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### *Dear Readers!*

Starting from 2011, Intercathedra – a Scientific Bulletin of the Economics Departments of European Universities, has been published as a quarterly.

International scientific collaboration presented in the first volume of *Intercathedra 2012* links a number of cities: Poznań (the Host City), Brno, Košice, Kraków, Presov, Tarnów, Trnava, Warszawa, Zagreb, Zvolen, Žilina and other Polish and foreign scientific centers. The *Intercathedra* brings together university cities, departments, but first and foremost - it unites people. We invite you to co-operate in the frame of the next volumes of *Intercathedra*.

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This edition marked as 28/4 includes, inter alia, papers that were presented at international scientific conferences: the Economic Forum 2012 in Laski and InterEconoMIX 2012 in Poznań.

*Intercathedra 2012* has been issued under the auspices of IATM, whose members provided materials for the volume, were responsible for its review, and prepared both mentioned scientific conferences. They deserve our deepest gratitude.

We cordially invite you to read this volume.

*Wojciech Lis*



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## STATE MEDICINE POLICY VERSUS PHARMACY MARKET IN POLAND: PROBLEMS, TENDENCIES AND BACKGROUND WITH AN EMPHASIS ON THE SITUATION AS OF 2012

**Abstract:** The bases of the state medicine policy, formed in preceding years, connected with the regulation of the pharmaceutical market, were introduced together with a new Medicine, Foods for Special Purposes and Medical Products Reimbursement Act as of 1st January 2012. The main purpose of the said act was a multi-structured regulation of the pharmaceutical market.

The purpose of introducing the new act was an improvement of the situation of the Polish pharmacy industry as well as the elimination of many anomalous phenomena taking place in recent years. Many groups of interest have already voiced their reservations in the period of drafting the new act. Many things were not amended. They are, however, important enough to be considered, as they may have significant results in the future, especially concerning the economic situation of pharmacies.

**Keywords:** the state medicine policy, pharmaceutical market.

### INTRODUCTION

In order to begin with, I would like to relate to the fundamental matter of the state medicine policy, as it is precisely the state which aims at ensuring sufficient access to medicines and equal access to healthcare is inscribed in the Polish Constitution.

In addition to that, the broadly understood state medicine policy also includes reimbursement and medicine prices. The reimbursement system's main objective is to ensure equal accessibility to reimbursable medicines. The medicine policy is, in a nutshell, the total of organizational and legal measures taken in order to carry out the major duty of the Health Minister, which is to safeguard the citizens' access to safe and efficient medicines in a manner deemed appropriate, with a simultaneous effort to decrease the patient's contribution to the treatment cost.

I have chosen this topic due to the social significance of pharmaceutical care for the society, as well as in relation to the considerable changes currently taking place in Poland.

The economic and social challenges connected with the functioning of the pharmacy market in Poland.

### SCIENTIFIC HYPOTHESIS

The bases of the state medicine policy, formed in preceding years, connected with the regulation of the pharmaceutical market, were introduced together with a new Medicine, Foods for Special Purposes and Medical Products Reimbursement Act as of 1<sup>st</sup> January 2012. The main purpose of the said act was a multi-structured regulation of the pharmaceutical market. The most important regulations, concerning the pharmacy market, are as follows:

- cutting back on the expenses on reimbursable medicines and setting them at the level of 17 per cent of the National Health System's yearly budget;
- setting permanent prices on reimbursed medicines;
- introducing a unified system of calculating retail margins;
- lowering wholesale margins on reimbursed medicines;
- introducing limit groups on specific molecules;
- introducing a ban on promoting medicines reimbursable by the state;
- introducing a ban on advertising pharmacies.

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In order to understand what made the Health Ministry undertake such a radical action, it is worth looking into the situation of the pharmaceutical market in the recent years.

Table 1. The number of pharmacies in Poland in the years of 2006-2011

2006	2007	2008	2009	2010	2011
12 490	13 020	13 300	13 380	13 690	Over 13 700

Source: IMS Health

Table 2. Polish pharmaceutical market in the years 2006-2011

	2006	2007	2008	2009	2010	2011
Total turnover in bn PLN	20,3	21,5	24,0	26,0	26,7	28,1
Statistical pharmacy in mln PLN	1,6	1,6	1,8	1,9	2,0	2,1

Source: Podsumowanie roku 2011, Ogólnopolski System Ochrony Zdrowia, No. 1/2012

Having possessed some knowledge on the pharmacy market, it is easily observable that the recent years have been characterized by dynamism and fast growth. The Health Ministry, implementing the new act, considerably shattered its structure and dynamics, influencing virtually all aspects connected with the functioning of the pharmaceutical industry. It is well worth knowing that the number of factors directly impacting the content of the Act was considerable. A large share of the factors resulted from reports by regional Pharmacy Chambers, others were due to the direct expenses of the National Health System. Ideas on the state medicine policy also played their part. Consequently, an attempt at an analysis of the key factors contributing to the content of the Act is well-founded.

### 1. The expenses on medicine reimbursement in the National Health System.

Reimbursement on medicines has been increasing rapidly. Currently it exceeds 8 billion PLN yearly. The plans of the National Health System for 2011 estimated the expenses on medicine reimbursement to amount to 8,55 billion PLN. As compared with 2010, the level is higher by 854,8 million PLN. According to the experts, it is a result of promotional activities and price incentives.

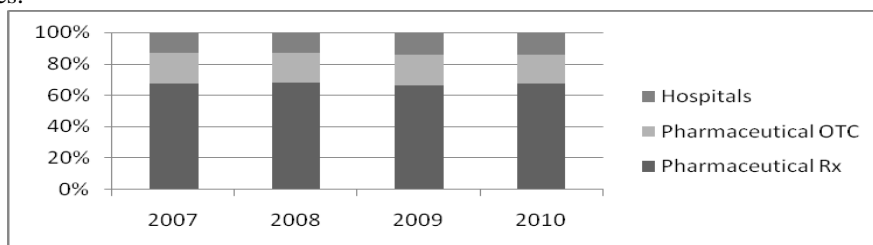


Fig. 1. The medicine market structure in Poland

Source: *Moda na Farmację*, No. 13/2011 [in:] IMS Health

### 2. Setting fixed prices on reimbursed medicines

Introducing an act on unifying the prices of state-reimbursable medicines was aimed at eliminating medicine tourism which had created a situation in which the patients either bought medicines for close to nothing in some pharmacies, or were awarded for supplying a prescription. It undermined the trust in the Ministry as the regulator of price. The pharmacies ought to compete with one another in terms of quality of service, not in terms of the price of reimbursed medicines.

### 3. Introducing a fixed system of calculating retail margins as well as lowering the wholesale margin on reimbursed medicines

The said measures, consisting of unifying and stating at a fixed amount the prices and margins in warehouses and pharmacies, are expected to eliminate phenomena such as artificially increasing



the reimbursement on medicines through the possibility of buying medicines for close to nothing in some pharmacies.

#### **4. Limit groups**

This is a new phenomenon, consisting of dividing the 421 molecules existing to date into 293 limit groups. This fact results in medicines within one group having an equal level of limit. The purpose of such a measure is to decrease the patient's participation in covering medicine costs.

#### **5. Introducing a ban on promoting state-reimbursable medicines and a ban on advertising pharmacies**

Intensified advertising might have contributed to the increase in the number of disposed medicines. As the results stated for the period of 2007-2009 show, 170.000 kg of expired medicines were gathered in Poland. The cost of disposing 1kg of medicines, which is stated to be 8 PLN, provides an image of a considerable strain put on the Polish state, i.e. on the taxpayers.

### **A DETAILED DESCRIPTION OF RESEARCH ISSUE OR RESEARCH RESULTS**

The purpose of introducing the new act was an improvement of the situation of the Polish pharmacy industry as well as the elimination of many anomalous phenomena taking place in recent years. Has it been successful in the end? It is worth considering whether the changes were not too radical or wrongly assessed, and whether they will actually contribute to improving the situation on the market. Many groups of interest have already voiced their reservations in the period of drafting the new act. Many things were not amended. They are, however, important enough to be considered, as they may have significant results in the future, especially concerning the economic situation of pharmacies.

#### ***Ad 1. The expenses on reimbursable medicines set at the level of 17 per cent of the National Health System's yearly budget***

It is a fact that the negotiations carried out in 2011, involving medicine producers and the Health Ministry, resulted in the publication of a new reimbursement list with the prices of medicines falling by 8.5 per cent on average. For 1974 types of medicines prices were lowered by 12.9 per cent on average, and in case of 656 medicines the prices increased by 4.4 per cent. On the other hand, Poland is among the countries which boast the lowest expenses on public and private medicines, as calculated per capita. Consequently, what sense does it make to set a fixed level of 17 per cent?

The data as of 2007 demonstrates that the Polish expenses on medicines constitute 25 per cent of all healthcare expenses, with the OECD average being 17 per cent. In terms of quotas, it is 250 USD per capita on average, with the OECD average at 460 USD.

#### ***Ad.2. Setting fixed amounts on reimbursed medicines***

The idea seems well-founded, especially considering the ever increasing expenses of the National Health System and the fact that lower prices on reimbursable medicines had been offered primarily in big cities, where the concentration of pharmacies is at its highest and thus the competition much more fierce; also taking account of the fact that a customer of a pharmacy there is considerably wealthier. Another disputable issue is the manner of stipulating the prices by the Health Ministry in the form of a directive. Announcing the prices by means of a regulation by the Minister of Health seems to be a much better idea.

#### ***Ad.3. Introducing a fixed rate of calculating retail margins and lowering the wholesale margin on reimbursable medicines***

A margin chart offered by the Ministry of Health serves the purpose of calculating the margin on reimbursable medicines. The official retail margin is calculated by means of the basis of the limit for each limit group. Consequently, it is not a margin stemming from the price act, explicitly stipulating that the retail margin should be the difference between the wholesale price paid by the buyer (the pharmacy) and the retail price paid by the customer or patient.



Preliminary analyses as of 2010 estimated that with such stated margins the retailers may lose even up to 500-600 million PLN. It is well worth noticing that wholesale margins remain percentage margins, irrespective of what the base price of the medicine is. The act prohibits giving any discounts on reimbursable medicines and introduces new rates of the wholesale margin. As it is, the margin for 2012 is set at the level of 7, 6 and 5 per cent for 2013 and 2014 and the subsequent years respectively. Where may this lead to? It is estimated that for the pharmacy to be able to function properly, i.e. carry out the tasks stipulated by the pharmacy law, the margin should be around 20-25 per cent. The yearly increase in fixed expenses takes up around 20 per cent of the margin. A large number of pharmacies now functions on 12-14 per cent of the margin generated from sales. What is more, pharmacies receive discounts from warehouses. The said discounts are calculated on the basis of the payment date and the turnover of medicines of a particular warehouse. An average discount on reimbursable medicines has been calculated to be at the level of 7-8 per cent.

Another discount, a higher one, concerns non-reimbursable medicines. It very often constitutes the total profit of pharmacies. The present act completely prohibits giving discounts on state-reimbursed medicines. The prohibition concerns the whole industry, on all sales levels. As far as pharmacies focused on medicines, and not chemistry, are concerned, it contributes to their considerable loss of discounts, sometimes even half of them. The problem pertains mainly to small pharmacies. Numerous pharmacy-related organizations and Local Pharmacy Chambers suggest their own schemes of calculating retail margins on state-reimbursable medicines. Those are demonstrated in the chart below.

Table 3. The method of calculating the margin stipulated in the act as of 12.05.2011, Art. 6.4 [where: x stands for the wholesale price of the medicine]

From-to	Calculating the margin
0,00-5,00 PLN	40%
5,01-10,00 PLN	2,00 PLN + 30% x(x-5,00 PLN)
10,01-20,00 PLN	3,50 PLN + 20% x(x-10,00 PLN)
20,01-40,00 PLN	5,50 PLN + 15% (x-20,00 PLN)
40,01-80,00 PLN	8,50 PLN + 10% x(x-40,00 PLN)
80,01-160,00 PLN	12,50 PLN + 5% x(x-80,00 PLN)
160,01-320,00 PLN	16,50 PLN + 2,5% x(x-160,00 PLN)
320,01-640,00 PLN	20,50 PLN + 2,5% x(x-320,00 PLN)
640,01-1280,00 PLN	28,50 PLN + 2,5% x(x-640,00 PLN)
1280,01- and more	44,50 PLN + 1,25% x(x-1280,00 PLN)

Source: *Medicine, Foods for Special Purposes and Medical Products Reimbursement Act as of 12.05.2011, Art. 6.4.*

Table 4. The proposal of the Superior Pharmacy Body on calculating the retail margin on the basis of the wholesale price of the medicine in the amount of:

Wholesale price in PLN	The rate of the official retail margin
0,00-4,80	40%
4,81-9,75	35%
9,76-15,55	25%
15,56-33,75	23%
33,76-66,67	21%
66,68-100,00	17%
100,01-200,00	12%
200,01-640,00	8%
640,01-1280,00	7%
1280,01 and more	6%

Source: *Biuletyn Wielkopolskiej Okręgowej Izby Aptekarskiej No. 3-4/2011*

The proposal has not been accepted.

#### **Ad 4. Limit groups**

The Ministry of Health, changing the follow-up wholesale margin to the level of 8-9 per cent, a negotiated fixed amount and the lowered fixed amount of 5 per cent, plans to further lower the rate of subsidies in Poland.

The division of medicines, and more precisely their active substance, according to the limit groups has been introduced in Poland for the first time by means of the new act. Molecules in a given category have the same limit level, including the registry of daily doses of medicines per package. Unfortunately, the estimations carried out by IMS Health show that the level of the patient's participation in paying for the treatment will increase to 38 per cent instead of dropping.

It is known that the level of the patient's participation in paying for the treatment is high. Before 2007, it was 36 per cent, in 2010 it was at the level of 34 per cent. WHO reports that the limited access to medicines is a result of exceeding the level of 40 per cent.

Introducing a ban on state-reimbursable medicine advertising and pharmacy advertising is expected to contribute to eliminating aggressive advertising campaigns artificially stimulating the demand for medicines financed from state funds. In addition to this, promotional activities lead to a faster exploitation of funds allocated to reimbursing medicines, thus limiting the possibilities of increasing the funds meant for other healthcare services.

#### **CONCLUSIONS**

A large share of Polish pharmacies already operates on the verge of losing their financial liquidity (2011). It is estimated that when the system of calculating pharmacy margins suggested by the Ministry of Health takes effect, 30-40 per cent of pharmacies will be closed down or taken over within a short period of time. The majority of closed pharmacies will be independent family pharmacies operating outside of big cities.

