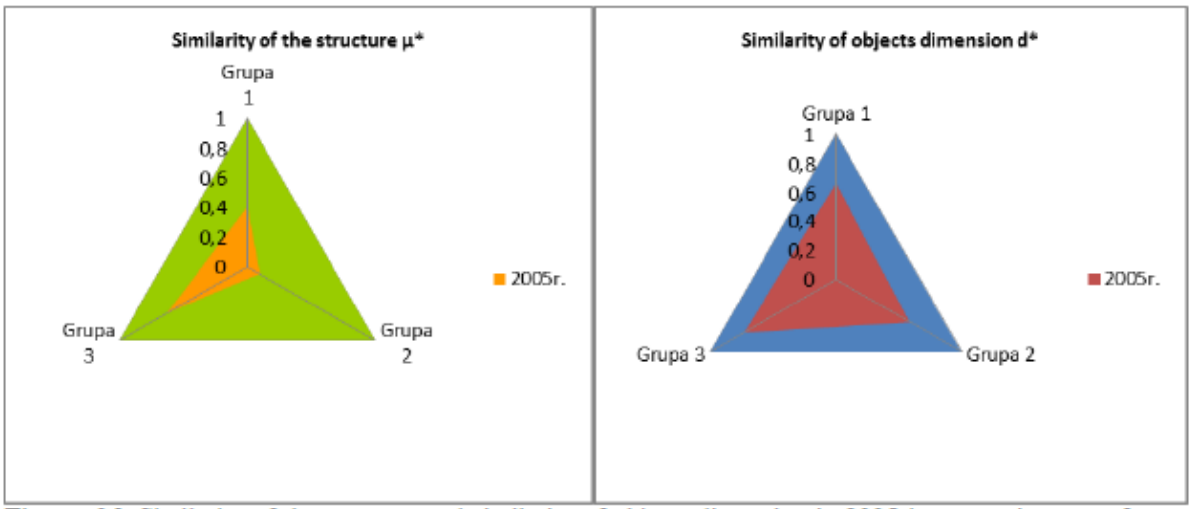

Figure. 2d. Similarity of the structure and similarity of objects dimension in 2005 in comparison to reference object. (Reference object is market yellow and blue colour).

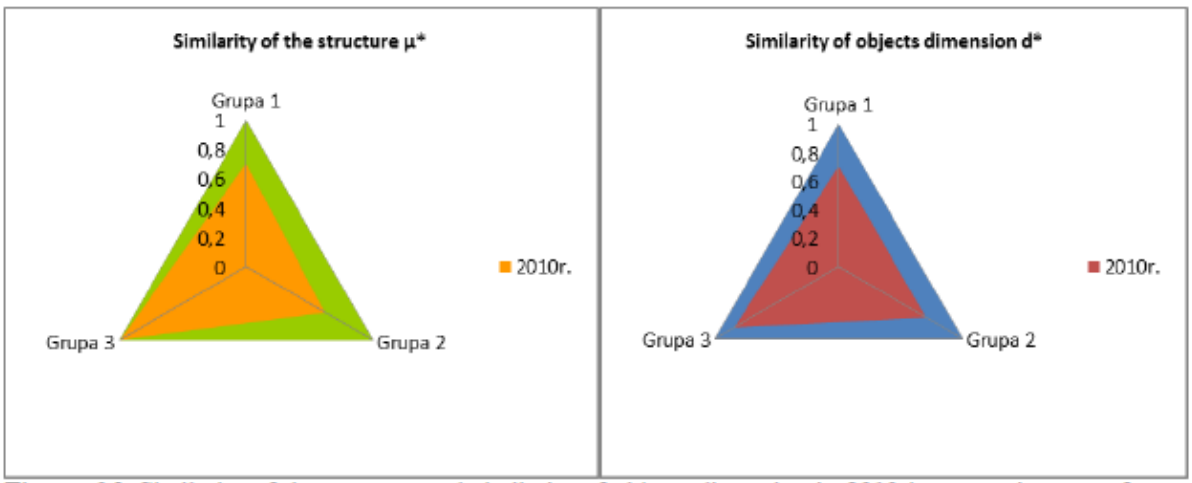

Figure. 3d. Similarity of the structure and similarity of objects dimension in 2010 in comparison to reference object. (Reference object is market yellow and blue colour).