According to the Local Pharmacy Chambers, independent pharmacies that are still in a good financial situation will be significantly weakened. They will be forced to cut costs by, among others, reducing the number of qualified personnel and stock, thus limiting the patients' access to medicines. This will have a direct impact on small and medium-sized enterprises, i.e. independent pharmacies, which will result in the lack of the possibility of carrying out reasonable planning and developing business activity.

The current and future situation on the Polish pharmaceutical market is well worth analyzing, as it is a very important part of the health sector in Poland. Moreover, it is a very interesting sector of the economy, as it is on one hand seen as belonging to the free-market, but on the other- the margins, staff, equipment, design or size of the commercial activity are statutorily dictated.

On one hand, the Polish pharmacy sector is in for hard times, as up to 25 per cent of pharmacies may go out of business, and on the other, world trends indicate that in 2012 the average growth rate for the whole sector will be in the range of 2.5 to 3.5 per cent, thus it will have been the highest in 25 years, and its whole volume may reach the level of 750 billion USD.

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*Adam Dymitrowski*<sup>2</sup>

## INNOVATIONS CREATED IN THE INTERNATIONALISATION PROCESS AS A NEW TYPE OF INNOVATIONS

**Abstract:** Innovations play an important role in a company's market activity, influencing its competitive position and corporate performance. A process which has an impact on innovations is internationalisation. While international expansion provides a company with new forms of activity, resources and relationships it seems that it results in creating new types of innovations.

**Keywords:** innovations, internationalisation, new type of innovations

### INTRODUCTION

The aim of the paper is to determine whether a new type of innovation is created in the internationalisation process of a company.

The reason for choosing this particular subject is the increasing interest in the matter of innovations. It is believed by many scientists that innovations have a positive influence on both: corporate performance [1] and competitive advantage [2]. If so, innovations may be one of the most important tools for a company to successfully operate on the market.

It is also important to analyse innovation from the perspective of the internationalisation process. International expansion is common among every type of company (taking into consideration such characteristics as: size, industry, form of ownership etc.). Internationalisation affects a company in a strong way. Because the environment which the company operates in is changing, it has an influence on the interior of the company and, among others, innovations. It is therefore crucial to examine the role of the internationalisation process in creating innovations.

### SCIENTIFIC HYPOTHESIS

The subject of research is innovations created in the internationalisation process.

In order to determine whether internationalisation enables a company to create a new type of innovations, it is important to present a detail description of the process of international expansion. This will allow identifying the necessary levels of analysis.

It is also crucial to provide a reliable definition of innovations. Understanding of innovation has evolved in time and there are many classifications of innovations types. Although there is an ongoing passionate discussion among scientists on the pages of scientific magazines and articles about the nature of innovations, not much has been said about innovations created in the internationalisation process so far. In response to the identified scientific gap in this matter an analysis of possibilities to create a new type of innovation in the internationalisation process has been undertaken.

The internationalisation process creates possibilities for the development of a company. Access to new markets, acquiring resources which were unavailable at the local market level and cooperation with foreign partners influence a company's growth in a positive way. International environment in which the company is operating during international expansion is very different from the local market. It should be stated that the surrounding of a company has an influence on its interior. While the exterior is changing, it moderates the interior of a company. One of the elements which are generated inside the company is innovations. It seems that company's change, resulted from engagement in the internationalisation process may affect creating innovations. The described relationships among presented issues led the author to take an attempt to verify the following hypothesis: Companies create a new type of innovations in the internationalisation process.

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The methodology used for the purpose of this research is a detailed literature review.

### **DETAILED DESCRIPTION OF RESEARCH ISSUE**

Innovations have been a subject of numerous scientific debates for some time. It is believed that the author of the theory of innovation is J. Schumpeter [18], who also coined the term "creative destruction", which is understood as a change aiming to improve the current state of affairs.

According to R. Rothwell [15] there are five different ways to understand innovation, which may be distinguished by taking into consideration the sources of its creation. First of them is technology stimulus (technology push), which describes the driving force behind innovation as the appropriate use of technological facilities of the company. The second source is the demand stimulus (need pull) that takes into account the role of the market and the customer. The third source of creating innovations is the coupled model (coupling model) which illustrates the need for the use of the first two methods simultaneously. A further one (integrated model) emphasizes the validity of coordination marketing and research and development activities along with building strong relationships with suppliers and key customers. The last source of innovations is the network model (networking model) which refers to the business relationship of a company with the environment and the growing integration between the two.

A frequently invoked definition of the term "innovation" has been developed by the Organization for Economic Co-operation and Development (OECD). It mentions:

- product innovation – a new or significantly improved product (compared to the previous version of the good or service, taking into account its technical specifications, components and materials, software, user friendliness or other functional characteristics),
- process innovation - new or significantly improved methods of production or supply (including techniques, tools and/or software),
- marketing innovation - a new marketing method involving significant changes in product design, packaging, distribution, promotion and price,
- organizational innovations - new methods of organizing business practices, consisting of modifying the working space or external relations [14].

The adoption of the definition proposed by the OECD seems to be appropriate because of a number of reasons. One of them is that it is commonly used. This definition seems to be the one used most often by scientist from all over the world. It is therefore easy to compare research results. Another reason in favour of using the presented nomenclature is the comprehensive way of approaching the research problem. Descriptions of innovation presented by the OECD meet this criterion, while adopting a different definition would significantly narrow our research area, rendering it impossible to make a thorough analysis of the issue of innovation.

The definition coined by the OECD has an additional value: it provides a classification on different types of innovations. Although it distinguishes four different types of innovations, in the literature on the subject many more types can be found. Table 1 presents only the most common classifications of innovation types.

Classifying innovations is important for a number of reasons. One of them is that they represent the scope of a company's activity. Also, each type of innovation has a different impact on a company's competitive advantage and corporate performance. Last but not least - classification helps to resolve the problem of the nature of innovations and understand the factors that influence them.

Until recently, creating innovations was seen as a process involving technology, demand or both stimulants. Currently, the demand and supply factors occurring at the same time with the use of marketing tools by a company in an environment characterized with network links are considered to be the driving force behind innovation. A concept which describes the changes taking place inside a company due to innovation was created by Terziowski [19]. According to his idea companies are constantly creating innovations while moderating operational strategy by means of taking use of

new organizational structures, procedures, ways of managing labour force or creating a working space which helps to create innovations.

Table 1. Common classifications of types of innovation

Criterion of selection	Types of innovation
Effects	<ul style="list-style-type: none"><li>• product</li><li>• process</li><li>• marketing</li><li>• organisational</li></ul>
Character of development	<ul style="list-style-type: none"><li>• continuous</li><li>• discontinuous</li></ul>
Character of change	<ul style="list-style-type: none"><li>• radical</li><li>• incremental</li></ul>
Scope	<ul style="list-style-type: none"><li>• architectural</li><li>• modular</li></ul>
Technology	<ul style="list-style-type: none"><li>• technical</li><li>• non-technical</li></ul>

Source: Own elaboration

Numerous opportunities to create innovations can be also identified in the areas of company competencies or the business environment. Within the company these are: supply chain, range of products and services, processes, technologies, new markets. Outside the company: customers, competitors, emerging technologies and new discoveries, powerful and influential actors, political forces, legal and social issues [3].

It is worth noting that the existence of the possibility to create innovations does not mean their actual creation. In practice, in order to make effective innovation it is necessary to adjust the factors from inside and outside of the company, as occasions related to demand and competitive pressure will not bring results if the company does not have the relevant skills or resources to answer them (for example well developed R&D activities).

While studying the matter of innovations, one can identify some common distinctive features. One of them is creating a substantial new value for the customer and business through creative change of one or more elements of the business. Innovations are thus new value, rather than new products.

They can occur at any level of business activity. This means that in order to create innovation it is required to evaluate all existing levels of business [17].

Also, an important characteristic is the need to introduce them to the market, because without this element they would not be innovations. For innovation is the response to market demand and requires to be commercialized. It means that in order to create innovation one should take into consideration the influence of the surroundings.

A factor which seems to influence the environment companies operate in is the process of globalization. One of its effects is the common process of international expansion among companies called internationalisation. Internationalisation can be understood as every kind of activity undertaken by a company on a foreign market [16]. However, such a definition does not include import, which is one of the forms of internationalisation. In order to adopt an accurate definition there is a need to differentiate between active (as described) and passive internationalization (building relations with foreign partners while staying at the local market level) [9]. A result of the studies of internationalisation are internationalizations models. These are: the strategic approach, Uppsala model, the eclectic paradigm and the network approach [8].

The strategic approach points out the importance of internal resources of a company. Taking into consideration the resources in its possession, the company analyses its surrounding for possible international expansion.



Another internationalisation model, which takes into consideration company resources, is the Uppsala model [12, 13]. However, in comparison to the strategic approach it takes intangible assets into consideration. The company is involved in the international expansion process because of the knowledge about foreign markets. The knowledge is created thanks to the experience the company develops when being engaged in internationalisation.

There is also an eclectic paradigm, where the most important factors in internationalisation are transaction costs. A company decides to expand internationally when there is a possibility to take advantage of low transaction costs on a foreign market [4]. This theory explains the location of foreign direct investments (FDI).

A further concept explaining internationalisation is the network approach [11]. According to this theory relationships established by a company with a variety of entities form its environment are the reason for international expansion and determine the behaviour of the company in the process of internationalization. Established network links are a key factor in the development of a company and contribute to the achievement of its long-term objectives.

Each of the models of internationalisation focuses on some important aspects, while neglecting other ones. It is therefore crucial to analyse the process of internationalisation being equipped with the knowledge from all of them. Only such kind of scientific approach seems to be appropriate, because there are a few issues which characterize the process of internationalisation. These are:

- relationships with foreign partners,
- resources (including knowledge),
- forms of internationalisation [6].

Each of them can be treated as a source of innovation in the internationalisation process, but also each of them moderates the process of creation of innovations.

Relationships with foreign partners deeply affect companies. They change the inside of a company, but also its surrounding. An important element in relationship is trust, which helps to tighten the cooperation. In the time influenced by past relationships a company can change its attitude toward cooperation in the internationalisation process [7]. Results of latest research show that companies which present different attitudes toward cooperation in the internationalisation process demonstrate different levels of innovativeness [5]. While relationships with foreign partners introduce change in the way the company functions, they also affect innovations. Because relationships in internationalisation differ from relationships on the local market they should result in creating a different type of innovation.

Resources are another factor which has an influence on innovations. Tangible and intangible (knowledge) resources vary in the foreign and in local market. In the process of internationalisation a company gains access to new resources, which were out of reach till that time. Innovations are a result of transforming resources in the possession of a company into a new value, which would fulfil the expectations of clients. That is why internationalisation should enable a company to create innovations which are different from the ones generated on the local market.

During the process of international expansion a company can enter foreign markets in many ways. The mode of entry is a form of internationalisation. Each form is characterized by profits which companies can earn, but also by certain risk. The higher the form of internationalisation, the higher both profits and risk. While the form of internationalisation has an impact on the inside of a company it also has influence on the results of its activity. That is why innovations created in the process of internationalisation should differ from innovations created on the local market.

Taking into consideration the way internationalisation expansion influences a company it is clear that innovations created in the process of internationalisation should be considered as a new type of innovations. It is so, because internationalisation changes all their core features, mentioned previously. A new value which comes with innovations is different in the process of internationalisation because the company has to satisfy the needs of new segments of foreign clients and adapt to a new international, risky environment. A result of this adaptation is a change at all



levels of business activity which moderates the way a company is operating on the market (such as organizational structure etc.) and in result methods of creating innovations. Also the needs to introduce innovations to the market vary abroad and locally.

A confirmation that it is justified to refer to innovation created in the process of internationalisation as an innovation of a new type, is the lack of distinction in existing classifications between innovations created by companies engaged in international expansions and those which are not. Admittedly, J. Gordon [10] writes about innovations which are new either to the world or country or company, but it is a different matter. In this case the criterion of selection is the scale of novelty. In case of innovations created in the process of internationalisation however, the criterion of selection is the engagement in international expansion of the company which generates them. For there is a difference in character of innovations created by companies in the process of internationalisation in comparison to the ones created by local companies. That is why innovations created in the process of internationalisation are a different type of innovations. This conclusion seems to be true in the context of existing innovation and internationalisation literature, although still requires a statistical verification.

## CONCLUSIONS

The paper describes the process of international expansion of a company as a factor which influences the developing of innovations. Because the internationalisation process involves new resources, building relationships with foreign entities and a variety of internationalisation forms it creates a significantly different environment for generating innovations. Innovations created in the process of internationalisation differ from the ones created by a company not engaged in international expansion in many ways. That is why it is justified to identify innovations created in the process of internationalisation as a new type of innovations.

Therefore, a contribution of this paper to the field of science of innovations and international expansion is to add a new criterion of selection to the already existing classifications of innovations, which is the engagement in international expansion of a company which generates them.

Although it is clear that the process of internationalisation influences creating innovations, still an open question remains as to how does it influence it. Do companies engaged in the process of internationalisation tend to gain more from innovations than companies which operate only on the local market? What is the influence of innovations created in the process of internationalisation on a company's success? Which types of innovations created in the process of internationalisation (product, process, etc.) are the most effective ones? Finding answers to these questions requires further research.

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## THE BENEFITS OF MODERN MULTI-CRITERIA EVALUATION METHODS IN AN INNOVATIVE CONTEXT

**Abstract:** This article emphasizes the utility and availability of decision methods useful in identifying the optimal solution in terms of decision-making. Attention focuses primarily on the AHP method using evaluation criteria. The case studies mentioned at the end of the article deal with the selection of appropriate alternatives for innovation of the management system. Ways of using assessment tools that are available online have also been presented.

**Keywords:** MCDM, AHP method, on-line decision tool, innovation, organization of production.

### INTRODUCTION

The decision is an important part in every choice of possible alternatives. Even when selecting innovative solutions more than one decision criterion should be taken into account. Often we encounter problems when we need to consider various alternative solutions against more assessment criteria. Such decision problems are called multi-criteria or of a multi-criterial nature.

### THE ADVANTAGES OF MULTI-CRITERIA

Mathematical models have emerged and have been used in the decision making process in practice due to the need of maintaining logical thinking in managing a large number of factors simultaneously.

Also, according to [1] mathematical methods are capable of taking into account different quality criteria, so it is not surprising that new modifications of existing tools, techniques and models are on the rise and their implementation in different areas is more frequent

The advantage of multi-criteria evaluation methods is based on the fact that variants facilitate our work in solving tasks of configuration options using a broader set of criteria. The decision-making process is defined by the following elements [2]: decision-makers and decision alternatives' accumulation, increased decision-making criteria and accumulation of goals.

[3] distinguishes methods of the multi-criteria decision as PATTERNS, basic method, the method of weighted partial order, or weighted scoring method, the method of determining the coefficient of significance such as the pr. grading method, ranking method, standardized coefficient significance, also methods for decision-making under uncertainty, using more familiar decision criteria [3].

The methods include: multi-criteria decision according to [4] and WSA, IPA, Tops, CDA and the tools for determining the criteria for the weights method include ranking, scoring method, Fuller's method, quantitative method of paired comparisons of criteria determining the weights of criteria lines and geometric averages and Saaty's method of determining weights of criteria, which is used in the method of AHP (Analytic Hierarchy Process).

### THE AHP METHOD FOR EVALUATION OF INNOVATIVE SOLUTIONS IN A MANAGEMENT SYSTEM

The AHP method is based on a pair-wise comparison of the degree of importance of each criterion and the degree of how variant-evaluated solutions meet these criteria. Based on mathematics and psychology, this method was designed by Thomas L. Saat [7]. The decision-making problem can be represented as a hierarchical structure. The highest level is the goal or decision, the lowest shows the variants considered.

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In the conducted case study it was necessary to decide on the optimal deployment of resources with respect to the interconnection within the systems controlled by a circuit whose starting point was the status quo. It was necessary to take into account the 6 criteria, namely: costs, reliability, extensibility, difficulty of implementation, purpose, unification For variants A, B, C see Figure 1.

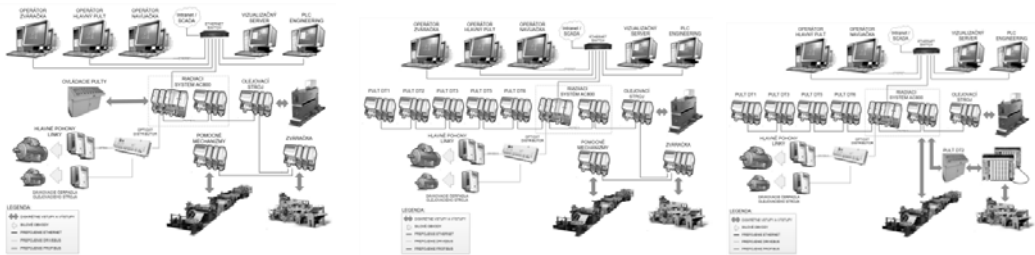


Fig. 1. Variants of control system innovations - rated variants A, B, C

Individual variations correspond with the need for replacement of the control system, however, the lines show a different arrangement of the various elements of the system.

**ASSESSMENT CRITERIA USED AND FINAL EVALUATION**

The evaluation of the AHP method is to demonstrate favorable collective human judgment, against judgments precisely specified by a pair of scores.

The less significant element is determined by its inverse. When there is need for compromise, for the purpose of assessment the numbers 2,4,6,8 - showing the mean values - can be used. Obtained values are entered onto Saaty's Matrix (Table 1).

Table 1. Saatty's Matrix

critierion	1	2	3	4	5	6	evaluation
1	1	1/3	2	5	1/3	3	0,184
2	7	1	1	5	3	1	0,255
3	1/2	1	1	3	1/3	3	0,159
4	1/5	1/5	1/3	1	1	1/3	0,056
5	3	1/3	3	1	1	1/3	0,183
6	1/3	1	1/3	3	3	1	0,163

The assessment was obtained by transforming an eigenvector matrix into a standard one, identifying which components of the evaluation criteria and alternatives meet the requirements of the criteria. The overall assessment of options was determined as the weighted sum of partial evaluation with respect to variations of the individual criteria.

Table 2. The resulting eigenvectors

criterion		Evaluation of alternatives					
		A		B		C	
Name of product	weight	weight	coefficient	weight	coefficient	weight	coefficient
costs	0,184	0,072	0,013	0,279	0,051	0,649	0,119
reliability	0,255	0,085	0,022	0,644	0,164	0,271	0,069
expandability	0,159	0,105	0,017	0,637	0,101	0,258	0,041
difficulty	0,056	0,146	0,008	0,322	0,018	0,532	0,030
expediency	0,183	0,263	0,048	0,547	0,100	0,190	0,035
unification	0,163	0,333	0,054	0,527	0,086	0,140	0,023
The weighted sum		0,162		0,521		0,317	
Order		3		1		2	

## ALTERNATIVE METHODS FOR DETERMINING RESULTS

To determine the rating (normalized eigenvector) it is possible to simply use freely available on-line tools [5] to calculate the standard personal resulting vector. The working environment of the on-line tool to calculate the evaluation is shown in Figure 2.

**AHP (Analytic Hierarchy Process) Calculation software by CGI**

This software (web system) calculates the weights and CI values of AHP models from Pairwise Comparison Matrixes using CGI systems.

1. Input: Size of Pairwise Comparison Matrix
2. Input: Pairwise Comparison Matrix (The values of Pairwise Comparison)
3. Display: Weights (Eigen Vector) and CI (Eigen Value)
4. Output: Text File. You can use the output by spreadsheets using cut-and-paste.

Usage of This CGI system

Please input the size of Pairwise Comparison Matrix ( the number of evaluation items or evaluation objects),  $n$  where  $2 \leq n \leq 9$ .

If you use only normal Comparison Values, that is, 1,2,...,9 and 1/2,1/3,...,1/9, then Check the "ONLY INTEGR VALUES"

Size of Pairwise Comparison Matrix (n) : 6

ONLY INTEGR VALUES

Fig. 2. Working environment online tool to calculate the evaluation [5]

Figure 3 shows the results of the above case studies where the AHP has been using the method of selected version control system. The optimal variant has been labeled the most valued variant - variant B.

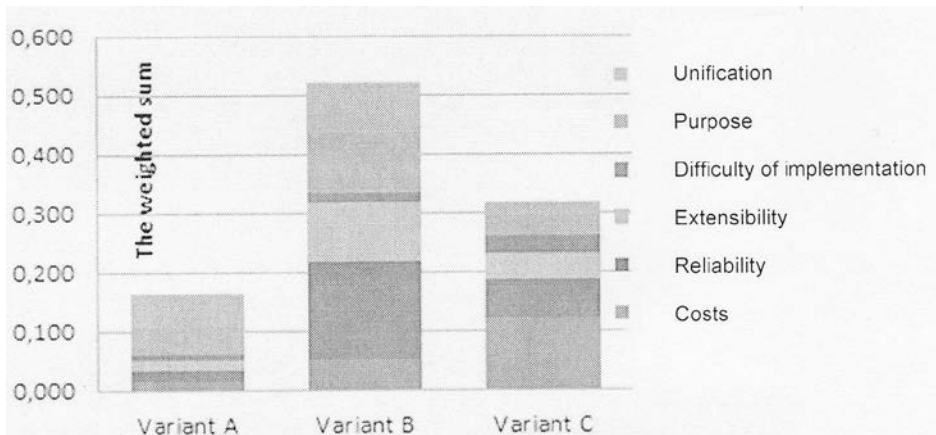


Fig. 3. Graphic representation of the final evaluation of alternatives

### NEED TO ANALYZE THE INTERDEPENDENCE OF THE EVALUATION CRITERIA

For a larger set of criteria it is rarely possible to prevent not containing other criteria and interdependencies, conditionally. To address these cases in theory and practice of multi-criterial evaluation, using appropriate mathematical apparatus is vital. Also it is possible to make use of a wide range of on-line tools [6].

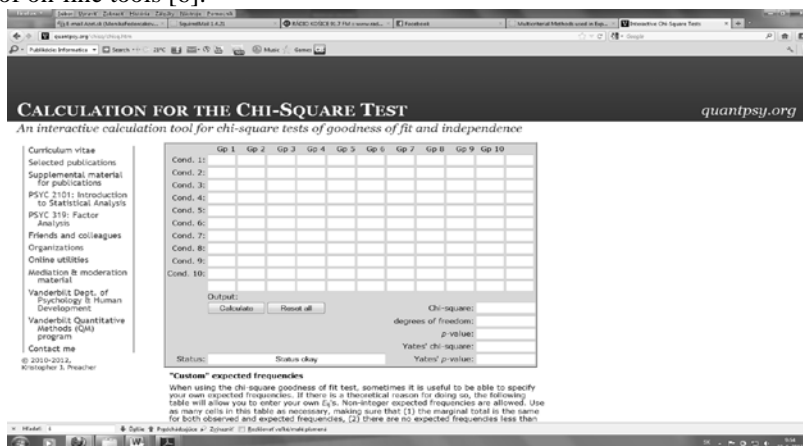


Fig. 4. Work environment online tool to determine the degree of independence of variables [6]

On this basis it is possible to show whether there is substantive guidance to the conclusion that there is a relationship between the criteria. The result of analysis of the interdependence of criteria can be either a reduction in the number of criteria or correction of the weights of criteria.

### CONCLUSION

It can be concluded that multi-level analytical method (Analytic Hierarchy Process) based on a pair-wise comparison of the degree of importance of each criterion and the degree of how variants of evaluated solutions meet these criteria is now available through highly accessible on-line tools, which is most rewarding and comprehensive in the above exact method of decision-making and not only because of the scale used, as proposed by Jaiswal [10].

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## CULTURE POTENTIAL IN CREATIVE ECONOMY

**Abstract:** The purpose of this study shall be to present a new approach to the role of culture potential in the process of stimulation of economical development. It includes analysis and assessment of: the place of culture potential in the contemporary concepts of development, essence of economy and creative economy, positions of the European Committee and the European Parliament concerning the role of creativity and culture in the process of stimulation of regional development, positioning culture aspects in the latest Polish documents outlining long-term challenges and development priorities.

**Keywords:** culture, creative economy, culture potential, economical development

### 1. INTRODUCTION

Undertaking the topic of the role of culture potential in the process of economical development was decided due to its rank and exceptional relevance. We should agree with J. Szomburg, from the Institute of Market Economy Research that after 20 years of priority for the economy the time for new priorities in Poland has come – the next 20 years should belong to education and culture, and that culture foundations should be appreciated, because their condition may constitute not only the source of weakness of democracy, state and society, but also uncertain perspectives for the future of the economy [20].

The urgent need of discussion in those conditions is obvious with reference to the place of culture potential in the process of economical development and searching for an answer to the following questions:

- how, in the times of creative economy, may culture affect the competitiveness of local and regional communities and determine educational choices, professional chances and ability to introduce innovation?
- how do we overcome the barriers limiting the use of potential culture to stimulate development?

The purpose of this study shall be to present a new approach to the role of culture potential in the process of stimulation of economical development. It includes analysis and assessment of:

- the place of culture potential in the contemporary concepts of development,
- essence of economy and creative economy,
- positions of the European Committee and the European Parliament concerning the role of creativity and culture in the process of stimulation of regional development,
- positioning culture aspects in the latest Polish documents outlining long-term challenges and development priorities.

### 2. CULTURE POTENTIAL IN THE PROCESS OF ECONOMICAL DEVELOPMENT

Connections between culture and development constitute the subject of interest of anthropologists, sociologists, graphic artists and economists. However, opinions concerning that subject are very diverse, which is connected first of all with the different definitions of culture by particular authors, as well as with the diversification of attitudes towards the cultural vision of the world and desired direction of changes.

Noticing the role of culture in the processes of economical changes following in various regions of the world constitutes one important aspect of contemporary discussions on the development process. In the process of development culture may constitute its goal, measure or perform the role of a regulator, deciding on the nature and directions of development [8].

In the concept of culture - potential culture is treated as important development capital, a resource affecting the decisions being undertaken and behaviors. Values which are held dear shall

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affect educational choices, professional chances or ability to introduce innovations in a similar, but simultaneously independent, manner as traditionally construed social capital. The concept emphasizes the mobile nature of culture potential, which flows between regions and countries [17].

Culture does not determine human behaviors finally, however it affects the formation of norms and values and the evolution thereof. Culture norms affect the manner of human behavior, people's attitude to work, motivation, maintenance of order, attitude to other people, behavior towards those well-known and strangers, level of corruption, type of values, attitude to religion, tolerance towards different behaviors [7].

Whereas, it is emphasized, presently the culture potential presents a much more important meaning for economical development than it used to do in the industrial age. Diversity and innovation [10] are awarded more often than previously. The increase of direct importance of culture in the economy is proven by the development of culture industries and creative economy [7].

Contemporary research of regions refers to complicated nature of their relations, connecting humans with the environment, reflected inter alia: in social actions of political, as well as of economical and cultural nature. In case of weaker transparency of functional structures, social identity, specificity of inhabitants life style, character and intensiveness of social relations are becoming the key to explanation of the specificity and identity of the region [1]. Therefore commencement of discussion with reference to the place of culture in the process of regional development and the new challenges in this field is desirable.

The wider definition of culture supports the problem highlighted: culture may be perceived in categories of special resources, which may be transformed into a local product, creating demand on the market, as well as the factors shaping the views and behaviors of local social actors, the attractiveness and image of the land, as well as an element creating local products and brands.

However, it does not mean that culture always determines economical development, neither does it imply that in all phenomena examined by economists culture factors ought to be considered. The fact whether culture exerts any influence should be examined empirically.

Constituting the axis of balanced development, culture is connected in a special manner with improvement of local identity and formation of civil society. As a factor of social and economical development it constitutes a resource, which – provided that it is properly used – becomes more and more significant capital in planning development on various levels, in the nearer and further perspective.

However, culture constitutes not only a resource of significant economical function. In the local scale it may cause important social effects, connected with quality of life and the feeling of well-being. In our times, we are becoming more aware of the fact that economical administration is a cultural activity and as such activity it is regulated by a functioning, axiological system.

Functioning of the economy depends strongly on the factors, which situate themselves in the sphere of widely construed culture, which „at first glance” are hardly connected with economical administration. Analysis of the reasons of economical development should include - not only express- economical factors (such as work, capital and land) or administration and management operations (organization, management), as well as many combined, although very significant factors that are conditioned upon culture. Economical objects are to a high degree inspired by meanings rooted in culture.

Until today the role of values and views that are conditioned upon culture as factors facilitating development was generally ignored by governments and development agencies. The existence of culture differences was noticed, but in case of development planning it was the values important from an economical point of view that were considered generally and almost exclusively.

In the strategies and voivodeship programs the attitude of noble support of everything, which concerns the area of widely understood culture (culture scenery, quality of life, education, income from tourism) is still dominant. The issues concerning culture industries are stressed more rarely, as well as the meaning of connections of the culture with economy, including its impact on innovation,



creativity and quality of human capital. Achievement of any competitive advantage is rarely declared as result of culture.

### 3. CREATIVITY AS AN IMPORTANT DEVELOPMENT FACTOR

Communing with culture is very strongly connected with creativity. Broadly understood culture constitutes the source of the most important elements of contemporary economic and development success: qualifications, creativity and ability to cooperate. Each country intending to stand out in the international community, not only as a cheap production base, but through increasing the value of its products, must have its own, unlimited sources of creativity.

Creativity does not constitute an abstract view, but it appears in all fields of life. It is not a state of mind, but the process of development and introduction of modern ideas into life in order to solve problems or satisfy needs. Therefore it is indispensable and invaluable not only in the sphere of ideas or art, but also in the practical and applicable dimension. It constitutes the foundations for the development of science, modern technologies, products and services and it is the source of changes in social and economic processes [19]. Broadly understood creativity includes cultural, scientific, technological and economic creativity.

Therefore creativity may be treated not only as a talent, but a special kind of ability to produce innovation. Unfortunately, the methods enabling measurement of those creative powers of a particular individual haven't been developed yet, and as Alberto Shapiro emphasized (who spent a lot of time researching creativity), despite many efforts, it is still not possible to determine the psychological profile of a creative person, nor tests enabling to reliably predict who, in a particular situation in the future, will present a high level of creativity [14]. Despite that it was not possible to identify the source of creative behaviors, such behaviors include: knowledge, ability to think creatively and motivation.

Those components of creativity may be affected by conditions offered to creative entities, mainly through ensuring that commissioned assignments completely engage their knowledge and creative abilities; through freedom of activity and securing resources which will enable to perform that task fully [14]. The worst environment for creativity is one that does not include innovation as a constant and indispensable element of activity and unwillingly accepts new ideas. The environment appropriate for creativity accepts new methods of activities and assumptions of risk, as well as ensures unlimited access to sources of knowledge and good flow of information and innovation - which is not something unusual, but quite normal and widely accepted [14].

Creativity is global in nature from one side – it is based on flows of content, trends and creators. On the other side, the local nature of culture production and efficiency of culture clusters, in which numerous companies from the creative sector are located on a small area, means that the optimal environment for the development of creative economy is found in big cities. Presently, creative potential equally includes material factors affecting the development of a particular area, its location, communication availability and presence of natural resources.

The importance of *grassroots* creativity that will be increasing in the future or that of jointly created knowledge requires a new approach to intellectual property, connecting ideas of reservation of rights with the concept of common and mutual use of a work of art. In the two nearest decades the model of creation and distribution of culture will be worked out and it will be significantly different from the 20<sup>th</sup> century model. That model will reflect the new attitude towards availability and use of knowledge or culture, characteristic for the digital generations [17].

The concept of creativity, as an important factor for societies and the economy, allows to broaden the definition of innovation, as dependent from culture. Innovation is material not only for the economy – in times of constant and sudden change it performs an important role also in the social or political sphere. Ensuring creative potential requires general cultural activity and respect for certain values.

#### 4. CREATIVE ECONOMY

Contemporary scientific and technical development, large dynamics of changes, more developed sources of knowledge, the new role of information and the manners of communication cause that both production and the manner of employment and style of work are changed, as well as the institutions themselves. Besides knowledge, innovation and creativity become the most important conditions of survival on the market. This causes also the economy of knowledge to be modified and replaced by the so-called creative economy, which does not concern only knowledge and science, but also imagination and innovation [15].

Economy based on knowledge, nowadays, is in need of creative capital, which shall allow to fully exploit the sources of information in order to combine effectiveness and competitive advantage.

The notion of “creative class” is very important for the considerations on the economy, the author of which is Richard Florida. He argues that human creativity constitutes the fundamental source of economic growth, but it is knowledge and creativity that support natural resources and physical work as the source of wealth and economic growth [4].

According to the opinion of Florida, creative potential depends on the presence of a highly mobile creative class, that is employees in professions which require independent thinking and assessment of the situation, application of non-standard approaches in completing tasks, ability to solve combined problems; persons who create significant new forms and whose work is based on searching for innovative solutions, which in turn requires a high level of education.

That class includes artists and designers, journalists and architects, scientists and engineers, as well as representatives of other liberal professions. The concept of the creative class is focused on people as the key resource in an economy based on creativity. Furthermore, R. Florida stresses that he recognizes creativity as an inborn feature, one of the basic abilities of every human being, which means that each person is a potential member of the creative class.

R. Florida says that there are three (3T) factors of economic development and elements necessary for the existence of conditions supporting creativity, namely [16]: technology, talent, that is talented and educated people and tolerance, meaning openness and friendliness as well as diversity of the place.

However, the renowned expert on regional studies, Kukliński mentions three issues: knowledge, imagination, freedom.

He argues that European regions should focus on creativity and knowledge in the course of planning the future. Creativity is becoming the main driving power of the development process in the 21<sup>st</sup> century. He added that the concept of a creative region consists of a creative regional society, creative enterprises, creative culture, science and education. We should focus on economy based on creativity, imagination and - first of all - innovation. However, it will not be achieved without the allocation of huge funds to education, development and research. According to his opinion, a revolutionary change in the education systems is required in order to build a creative economy [11].

The basic barrier of changes focused on creativity and innovation is the incompatibility of the rules of the economic system with the new reality of a civilization of knowledge and information, which is so different from the industrial civilization. New economy requires priorities to stimulate creativity, innovation and development of education [15]. Obviously, the sources of development are first of all embedded in minds, not products.

The age of creative economy is only emerging and it is difficult to elaborate a more detailed analysis and forecast. It is difficult to determine whether imagination will become the main driving power. However, it is certain that both creative economy as well as creative society are becoming one of the largest challenges of the 21<sup>st</sup> century.

## **5. CULTURE AND CREATIVITY IN THE POLICY OF THE EUROPEAN UNION**

The cultural dimension of the European integration was formally considered for the first time in the Treaty of Maastricht of 1992. It is stressed therein that the purpose of the European Union is based on care and support of diversity of cultural heritage and ensuring access to cultural achievements to all citizens. "The European culture model" thus connects respect for the cultural diversity of each nation with exchange and cooperation, which supports the development of each culture [22].

The European Union includes culture issues into many other areas of activity, such as: education, scientific research, support of information and communication technologies, as well as social and regional development. The European Commission regards culture as the factor stimulating economic growth and support of employment [2].

The program Culture (2007-2013), with a budget of 400 mln euro, includes all activities within the scope of culture, which are not actions of audiovisual nature. It assists thousands of cultural organizations in the creation and performance of cultural and artistic projects.

It also supports agencies acting on the European level in the field of culture and allows to appreciate the main cultural achievements of Europe in the field of architecture, culture heritage and music, as well as the European Culture Capitals.

Many other programs have an unusually positive influence on culture, through particular cultural projects which propagate the use of foreign languages and stimulate personal culture experiences.

Among those programs is "Europe for Citizens (2007-2013) [3], which is also based on the article of the Treaty concerning culture and propagates active European citizenship, as well as the programs supporting life-long education (including Erasmus and Erasmus Mundus), multi-linguistic abilities and requirements of youth.

In May of 2007 the European Commission proposed a plan of action for the benefit of culture. Propagation of cultural diversity and inter-cultural dialogue constitute the programs main purpose. Culture is perceived as the key element in international relations. The role of culture is also emphasized as being the catalyst of creativity [18].

Promotion of creativity and innovation in the form of life-long education is concurrent with the goals of existing Community programs. Therefore the goals of the European Year of Creativity and Innovation may be carried out within the scope of those programs and the margins determined according to them, i.e. concerning the establishing of priorities for financing. The programs and policies in other fields, such as culture, communication, resourcefulness, cohesion, development of rural areas, scientific research and information society, which are also contributing to the promotion of creativity and innovation, may provide support for such initiatives within their corresponding legal frames.

## **6. CULTURE AND CREATIVE POTENTIAL IN POLISH STRATEGIC DOCUMENTS**

In reply to the need of a new civilization project, the new lodestar of the country's development - the strategic advisors team of the Prime Minister had prepared and presented on 17<sup>th</sup> June of 2009 a report under the title of "Poland 2030. Development challenges", which opens public debate on the notion of our future. The document mentions the ten most important challenges which Poland will have to face in the next twenty years. The significant role of culture and creative potential has been emphasized in the program, especially for the coming challenges, i.e. increase of social capital.

A basic modification of the so far conducted regional policy was also provided in the National Regional Development Strategy 2010 – 2020: Regions, Cities, Rural Areas (NRDS) - recognizing goals of regional development and defining the importance of regional policy and other public policies in the course of their performance. Poland's new regional policy is aimed at the introduction and realization of changes defined as a new paradigm of regional policy" [9].

The document emphasizes that culture defines conditions both of social as well as economic development. It creates the intellectual potential of regions in the social dimension, building human capital, as well as cohesion and social integration.

On the other hand, it affects - as a factor of economical development - *inter alia* increase in investment and settlement attractiveness of regions, determines development of tourism, creates labor market and the culture industry, and supports the metropolitan functions of cities within its unique economic scheme. Percentage share of GDP produced in the field of culture and culture industries in 2002 amounted to 4,5 per cent, which places Poland on an equal position with the developed countries of Europe. However, the share of the culture sector in the GDP of the European Union in 2003 amounted to 2,6 per cent.

Taking into account the above provisions, the challenge of regional policy should be to protect and maintain the natural environment as well as to apply the cultural potential of Polish regions in order to increase social capital and economic growth. In the beginning of 2010 the National Culture Center commenced a social campaign under the titles of "Culture is important", with a goal to make the public opinion aware of the role of culture in the stimulation of economic development and social life.

The opinion that culture not only improves the quality of life but also creates profits had already been emphasized during the Congress of Polish Culture in the previous year. At that time Mr. Bogdan Zdrojewski, the Minister of Culture and National Heritage, proposed the motto: "Culture is important", which became the starting point of the social campaign of the National Culture Center.

## CONCLUSIONS

Both culture as well as creativity constitute a very difficult research subject. They produce many academic problems because they are difficult to define and measure and the causal and consecutive relations connecting them with other variables such as politics, institutions or economical development, are multilateral in nature.

Many authors of economic analyses regard that it is enough to present a single good reason behind any phenomenon, while factors determining the course of complicated processes are always very diversified in nature and mutually connected with each other [13].

The same problem concerns the education of society and economies open to knowledge, creativity and innovation. That multilateral process includes all fields of life. It concerns both : the generally binding norms and values, as well as the attitudes of individual persons. Thus a change of mentality is so important, as is the manner of thinking and the will of political elites and of every citizen [21].

Unfortunately, the contribution of creativity to the Polish economy is significantly poorer than in the countries of Western Europe; despite the fact, that Polish people are a creative nation, educated and well-read, interested in science and culture.

Should Poland want to effectively compete on the global market, it must improve its relations between culture and creativity, both in the governmental and public sphere. It has to be remembered that culture and industry should be treated as a whole, together with any areas of activity and symptoms of initiative based on imagination. According to Dembiński, director of the British-Polish Commercial Chamber, "the eyes of the young generation should be opened" on the possibility to increase the level of human spirituality and the release of creativity [12].

A chance to improve the competitiveness of Poland in the international community can certainly be seen in the development of science, which may constitute an excellent tool for the increase of knowledge resources and in order to use its achievements in the process of building a new creative society [21].

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## PUBLICATION OF JOINT-STOCK COMPANIES' FINANCIAL RESULTS AND THEIR SHARE PRICES ON WARSAW STOCK EXCHANGE

**Abstract:** The development of the capital market made access to information about joint-stock companies on the market universal and free of expenses. Depending on the capital market's extent of effectiveness these information are variously reflected in share prices of joint-stock companies. This article aims to examine whether the announcement of publicly available information – quarterly earnings announcements of joint stock companies including their level – affects share prices of joint-stock companies on the Warsaw Stock Exchange. This article is also to study whether an investor using that fact has an ability to achieve above-average rates of return.

**Keywords:** share price, financial results, rate of return

### INTRODUCTION

The company's financial standing is one of the most important – beside historical share prices – aspects taken into consideration by investors in the construction of portfolio securities. Enterprises that achieve good financial results are more reliable, promising and attractive object of potential investment. Periodic reports are the source of information of these results, obligatorily, according to regulation and published by security issuers listed on the Warsaw Stock Exchange.

The basic aim of the article is to examine the influence of quarterly financial results' publication by companies listed on the Warsaw Stock Exchange on their share prices, the influence of its determinants and its consequences for investors who locate their funds on the Warsaw Stock Exchange. The detection of a potential dependence may enable an investor to succeed on the capital market. There is still lack of an up-to-date and complex analysis of this subject in research on the Polish capital market.

### RESEARCH METHODOLOGY

The traditional event-study methodology was used in the research. The proper research is preceded with defining the event whose influence on shares quotation will be examined with determining the exact moment of its occurring and the preceding/following period. The next step is to forecast expected rates of return by investor in the event window, therefore rates which may be expected in case no research being conducted. The following market model may be used [1]:

$$\hat{R}_{i,t} = \alpha_i + \beta_i R_{m,t}$$

where:

$\hat{R}_{i,t}$  – expected rate of return of  $i$  share in day  $t$ ,

$R_{f,t}$  – free of risk rate of return,

$R_{m,t}$  – rate of return from market portfolio in day  $t$ .

Parameters of that model are estimated based on observation from the estimation window, including the period which directly precedes the event window (Fig. 1).

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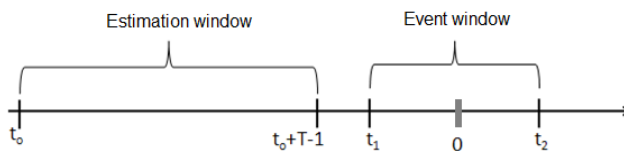


Fig. 1. Estimation window and event window

Source: Own elaboration.

Having established the expected rate of return model, abnormal rate of return may be aggregated, defined as [1]:

$$AR_{i,t} = R_{i,t} - \hat{R}_{i,t}$$

where:

$AR_{i,t}$  - abnormal rate of return  $i$  at time  $t$ ,

$R_{i,t}$  - actual rate of return  $i$  at time  $t$ .

The next step is to verify the hypothesis about the lack of influence of an examined event on the formation of asset return. Firstly, the cumulative abnormal returns must be aggregated [2]:

$$CAR_{i,t} = \sum_{\hat{t}=t_1}^t AR_{i,\hat{t}}$$

where:

$CAR_{i,t}$  - cumulative abnormal return for firm  $i$  at time  $t$ ,

$AR_{i,t}$  - abnormal return for firm  $i$  at time  $\hat{t} = t_1, t_1 + 1, \dots, t_2$ .

The null hypothesis may be verified by following [3]:

$$J = \sqrt{\frac{N(M-4)}{M-2}} \cdot \frac{1}{N} \sum_{i=1}^N \frac{CAR_{i,t}}{\hat{\sigma}_{CAR_{i,t}}}$$

where:

$\hat{\sigma}_{CAR_{i,t}}$  - standard deviation of cumulative abnormal return determined on the basis of the estimation window,

$N$  - number of events in research sample,

$M$  - number of days of the estimation window.

Defined statistic  $J$  has a normal distribution with mean 0 and variance 1. Conclusions drawn from empirical statistics are often confirmed in the forming of average cumulative returns, calculated according to the formula:

$$\overline{CAR}_t = \frac{1}{N} \sum_{i=1}^N CAR_{i,t}$$

Notation as previously.

## RESEARCH DESCRIPTION

For the sake of the research it was assumed that the tested event was the publication of quarterly financial results. The date considered for the event to take place was the day of transferring period reports into public information (in case of lack of reports for the 2<sup>nd</sup> and 4<sup>th</sup> quarter half year and yearly reports were considered). The research window for such defined events included a period of 5 days preceding the day of publication of the proper report and 10 days following that date. The estimation window included 35 days preceding the event window.

Joint-stock companies listed on the Warsaw Stock Exchange were the object of the article. Because of the large diversity (in terms of liquidity and size), 10 joint-stock companies were chosen, representing the WIG20, mWIG40, and sWIG80 indices (Table 1).



Table 1. Joint-stock companies taken into research

WIG20	mWIG40	sWIG80
Asseco Poland SA	Agora SA	Bank BPH SA
Bank Handlowy w Warszawie SA	Bank Millennium SA	Comarch SA
Bank Polska Kasa Opieki SA	Boryszew SA	Dębica SA
BRE Bank SA	Budimex SA	Farmacol SA
Globe Trade Center SA	Echo Investment SA	Mostostal Warszawa SA
KGHM Polska Miedź SA	Grupa Kęty SA	Pelion SA
PBG SA	Kredyt Bank SA	Polnord SA
Polski Koncern Naftowy ORLEN SA	Midas SA	Sygnity SA
Powszechna Kasa Oszczędności Bank Polski SA	Netia SA	Vistula & Wólczanka SA
Telekomunikacja Polska SA	Polimex Mostostal SA	Wawel SA

Source: Own elaboration

The companies' financial data used in the research came from the NOTORIA SERWIS firm's base. Data on the listing of shares was taken from the Warsaw Stock Exchange website [5].

The event analysis carried out in the research concerned the period from the 1<sup>st</sup> quarter of 2006 to the 4<sup>th</sup> quarter of 2010. This led to 600 observations altogether (30 companies multiplied by 20 quarters). The exact date of publication of the periodic report was established for every observation. The report included information about interesting company financial results. In each next step the events in which window disturbing events appeared and could be reflected in share prices of particular companies, were eliminated. Leaving these observations in the sample could have led to deforming results obtained in the research. Finally, the sample counted 580 events.

The examined sample was divided, and thus the research was carried out taking into consideration two criteria: company size/liquidity (reflected in the stock exchange index) additionally the level of published financial results – which is predictable. The model created by G. Foster, C. Olsen and T. Shelvin [4] was used in order to determine which publications are consistent with investors' expectations. According to that expected financial results are presented in the dependence:

$$E(Q_{i,t}) = Q_{i,t-4} + \varphi_i(Q_{i,t-1} - Q_{i,t-5}) + \delta_i$$

where:

$Q_{i,t}$  - quarterly financial results of the  $i$ -th firm in period  $t$ ,

$\varphi_i, \delta_i$  - parameters estimated using recent 20 quarters of data.

This linear regression was estimated with using the traditional method of least squares and its application could determine the forecasted financial results, expected by investors of every examined joint-stock company. Next step for every analyzed event is to calculate an error for such a constructed forecast:

$$FE_i = \frac{Q_{i,t} - E(Q_{i,t})}{|Q_{i,t}|}$$

Next, events were divided according to the following criteria:

$FE_i < -20\%$  - unexpectedly poor results,

$-20\% < FE_i < 20\%$  - results consistent with investors' expectations,

$FE_i > 20\%$  - unexpectedly good results.

Later in the article these were described as “wrong”, “expected” and “good” accordingly.

## RESEARCH RESULTS

In Table 2 the combination of empirical values, with taking the stock exchange index under consideration, is presented and shows the nature of the published financial results.



Table 2. Empirical statistics with taking the stock exchange index under consideration and the nature of published financial result.

Day	WIG20	mWIG40	sWIG80	WIG20			mWIG40			sWIG80		
				Financial result			Financial result			Financial result		
				EXPECTED	GOOD	WRONG	EXPECTED	GOOD	WRONG	EXPECTED	GOOD	WRONG
5 <sup>-</sup>	-0,43	1,27	-2,18	-0,22	0,06	-0,53	0,30	1,26	0,57	-1,42	-0,04	-1,51
4 <sup>-</sup>	-1,08	1,20	-3,60	-1,21	-0,25	-0,30	-1,22	1,09	1,72	-1,82	-0,13	-2,75
3 <sup>-</sup>	-0,95	1,48	-1,92	-0,98	-0,28	-0,29	-1,00	1,49	1,62	-1,73	0,81	-2,35
2 <sup>-</sup>	-0,02	1,08	-0,81	-1,07	0,10	1,02	-0,48	1,34	0,77	-0,71	0,60	-1,25
1 <sup>-</sup>	0,70	1,49	-0,35	-0,60	0,58	1,27	0,16	1,44	0,84	-1,59	1,46	-0,62
0	1,30	1,54	-0,23	-0,80	2,35	0,78	1,39	2,33	-0,81	-1,27	1,50	-0,71
1	1,50	0,30	-0,99	-0,24	1,97	0,89	0,70	2,30	-2,19	-1,10	2,71	-3,14
2	1,95	-0,39	-1,40	0,20	2,16	0,97	0,37	1,58	-2,36	-1,72	2,53	-3,12
3	1,80	-1,09	-2,07	0,03	2,14	0,90	0,47	1,28	-3,22	-1,80	2,57	-4,14
4	1,48	-1,32	-1,98	0,53	0,99	0,93	0,24	0,97	-3,13	-0,83	2,13	-4,37
5	1,63	-1,56	-2,60	0,98	1,00	0,82	-0,11	1,04	-3,32	-0,59	1,59	-5,04
6	1,21	-1,39	-3,13	0,60	0,70	0,68	-0,35	0,97	-2,82	-0,90	1,48	-5,52
7	1,18	-1,02	-3,10	0,24	0,86	0,81	-0,48	1,61	-2,73	-0,27	1,23	-5,75
8	1,43	-0,66	-2,66	0,29	1,21	0,84	-0,02	1,75	-2,65	-0,22	1,16	-5,03
9	1,62	-0,11	-2,63	0,53	1,01	1,11	0,49	1,96	-2,36	-0,21	0,78	-4,64
10	1,33	-0,17	-2,12	0,05	0,95	1,19	0,24	1,89	-2,21	-0,40	1,09	-3,98

Source: Own elaboration.

The research was carried out with the assumption of relevance level equal 5 per cent. When the test performed indicates that there is reason to exclude the null hypothesis on the lack of market reaction on event, the proper value of empirical statistics was written in bold italics.

When interpreting the results based solely on the criteria of size and liquidity of surveyed companies (II-IV columns), it is evident that only in case of the publication of quarterly financial results of companies in the sWIG80 index a clear market reaction to this event can be seen – so, there are grounds for rejecting the null hypothesis.

Having the second criteria in research additionally – the level of published financial result - it's easy to notice that regardless of the size and liquidity of a company, publishing quarterly financial results compatible with investor expectations does not affect any market reaction. Results of companies correspond with players' expectations and thus they do not respond to their sales announcement/ purchase of shares. The situation changes when the published financial results turn out to be surprisingly good or wrong, from the investor's point of view. In both cases a clear market reaction to the event is seen.

Considering the option in which published financial results are surprisingly good from the investors' point of view, in case of all companies there are at least two days for which the rejection of the null hypothesis has grounds, which tells us about the lack of a market reaction to this event. Unexpectedly bad financial results are not reflected in investors' behaviour and thus do not cause statistically crucial interest rate changes, obtaining only shares from the WIG20 index in their portfolio. Such a situation may be justified with the fact that these investors play long-term. Information about bad financial results for the last 3 months is not a good enough sign for them to fundamentally reconstruct their portfolios.

The conclusion drawn, based on empirical statistics, is also reflected in charts which show the forming of the average cumulative abnormal rate for companies surveyed in the 15 days event window.

On charts constructed for companies in particular indices there is a clear market reaction to the publication of unexpected financial results. An example of that may be the results' publications for companies in the sWIG80 (Figure 2).

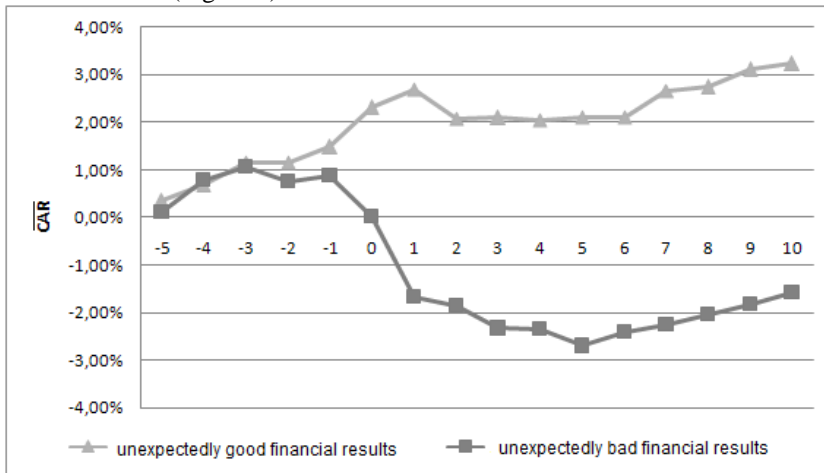


Fig. 1. Average cumulative abnormal rate of return for companies in the sWIG80 index with taking its level of financial results into consideration

Source: Own elaboration

What is particularly interesting, apart from the clear market reaction on the examined event, is that the graph shows that there is a positive dependence between the firm nature and forming of analyzed values – the decrease and negative values of the average cumulative abnormal rate of returns accompanies the publication of unexpectedly weak financial results, while unexpectedly good financial results correspond with their growth and positive values. The same trend may be noticed in case of companies in the other two analyzed indices.

The acquired results suggest that investors are able to reach positive rates of return when buying shares of companies whose published financial results proved surprising. Similarly, investors may avoid losses by selling shares on the publication day of results that proved disappointing.

## CONCLUSION

Rehearsed research revealed that the influence of publication of quarterly financial results on share prices depends on the criteria used in research. Taking into consideration only companies' size and liquidity, the publication of quarterly financial results exerts influence on share prices only in small and the least liquid companies – representing the sWIG80 index. This fact may be explained with the lack of investors' knowledge about such companies and thus the lack of clarity and



predictability. The research also revealed that market reaction to the analyzed event depends, to a large degree, from the level of financial results reached by companies. For results that correspond to investors' expectations that reaction is not statistically crucial. For financial results which are surprising from the investors' point of view the market reaction has a positive correlation with the nature of published financial results – results lower than expectations are connected with a negative average abnormal rate of returns, while results which scored higher than investors' expectations are correlated with a positive abnormal rate of returns.

Summing up, the obtained results suggest that there may be a possibility of reaching an above-average rate of returns on the Stock Exchange based on publicly available information. Investors may not only avoid losses, but also obtain profits from investment after the publication period of quarterly financial results by using the simple model of expected financial results.

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## THE ANALYSIS AND PROCESS OF INVENTORY REDUCTION IN COMPANIES

**Abstract:** Stocks are one of the most important elements in every production organization. Experience shows that reduction of stocks leads to increasing productivity. That is the reason why low stock level is a good indicator of an economically sound company.

**Keywords:** Inventory analysis, inventory quality ratio

### INTRODUCTION

Nowadays many companies are trying to find possibilities for how to reduce their stocks in the most effective way. There are some measures that lead to inventory reduction [7]:

- reduction of acquisition costs
- cooperation with suppliers
- reduction of stock levels
- application of pull system equipment
- reduction in the number of production stages
- reduction of disposition cycles
- reduction of transport times
- differentiation of customers
- cooperation with key customers
- Implementation of new inventory software.

The first step in the process of inventory reduction is performing an inventory analysis. Inventory analysis is divided into two parts [7]:

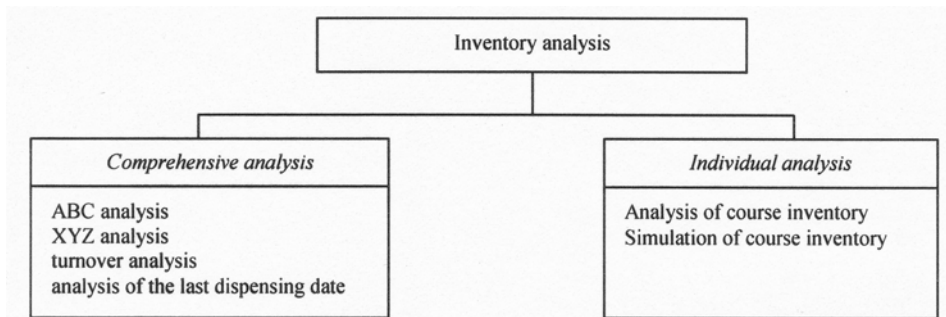


Fig. 1. Inventory analysis [based on 7]

### PROCESS OF INVENTORY REDUCTION

Inventory Quality Ratio – is one of the most effective tools for inventory reduction. IQR classifies the quality of inventory, so the company may target the problem areas. The main role of IQR is to separate good inventories from bad ones.

This method was developed by 35 materials managers to reduce inventories in their companies by 20% to 40 per cent [4].

The inventory quality ratio is the ratio of the active inventory dollars to total inventory dollars.

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$$IQR = \frac{\text{active inventory dollars}}{\text{total inventory dollars}}$$

The inventory quality ratio's lean logic is shown in Figure 2. The inventories in the diagram are divided into 3 groups [6]:

- items with future requirements
- items with no future requirements
- items with neither.

The items in these groups are stratified into typical ABC-type classifications based on their future dollar requirements (ABC), their past dollar usage (DEF) or their current dollar balances (GHK). The dollars of each item are categorized as Active (A1,A2), Excess (E1, E2,E3), Slow Moving (SM) or No Moving (NM). These are called inventory quality categories [4], [8].

The ideal value of the IQR would be 100 per cent. In case of using generous inventory rules of 4–12–24 weeks of supply for A-B-C items, the range of the IQR in most manufacturing companies is about 30–40 per cent. This means that maybe 60 per cent of their inventory dollars are tied up in excess, slow or no moving items. Slow inventories and no moving inventories account for about 10 per cent of the dollars and one category, Excess 2 (E2), typically accounts for 30 to 50 per cent of the total inventory dollars. This model can be also adapted to some MRP and ERP systems [4], [8].

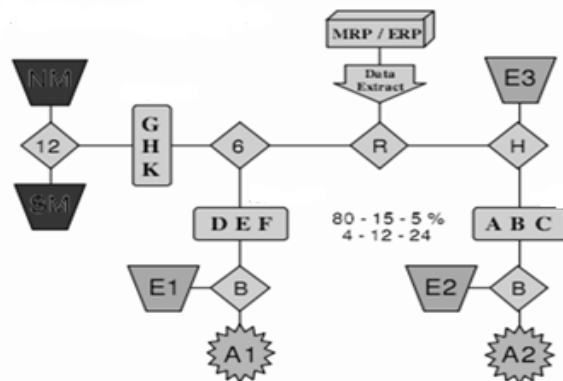


Fig. 2. Inventory Quality Ratio [based on 8]

## CONCLUSION

Inventory reduction requires the realization of complex and systemic measures that interfere with all areas associated with the implementation of material flow. A key goal of inventory reduction is to introduce measures that will increase flexibility in a company and improve the logistics chain.

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## **QINS: A QR-CODES BASED INDOOR NAVIGATION SYSTEM FOR MOBILE MARKETING**

**Abstract:** Nowadays mobile marketing has a variety of forms. Existing solutions are insufficient to present the customers with desired content depending on their current location inside a large area building. The paper is devoted to a system solving the indoor navigation problem for mobile marketing. Existing indoor navigation systems are characterized. The idea of QR codes is presented in context of mobile marketing solutions and their effects are given. The proposed system is based on the QR code scanning technique as a new mobile marketing solution, which reaches the customer in an interactive way.

**Keywords:** QR-code, indoor navigation, mobile marketing, smartphone.

### **INTRODUCTION**

The number of smartphone users is continuously growing. According to the forecast of the International Data Corporation (IDC) [1], approximately 1 billion phones will be sold worldwide in 2015. Smartphones play a significant role in marketing communications, making it more efficient. According to the survey conducted by Google [2], 79 per cent of smartphone users use a smartphone when shopping to compare prices or to learn more about the product, 71 per cent of smartphone users search the information using a smartphone under the influence of advertising, 82 per cent of smartphone users notice mobile advertisements and half of them take any action, while 35 per cent of them visit the site and 49 per cent of them make a purchase.

Mobile marketing is a continuously growing trend in marketing communications. In [3], mobile marketing is defined as “any marketing activity conducted through a ubiquitous network to which consumers are constantly connected using a personal mobile device”. The main advantage of mobile marketing is a personalized and immediate way to reach a target audience. The interaction with the customer is flexible and active, leading to a high level of efficiency.

Over the years, mobile marketing has adopted a variety of forms. The most common are short message service (SMS) and multi-media message service (MMS). Proximity marketing allows advertisements and messages to be served to customers encompassing their cell phone location with the help of Bluetooth or wireless technologies. Location-based marketing allows multi-media content to be delivered to customers depending on their location via the GPS technology. Pay per call mobile (a.k.a. click-to-call) is a form of mobile marketing, where mobile advertisement has the form of a phone number the customer can select and make a phone call, without having to dial the number manually. Voice marketing is voice broadcasting of pre-recorded messages to the customer. Finally, mobile banner advertisements are banner advertisements fit to the sizes of a cell phone screen.

Large area buildings such as shopping malls or fairs are examples of areas in which mobile marketing is applicable. Currently, visitors of large buildings who want to find a shop or a stand have to be supported. GPS-based navigation solutions cannot work inside the buildings because the satellite signal is not available. In shopping malls a list of shops and their locations is displayed, sometimes their whereabouts are indicated on the shopping mall map. The map comes in the form of an interactive map on a big LCD screen, a paper map or simply a printed and hung large poster in a showcase inside the building, not necessarily at the entrance to the shopping mall. A problem arises if the customer wants to reach an interesting shop inside a large area. It is troublesome, especially if the customer is going to visit many places and buy only listed products. Moreover, the

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customer would like to be informed about current shop offers and promotions in the proximity of his or her current location. Posters in the shopping mall only show static content, not allowing retailers to inform customers about the latest established offers and promotions. To overcome the above problems, a new solution is needed.

The aim of the paper is to present an innovative use of QR codes for mobile marketing, which solves the common problem of indoor navigation in large area buildings. On one hand, it helps the customer to find a destination point in the building. On the other hand, it helps to improve customer relations, reach them in a faster way and increase service quality. The paper answers the question on how to fit mobile marketing into an indoor navigation system, while offering the customers a dynamic exchange of messages about current shop offers and promotions. Information presented to the customer is associated with his or her current location and with the main goal of facilitating the course of shopping.

The remainder of the paper is organized as follows. In Section 2 an example of a scenario is described in the context of the presented problem. In Section 3 related works concerning indoor navigation and mobile marketing are presented with examples of QR codes use. Section 4 is devoted to QINS: a QR-code based indoor navigation system for mobile marketing, taking into account its architecture, main functions of the system and an example of the application of the system. Section 5 concludes the paper and describes future works.

### **ILLUSTRATIVE EXAMPLE**

The following scenario aims at illustrating a typical situation related with indoor shopping and associated problems.

1. The customer (Mr. John) enters the shopping mall. He wants to buy a new T-shirt, if possible taking advantage of a special offer. Before he finds the interesting shop, he wants to find a list of all available clothing stores in the center. He asks other customer how to find a shopping mall map. He is informed that the shopping mall map is next to the information point distant from the entrance to the shopping mall.
2. Mr. John goes to the information point to see the shopping mall map. He reads about shops, events, promotions, previews the shopping mall map and finds several potential shops. Finally, he decides to go to one of the shops localized in the center - a ZARA shop, which corresponds to his demands. He must note or remember the location of the ZARA shop. He takes notes and starts to walk. It is worth to note that the desired shop may be right next to the entrance to the shopping mall.
3. Walking through the shopping mall, Mr. John sees a lot of posters about shops, their offers and promotions (sometimes many offers are displayed on LCD screens located in many places), but unfortunately not associated with the product he wants to buy. From time to time he asks other customers if he is going in the right direction. In most of the cases the answer is insufficient.
4. At some point he wants to buy a beverage or he may remind himself about other products. He cannot establish his current location and find the right path to the destination points.
5. Mr. John finally reaches the ZARA shop and buys the chosen T-shirt. Because of the rush, he does not notice many shop opportunities.

Mr. John has encountered the following problems during his shopping trip: 1) localization of the potential shop, 2) navigation in the large area of the shopping mall, 3) finding only interesting information among an overload of data being shown to customers, 4) buying other interesting products or using shop promotions.

### **RELATED WORK**

In large area buildings a GPS signal is not available indoors. Indoor navigation systems are considered much more challenging than outdoor navigation ones. Many researchers have proposed indoor navigation solutions. Most of the currently used techniques [4] are: 1) electronic sensor-based solutions, i.e. measuring the distance between a tag and an ultrasonic receiver based on the

time of the ultrasonic pulse motion to calculate the position of the tag, 2) Radio Frequency Identification (RFID)-based solutions with 2m accuracy respectively, 3) indicating a location on the basis of the last known GPS location measurements of the accelerometer, barometer and gyroscope, 4) using Wi-Fi network triangulation or 5) triangulation based on a signal from a cellular network of base transmitters. Most of the mentioned solutions are time-consuming and require extra installation or/and additional tools.

A modern indoor positioning solution was introduced in 2010 as the Shopkick application. Shopkick is based on a high-pitch frequency that cannot be heard by humans, but can be picked up by a microphone on the mobile phone to locate the user's current position inside a store [5]. Audio emitting devices or small transmitters are placed in each store in the shopping center. Consumers receive rewards and exclusive deals at Shopkick's national retail partners simply for walking into the stores. Although the presented solution connects method for indoor positioning with a marketing campaign, it does not support indoor navigation.

Smartphones today are equipped with high-quality cameras and lower fees are charged for data sent over the network. It creates an opportunity for new kinds of advertising in the form of QR codes [6]. QR codes can be easily read by QR code scanners by using an in-built smartphone camera. According to [7], the QR (Quick Response) code is a 2-D (two-dimensional) matrix code developed by the Japanese company Denso-Wave in 1994 with the main objective of "Code read easily for the reader". In comparison to the traditional bar code, the QR code is able of encoding the same amount of data in approximately one-tenth the space of the traditional bar code (cf. Figure 1). An example of the QR code is shown also in Figure 1, and it stores a string containing the title of this paper.

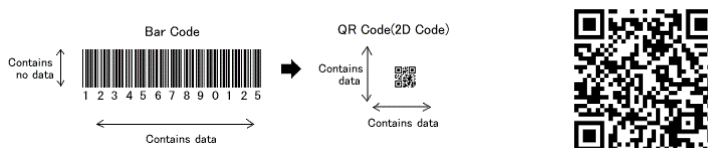


Fig. 1. Comparison of traditional bar code and QR code with an example

Source: QR code webpage [7]

In 2000 the QR code standardization was approved as an ISO international standard (ISO/IEC18004). More information about QR codes is available in [7].

Over the last years QR code usage among smartphone owners has been greatly increased as one of the mobile technologies. According to the survey conducted by Forrester [8], three-quarters of American online retailers use QR codes in their marketing activities. The study conducted by comScore [9] proves that QR code usage among European smartphone users almost doubled over the past year. As it is shown in Figure 2, the number of users scanning QR codes is still increasing, especially in Spain, which is the fastest growing European market but also the second biggest market in terms of penetration of QR codes. Germany is ranked first for scanning QR codes with 18.6 per cent of users, but still giving the leadership to the United States and Japan, where scanning QR codes is the most intensive.

According to the second graph in Figure 2, almost three-quarters of QR code scans are aimed at obtaining product information (called mobile tagging [10]), making this the most popular type of QR code scans across Europe and America. An example of using mobile tagging in mobile marketing is a project called "Favorite Places on Google" proposed by Google in 2009. The project involved about 100 thousand local businesses and venues in the U.S. The advertisers have integrated a communication tool into mobile phones. The owners of the shops tagged their premises with unique QR codes, which the passers-by could use to retrieve more information about the store, read reviews, and mark the shop as a favorite one - all this supported by Google maps.

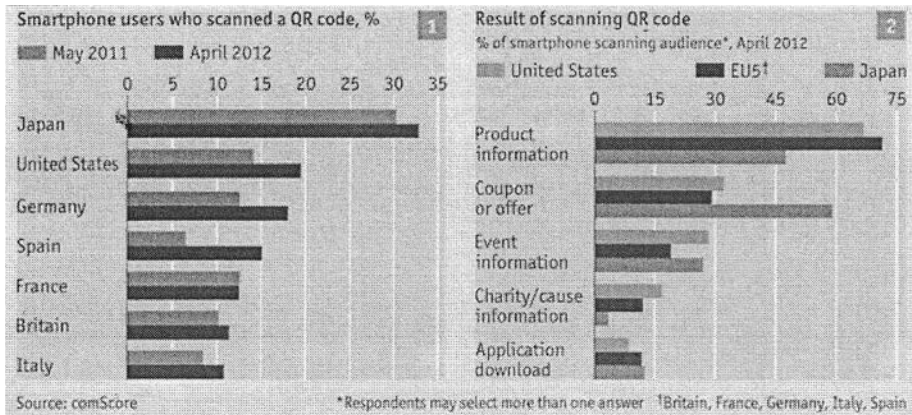


Fig. 2. Statistics of QR codes use

Source: comScore [9]

By contrast, in Japan the smartphone users scan the QR codes mostly to download a discount coupon or a special offer. Mobile couponing [10] is an example of such projects and describes the way of gaining coupons via mobile phones.

Mobile payments have been commonly adopted in the U.S. and they have been used especially in bank transfers over the web. An example is the LevelUp application applied to payments for offered services, e.g. in restaurants. After the scanning of a generated QR code, the required fee is charged based on previously entered personal customer data into the application [11].

In [4], an indoor navigation system has been proposed with the assistance of QR code scanning extended by AR (Augmented Reality). The author uses QR codes to determine the user's current location and navigate him to the internal Point of Interest (POI) in areas such as museums or exhibition centers. The presented solution does not provide the user with visualizing the desired point on the map and a path to this point. The user must use extra in-built mobile phone tools to find his or her destination, i.e., sensors such as a digital compass, camera and accelerometer. In addition, there is no marketing support in such solutions, e.g., retrieving service information about collaborating POIs with user's current location or offering promotions to the user.

The presented marketing initiatives involving QR codes brought surprisingly big gains. But, they do not solve the common problem of indoor navigation in large area buildings. To sum up, there is no holistic solution that takes into account two aspects: indoor navigation and a dynamic exchange of messages relating to the user's current position.

## THE QINS SYSTEM

The QINS system proposed in this paper is a QR-code based indoor navigation system supporting mobile marketing. The target audience (potential customers) of the QINS system includes mainly: shopping centers, fairs, airports and other large areas where an indoor navigation solution is desirable. The system is currently under deployment in the Shopping, Arts and Business Center in Poznan (Poland).

## ARCHITECTURE

The architecture of the QINS system is based on the following components.

1. Each shop, statue, landmark or other POI in the shopping mall is labeled with a QR code with the main goal of indicating its position on an interactive map and scanning at any moment the customer is walking through the shopping center. The QR-code is associated with the unique number of the POI, complete with coordinates which are essential to locate the POI on the map

available in the application. By means of a unique number the POI is associated with its products, promotions, news, offers, etc.

2. Store managers or other dedicated persons are responsible to update data associated with the given store. They use an internet portal to publish up-to-date information. Only authorized persons can access the web interface of the portal.
3. The visitors access the QINS system via a dedicated application. The application can be downloaded by scanning a QR-code containing the link to the installation version. The QR code is placed on the main doors to the shopping mall.
4. A system administrator has the full set of rights and he is the main manager of the system. The administrator gives rights to store managers, allocates the data space each store can contain, decides about which news and promotions should be featured and displayed on the introduction screen of the application.

## MAIN FUNCTIONS

The system has the following functionalities.

1. Fast and easy offline navigation and moving in the shopping mall using QR codes. To use this function a user chooses the QR CODE SCANNING option from the main menu of the application (a screenshot of the main menu is presented in the Figure 3). Then, the user scans the given QR code and afterwards a path to the desired point is printed for the user.
2. Search of desired POIs such as stands, shops, information points, cafes, toilets, etc (SHOPS option). The user can choose one of the categories of shops and the shop of interest from the provided list and find information about its products and offers. Access to electronic versions of the shop catalogues is available.
3. Quick localization of POIs on an interactive map (MAP option). The user can preview an interactive map by browsing different levels or different localizations on the given level to find the desired POI.
4. Access to information about current promotions of shops and news (*PROMOTIONS* option). The most noteworthy news and the best offers of stores are listed for the user.
5. Access to information about current and upcoming events/fairs (*EVENTS* option). All the information is sorted by date with particular reference to the biggest events.

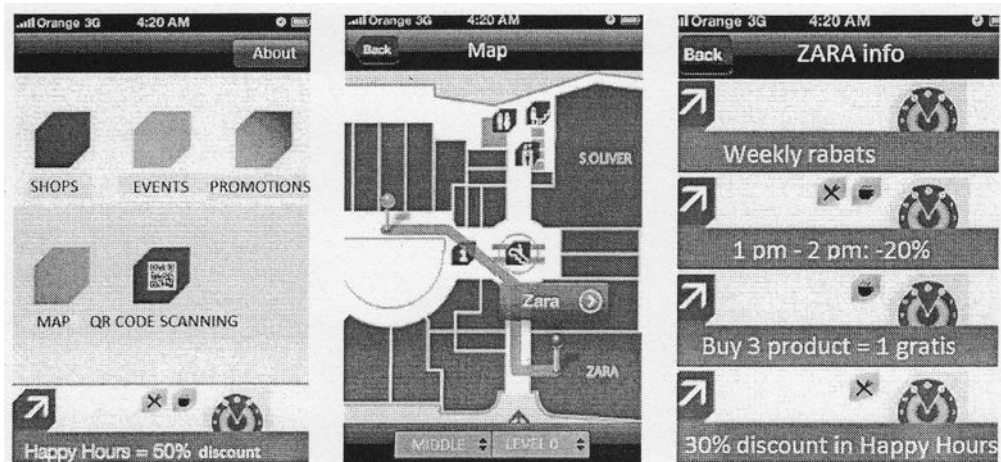


Fig. 3. Starting from the left: Main menu of the application (1), User localization on the interactive map and path to the destination point (1), Information about store promotions (3)

Source: The maps are from [12]

## **APPLICATION OF THE QINS SYSTEM**

The mentioned functionalities are presented below in the form of the system usage scenario with Mr. John (cf. Section 2) and related screenshots from the application. The scenario is as follows.

1. Mr. John enters the shopping mall and is at the entrance. First, he installs the application and enters the main menu of the application. At the bottom of the screen the advertisements about current featured discounts and promotions are moving at an alternate pace.
2. Mr. John previews available products by entering certain phrases in the search box displayed in the application. He decides to go to a ZARA shop, which corresponds to his demands. The application notes that fact and is ready to be used as an indoor navigation system to help Mr. John walking through the shopping mall.
3. Mr. John chooses the QR CODE SCANNING option and scans the nearest QR code in the shopping mall. He is localized in a given point on the map – this position has been indicated on the map (in the form of a green point). Then, a path to the destination of the ZARA shop is drawn (cf. (2) in Figure 3). For the purpose of the example, a very easy path has been drawn. Of course, much more complicated routes can be displayed on the mobile screen taking into account multiple store levels. On one hand, there is no doubt about it that it takes more time to reach the final point. But, on the other hand, the user can scan other QR codes during his/her walk to find out his/her current position. Thus, all the time the user is obtaining information about promotions, news, etc. related to the QR code which was just scanned. It is also worth to mention that every moment Mr. John can change his destination POI. He can do that by choosing a point both on the interactive map and from the list of all POIs chosen from the main menu.
4. At the time Mr. John reaches the final place, he scans the QR code associated with this place. The application notes that fact and is informed that he is at the desired location. One more time, but now on the full screen, all the promotions and discounts of the given store are presented to Mr. John (cf. (3) in Fig. 3).

Mr. John spends much less time using the QINS system than earlier and he does not face the problems occurred in the scenario presented in Section 2.

## **CONCLUSIONS**

The main contribution of the paper is introducing a new holistic solution that takes into account two aspects. On one hand, the main advantage of the proposed system over existing solutions is an approach to computer support for indoor navigation. It refers to navigation of customers in the large area buildings where a GPS signal is not available. On the other hand, the system offers customers a dynamic exchange of messages about current shop offers and promotions relating to the user's current position. The result of such mobile marketing could increase the total sales of retailers. The shopping malls providing such solutions could become more popular, have more customers, and thus have significantly higher profits. The solution improves customer relations and reaches them in an interactive way. It has been shown that a combination of the technical capabilities of the constantly evolving mobile technology and marketing innovation meets the customers' requirements.

It is planned to examine the effects of the system implementation in the Shopping, Arts and Business Center. Among the future works, quantitative and qualitative information is going to be analyzed concerning the number of customers using the QINS system, indicating the most useful parts of the QINS system and parts of the QINS system to be improved. Moreover, introducing user profiles to the system is planned to present them with only chosen products and categories. Extending the system to other platforms is also considered. In the future the application is expected to support the three most popular mobile application stores: App Stores iPhone, Google Play and BlackBerry App World.

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## **CONSUMER REVIEWS PUBLISHED ON THE WEB. AN ATTEMPT OF SYSTEMATIZATION OF THE SUBJECT**

**Abstract:** Thanks to Web 2.0 phenomena consumers have gained the ability to easily publish their opinions about products on the Web. Still, there is a lack of publications that would bring some systematization to the subject thus enabling a better understanding of the field and making further analysis and research easier. This article presents an analysis of twenty existing consumer review-enabled web portals in order to propose such systematization and provide a reference point for further research. Also, a short introduction to the problem of opinion summarization is presented.

**Keywords:** Customer reviews, Web 2.0, consumer decision making

### **INTRODUCTION**

Internet is the natural medium for publishing and retrieving opinions about products. Thanks to Web 2.0 phenomena a significant increase of user engagement in creating content in the Web can be observed, which is being realized using such solutions as wikis, blogs and other systems built according to the rules of the so-called architecture of participation [6]. Based on this, a new category of so-called consumer reviews has appeared. Such reviews can be defined as opinions concerning certain goods or services formulated by consumers (who usually are not experts in the field upon which the opinion is stated) and published on a web forum, web page of an e-commerce portal or other pages that allow posting such content [4]. Such reviews may concern the whole product or individual aspects of it. Also, they are sometimes published on the same web sites as professional reviews written by critics, professional testers or editors of the portal, but these two types of reviews are usually clearly separated from each other (for example, they are published in different sections of the portal).

A great number of research has been conducted on analyzing the impact of such reviews on consumer behavior - and it revealed the increasing role that such reviews are playing in consumers' purchasing decisions. Still, there is a lack of publications that would bring some systematization to the subject. This article is an attempt to fill this gap based on the analysis of existing web portals which enable users to publish and receive reviews. The article is structured in the following manner. First, the scope of analysis and research methodology are described. Then, a short overview of available research on the impact of customer reviews on purchasing decisions will be presented. Next, a proposed systematics of the web portals which allow publishing and retrieving customer reviews is presented. Additionally, a short overview of existing research on the influence such reviews have on decisions made by customers will be presented. The article concludes with final remarks.

### **SCIENTIFIC HYPOTHESIS**

The hypothesis behind the paper was that the subject of consumer reviews can be described using some developed systematics. Such systematics could bring additional understanding of the field and make future analysis easier. In the remaining part of this section a detailed description of the conducted analysis is presented whose goal was to develop such systematics.

#### ***Subject of analysis***

The article aims to analyze existing web portals in order to:

- identify types of web sites that allow publishing and retrieving of opinions;
- describe common features of such web portals;

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- identify means through which such opinions can be expressed.

### ***Scope of analysis***

The analysis presented in this paper was conducted based on twenty web portals which provide the feature of publishing and retrieving customer reviews. It was conducted in September and October 2012 and reflects the state of these portals in this period. In terms of territorial scope particular focus was paid to portals whose main market is Poland or at least have Polish-language versions. Only in two cases non-Polish language sites were included in the analysis.

### ***Description of research methodology***

The analysis, that this paper is a result of, was conducted in the following way. Firstly, a detailed literature study has been conducted, which gave us an overview of the subject matter. Based on that a list of web portals enabling the publishing and retrieval of customer opinions has been prepared. The portals that were to be included in the list were identified using the Google search engine and similar search engines, such as *pl.similarities.com*. When establishing such a list we applied the following two guidelines:

- the portals should be different from each other in as many aspects as possible to represent a broad spectrum of approaches to the use of customer reviews;
- if possible, for all portals mentioned in the literature, Polish portals with similar features were searched for - as our research is focused on the Polish market.

The list contained 20 such portals. Next, each portal on the list was thoroughly analyzed. The author identified what such portals have in common and in which features they may differ.

## **DETAILED DESCRIPTION OF THE RESEARCH ISSUE OR RESEARCH RESULTS**

### ***The impact of reviews on economic decisions of customers***

In paper [1] three psychological factors are identified which make consumer reviews particularly influential on consumer behavior:

- in theory, the authors of consumer reviews have no interest in publishing false information;
- in case of messages received from a sender who which has something in common with the recipient, the recipient perceives the message as more relevant; in this case, such a similarity is the fact that both the sender and receiver are regular consumers;
- consumer reviews often contain descriptions of real world situations or refer to personal experiences of the author. Messages containing such elements often attract readers' attention and induce their empathy with the author, thus causing emotional "contagion" [1].

A number of research has been conducted in recent years, which confirmed the increasing role of consumer reviews in the consumer decision-making process. In paper [7] 30 publications were enlisted which proved the significant economic effect of the so-called polarity of reviews (the word 'polarity' concerns the fact whether the overall opinion about a product was negative or positive). At the same time, however, seven publications were enlisted that did not confirm any relationship in this area [7].

From among the published studies it is worth to mention the following results.

- 70 per cent of Internet users trust the opinions of unknown persons published on the Internet, while in case of opinions expressed by one's friends this value reaches 90 per cent. Both these values are higher than other forms of encouragement to buy (for example, different types of advertisements) [8].
- Among those planning to travel and analyzing customer reviews during their planning process, from 25 to 33 per cent of the respondents admitted that they decided to change their hotel stay based on such reviews [3].
- Almost a quarter of respondents who were Internet users said that they had analyzed online customer reviews also before purchasing products offline; at the same time, for products with high average opinion rates, consumers are willing to pay an average of 20 per cent more [5].



It should also be noted that, based on existing research results, the impact of consumer research on a specific person depends on his or her characteristics, such as experience in browsing the Web and demographic traits, for example age [3]. Additionally, reviews have a different impact on consumers depending on the subject they concern. In paper [3] it was found that consumers who are planning a holiday trip pay much more attention to reviews of hotels than to reviews of restaurants or touristic attractions.

### ***Types of review-oriented services***

An opinion on some product can be expressed through any type of communication means available on the Web. Still, opinions are usually expressed on one of several types of web portals. Below we propose a categorization of such portals and provide a short description for each of these types with examples of web portals which belong to the given category.

**Theme portals.** Such portals focus on a specific type of goods or services, such as books ([lubimyczytac.pl](http://lubimyczytac.pl)), movies ([filmweb.pl](http://filmweb.pl)), restaurants ([gastronauci.pl](http://gastronauci.pl)) and hotels ([pl.tripadvisor.com](http://pl.tripadvisor.com)). The range of such focus can be different (on [gastronauci.pl](http://gastronauci.pl) shares reviews only of restaurants, while on [tripadvisor.com](http://tripadvisor.com) there are additionally reviews of hotels). For users such portals can be considered as a knowledge base concerning a given subject, containing not only reviews but also other types of content, like news, interviews with people important in the field (like book authors on [lubimyczytac.pl](http://lubimyczytac.pl)), etc.

**Review portals.** Under this category we list portals which focus solely on publishing and retrieving reviews, while the range of goods and services under review is usually very broad (these portals do not focus on any specific category of products). In Poland, important portals in this category are [cokupic.pl](http://cokupic.pl), [opineo.pl](http://opineo.pl) and [znam.to](http://znam.to).

**Price comparison services.** The goal of such services is to aggregate information about product prices from many shops. On some portals of this type it is also possible to publish reviews of both products and shops for which the prices are compared. Here it's worth to mention the portals [ceneo.pl](http://ceneo.pl) and [skapiec.pl](http://skapiec.pl), which both have advanced review functionalities.

**Online shopping portals.** Currently, more and more portals enable customers to review products which they have in offer. One of the pioneering portals of this type is [amazon.com](http://amazon.com). In Poland, good examples of such portals are [merlin.pl](http://merlin.pl), [empik.com](http://empik.com) and [komputronik.pl](http://komputronik.pl).

**Online auction websites.** Portals of this type usually have features for assessing the credibility of buyers and sellers, which aims to help its users to learn whether the given partner can be considered reliable and whether it is safe to conduct business with him. After the transaction both sides express opinions about each other. Such opinions may concern the compliance of the product with its description, ease of communication, time of delivery, etc. System of this type exists on, for example, [allegro.pl](http://allegro.pl).

**Producer websites.** Sometimes, companies enable the on-line feature of reviewing their products directly on their own website. In such situation customers who own products of the company are asked to publish their opinion about the product or about the whole company. It's worth to mention that many pages allow customers to fill out forms in which they express their opinion concerning the products or the company, but very often such opinions are not available to other users but instead serve only as a feedback for the company itself. Also, some companies publish only selected reviews. Still, there are some companies which publish all reviews posted by customers. Such a company is, for example, Panasonic ([www.panasonic.co.uk](http://www.panasonic.co.uk)).

**Web forums.** Discussions on web forums often include expressing opinions about certain goods or services. Such forums can be connected to theme portals, giving its users an additional opportunity for publishing their opinions. On Web Forums there are often separate sections concerning reviews (for example, the book reviews section on the forum <http://ebooki.linuxpl.com/>), or even sometimes whole forums are dedicated mainly to publishing reviews (for example, the movie review forum [www.forum.filmowo.net](http://www.forum.filmowo.net)). Usually on such forums the thread begins with a review of a product, followed by a discussion concerning the product under



review or the review itself, with reviews from other users, perhaps presenting a different view on the subject.

Blogs. Consumers may also publish their opinions concerning products on blogs. There are specialized blogs devoted to reviewing specific types of products. Still this category differs significantly from the ones described above, as on a single blog usually only a few people may publish their opinions. Moreover, in this case it is difficult to say with confidence whether these are indeed customer and not professional reviews, which are beyond the scope of this paper.

### ***Common features of opinion-oriented services***

In the previous section we have discussed many types of portals that allow customers to publish their opinions on products. In addition to the proposed systematics, such portals have different additional characteristics that are worth discussing.

First, it is worth to note that portals differ in terms of range of products that may be reviewed. Apart from the fact that it can be wider (for example on review portals such as [opineo.pl](http://opineo.pl)) or narrower (e.g. only books at [lubimyczytac.pl](http://lubimyczytac.pl)), another dimension here concerns the closeness or openness of the list of products under review, by which we mean that on some portals users can edit such lists, while on others it is not possible. For example, on web forums ([forum.filmowo.pl](http://forum.filmowo.pl) and [ebooki.linux.pl](http://ebooki.linux.pl)) users create threads named by the title of the movie or the book that is to be reviewed, so there are no restrictions here. Similar is the case of the website [filmweb.pl](http://filmweb.pl), where users can add a record about a movie to the database and then publish a review of it. On the other hand, on a number of portals (such as price comparison services, online shopping portals or producers' websites) such possibility does not exist.

Portals differ also in means of relationship between the portal and products under review. This dimension can be understood in terms of the role of customer reviews in the business model of the site. On one hand, reviews can be treated as content attracting readers to the portal. This is the case for many theme portals and price comparison services (like [lubimyczytac.pl](http://lubimyczytac.pl) and [ceneo.pl](http://ceneo.pl)). In such cases revenues may be derived from sources such as advertising. Another important goal of providing reviews' functionality is to increase the credibility of the portal. This can be the case for producer websites, online stores or online auction sites. Reviews may also be used to increase the usability of the portal; for example, online shops may enable users to search the catalog of products and services using advanced filtration mechanisms based on reviews including, for example, restricting search results to items for which customers rating is at least at a certain level.

Another interesting thing about such portals is that published user opinions may be subject to verification by the editors of the portal. For example, on the [gastronauci.pl](http://gastronauci.pl) portal all reviews published on the site are analyzed for their constructiveness. Also, the owner of a restaurant under review may request the removal of a review if it contains false or misleading information. In case when the information can be objectively considered false, such request is fulfilled. Also, such verification of a review may be performed by other users who can rate reviews, as in the case of the [filmweb.pl](http://filmweb.pl) portal, where it is possible to state whether the review was helpful or not.

### ***Ways of expressing opinions***

In this section the identified means through which users may express their opinion will be discussed. It's worth to mention that on many portals several means described below are offered simultaneously and in such situation consumers may express their opinion in several ways. The opinion may concern whole products or their individual aspects.

Stars rating. On many different portals (for example [cokupic.pl](http://cokupic.pl) and [amazon.com](http://amazon.com)), users are encouraged to assign a specific rate to the products. This functionality is often visualized in a form of stars (usually five) and users may express their opinions by clicking one of the stars representing a specific rate. Such rates can be assigned also to specific aspects of products. In this system the aspects which the user can rate are predefined, as is the case with the [gastronauci.pl](http://gastronauci.pl) portal, where users can rate the following aspects: food, décor, service and price/quality ratio.

Do you recommend this product? This is the simplest form of expressing one's opinion on a product, in which the user states whether the product is worth recommending or not. It can be understood that if a user's opinion of the product is positive- he will state that it is worth recommending; and if negative - he will choose the option indicating he or she doesn't recommend it. Thus, it can be treated as a special case of the stars rating method, with only two possible values – positive or negative. This type of opinion expression is available, for example, on the cokupic.pl portal.

Advantages and disadvantages. Opinions may also be expressed in the form of a list of advantages and disadvantages. The actual values in each of these categories can be either arbitrary, as in the case of e.g. the ceneo.pl portal (where the user may enter any comment expressing an advantage or a disadvantage), or selected from a pre-defined list of options attached to the product type on the product list. For example, on the cokupic.pl portal in the category of Computer Games / PC Games the possible advantages, among others, are "easy to learn" and "intriguing storyline" (in total there are 11 possible traits) and from among disadvantages users may select items such as "boring" and "no multiplayer option (a total of 8 possible disadvantages is defined).

Textual description. By description we mean simply a text written in natural language, without a fixed structure, in which the author expresses his opinion on the object. Such texts may be of varying length, written in a different styles, focusing on different aspects of reviewed articles, etc. A list of advantages and disadvantages with no specific predefined options, where the user inputs a list of arbitrary text strings, can be considered as a special form of textual description.

Other. Reviews can also be published in other forms. For example, a more and more popular form of reviewing products is the publishing of short videos, for example, posted on the website youtube.com. This type of review, however, is used more often in the case of expert reviews, for example, on the site cnet.com. Analysis of these expressions of opinion, however, remains outside the scope of this article.

### ***Summarizing opinions***

In the case of many existing reviews on a specific product it may be very difficult for a consumer to process them all and get a clear picture of the product. This is an example of the well-known phenomenon of information overload [2]. In such case, some mechanisms must be deployed to automatically summarize reviews. Based on this users may receive an overview of opinions on the product.

Depending on the method in which the opinion was expressed, such summarization may be either simple or difficult. Star ratings can be easily summarized, for example, by counting the mean value of ratings given by all reviewers. Also, a distribution of ratings may be presented to the user (showing how many per cent of reviewers gave a specific rating). Similarly, in case of the method in which a user states whether he or she recommends the product, statistics can be determined on the percentage of users who gave a positive rating (or, in other words, who consider the product as worth recommending).

In case of expressing opinions as a list of advantages and disadvantages, the summarization method depends on whether the list of possible pros and cons is fixed or not (that is, whether there is a pre-defined list of possible options attached to a specific product). In case when it is fixed, it is easy to prepare summaries so that readers can quickly learn the most frequently mentioned advantages and disadvantages of the product simply by counting how many users selected the given advantage or disadvantage.

Still, the summarization task becomes much more difficult in case of textual descriptions. To perform this task natural language processing techniques must be used: this constitutes an important research problem. The field of study focused on this area is called sentiment analysis or opinion mining [7].



## CONCLUSIONS

In this paper an attempt was made to bring some systematics to the area of online consumer reviews. It was based on the analysis of twenty different review-enabled web portals. Apart from identifying and discussing different categories of such web portals, identified methods of opinion expression were also presented. Moreover, a short introduction to the problem of opinion summarization was presented. The author plans to conduct further research in the area of automatic summarization of opinions written in the Polish language to enable summarization of such reviews.

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## **TRANSFORMATION OF THE ECONOMIC RELATIONS BETWEEN THE PRC AND THE US AND THE EU**

**Abstract:** China experienced over the last three decades a very rapid economic growth and has become the second economy in the world and the largest exporter. This paper describes the changes in the international balance of power caused by the development of the Middle Kingdom. The research allows to identify further trends and factors that determine the distribution of spheres of influence in the world.

**Keywords:** China, economic relations, the US, the EU, the economic crisis

### **INTRODUCTION**

Taking into consideration principal indicators of economic and social development - GDP growth and the level of HDI, one can see a clear difference between China and the developed countries. China is trying to reduce the backlog in many areas in relation to the West. China's economic growth, ongoing for many years, continues to amaze observers around the world [1]. The last global financial crisis showed the strength of the Middle Kingdom and deepened the network of relationships between the PRC and developed countries, while the world economy clearly slowed down.

In order to investigate the nature of the relationships between the PRC and developed countries, the research is focused on its major economic partners - the European Union and the United States.

### **IMPLICATIONS OF CHINA'S ECONOMIC EXPANSION FOR THE EUROPEAN UNION**

The growing strength of the PRC raises concerns among some European countries, but the obvious fact is that the European Union needs the Chinese market for further development. This situation determines the current shaping of the political and economic relations that have deepened significantly in recent years.

The most important position in China's foreign policy is still reserved for the United States, but after the US, Europe is a priority. China shapes the relationships with the EU based on three principles: maintaining positive relationships - both with the entire European Union and its individual members; the constant observation of progressive integration processes; encouraging the EU to become independent from the United States [2]. China's strategy towards the EU reflects previous efforts of the Middle Kingdom to build a real world power. Only a favourable international environment can enhance the economic, military, scientific and political position of the PRC.

The European Union's policy towards China and the entire region of Asia is primarily related to the strengthening of Europe's role in the region and continuing the construction of the relationships based on annual meetings of the two partners and bilateral agreements. The European Union is trying to support the development of China by assisting in the implementation of management standards with an emphasis on respecting human rights and the principle of sustainable development.

Trade relations between the EU and the PRC do not have a long history. Just the period of two decades was enough for the EU to become the largest market for Chinese goods. The Middle Kingdom became at the same time also the fastest growing market for EU exports (Table 1).

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Table 1. The share of China in imports and exports of the European Union in years 2000-2010 (%)

	2000	2005	2008	2010
Import (%)	7,5	13,6	16,0	18,8
Export (%)	3,0	4,9	6,0	8,4

Source: Eurostat database [3], UN Commodity Trade Statistics Database [4]

In trade, a permanently negative balance of foreign trade of the European Union with the PRC is observed. China is the EU's main supplier of integrated circuits, textiles and garments and telecommunications equipment (Table 2).

Table 2. The share of import from China in the total import of the European Union: distribution of selected product categories in years 2000-2010 (%)

2005	2007	2009
Telecommunication equipment		
14,8	19,6	20,7
Integrated circuits and electronic components		
4,1	8,4	15,2
Automotive products		
1,0	1,2	1,5
Iron and steel		
1,4	5,4	2,2
Agricultural products		
3,4	3,6	3,4
Products of the processing industry		
6,2	7,5	8,6

Source: International Trade Statistics 2006, WTO, Geneva; International Trade Statistics 2008, WTO, Geneva; International Trade Statistics 2010, WTO, Geneva [5]

FDI flows between China and the European Union had, until recently, a rather one-sided nature; the destination of investment primarily being the Middle Kingdom. As a result of the economic crisis Chinese companies have recognized the real possibility of profits from FDI in the EU. In 2010 Chinese companies have invested in the EU amount reaching 6 billion USD, while in the Middle Kingdom EU countries have invested 6.9 billion USD. The main countries of Chinese foreign direct investments by the end of 2010 were: Luxembourg (5.8 billion USD), Sweden (1.5 billion USD), Germany (1.5 billion USD) and the United Kingdom (1.4 billion USD) [6]. The role of other EU countries as targets of Chinese FDI was until now limited.

The PRC foreign direct investments in the EU are not focused on industries connected with mineral resources such as in Africa, Asia or Latin America. In contrast, Chinese companies invest primarily in the financial sector, telecommunications, automotives, technology and real estate. The PRC has been buying in the past years Eurobonds on a massive scale, saving some of the EU countries from bankruptcy [7]. The investment strategy of the Middle Kingdom can be considered as highly diversified. Its purpose is to create opportunities for further development of China in the future by securing not only mineral resources, but also high technology. An example is certainly the research centre in Sweden opened a few years ago by Huawei.

The most important dimension of the relations between the European Union and China remains the economy. The main objective of both partners is to protect their own interests. The PRC uses know-how of the EU countries that it had worked out over the years, while the European Union gains a stable economic partner. One expects a further development in their relationships.

Everything suggests that the often repeated term "strategic partnership", which refers to mutual relations of the EU and the Middle Kingdom, will prove justified in the future.

### IMPLICATIONS OF CHINA'S ECONOMIC EXPANSION FOR THE UNITED STATES

An important issue of the US-PRC relations, which is of particular interest to researchers, is the degree of mutual dependence of the two largest economies in the world. The value of trade between the US and the PRC in 2010 amounted to 456.8 billion USD. The share of Chinese exports to the US market in recent years was in the range of 20 per cent of total exports, while China's share of total US exports in 2010 amounted to 7.2 per cent (Table 3). From 2000 to 2010 the US foreign trade deficit with China grew from 84 billion to 270 billion USD.

Table 3. The share of China in import and export of the US in years 2000-2010 (%)

	2000	2005	2008	2010
Import (%)	8,6	15,0	16,5	19,1
Export (%)	2,1	4,6	5,5	7,2

Source: Eurostat database [3], UN Commodity Trade Statistics Database [4]

Table 4. The share of import from China in total import of the United States: distribution of selected product categories in years 2000-2010 (%)

2005	2007	2009
Telecommunication equipment		
33,1	37,5	40,2
Integrated circuits and electronic components		
6,9	8,8	9,6
Automotive products		
1,3	2,1	3,0
Iron and steel		
8,4	13,5	11,7
Agricultural products		
4,4	5,4	5,5
Products of processing industry		
20,2	23,2	26,6

Source: International Trade Statistics 2006, WTO, Geneva; International Trade Statistics 2008, WTO, Geneva; International Trade Statistics 2010, WTO, Geneva [5]

Until recently, China was the main supplier of uncomplicated technological products for the US. Potentially cheaper (although more and more expensive) labour force is currently used for the production of not only clothing and toys, but also high-tech equipment. Chinese companies are major suppliers to the US market of telecommunications equipment, integrated circuits and electronic components (Table 4). This has resulted in a large trade deficit with China also in high-tech products. A difficult issue is the violation of intellectual property rights by Chinese producers. Projects of various products, ranging from toys, through household appliances and specialized machines are being copied on a large scale.

In the last two decades huge capital flows between the US and China were observed, which can be divided into FDI, as well as the enormous purchases of securities. The US securities bought by the PRC allowed to cover the rising deficit and public debt of the US. From year to year the importance of the Middle Kingdom as a major creditor of the United States is growing. Even in 2002, China was in the possession of US securities worth 118 billion USD, while in 2010 this amount was as high as 1.15 trillion USD. China maintains, therefore, more than one quarter of the



US debt [8]. It is also worth paying attention to the increasing value of US corporations' shares held by China – about 130 billion USD.

Investments made by The Middle Kingdom in the United States are based mainly in the financial sector – the investors are Chinese state funds and state-owned companies. In recent years one could observe the attempts to take over some American companies by Chinese corporations; however, they usually ended in failure, mainly due to unfavourable US regulations. Greenfield and brownfield investments carried out by US companies in the PRC in 2010 reached a cumulative value of 49.4 billion USD, placing China on the 17th place among the recipients of the US FDI.

Closer co-operation between the great powers is hampered by a different perception of sovereignty and human rights. China, which is from year to year showing itself to be more and more economically present in Latin America and Africa, does not interfere in the internal affairs of those regions and is not interested in the issues of human rights violations or armed conflict. This position does not match to the strategy of the US. Another problem in the relationship is also China's exchange rate policy, designed to maintain competitiveness of the Middle Kingdom.

Cooperation between the US and China, despite a few trouble spots, has significantly deepened in recent years. Experts predict two real scenarios of further cooperation in the future. The optimistic scenario indicates the mutual benefits of China's economic development. The second option states that the Sino-US relations will be held on the basis of a zero-sum game. The coming years will show whether China's economic expansion will be accompanied by efforts to expand their political ideology. A scenario dividing the world into two camps - one supporting China, and the other - the USA is therefore possible, but rather unlikely [9].

## CONCLUSIONS

Economic relations between the PRC and the US and the EU continue to strengthen and are reflected through the increasing year-on-year trade and foreign direct investment in both directions. All partners will likely continue to benefit from further cooperation [10]. The main conclusions of the study are as follows:

- the economic interdependence of the Middle Kingdom, the EU and the US determines the maintaining of correct diplomatic relations between the two partners;
- previous strategy of China's economic expansion indicates that the United States is still regarded by the Middle Kingdom as a leading economic, military and political power in the world;
- China's aid to the countries of the European Union during the current economic crisis and the increasing value of US securities held by the PRC contributes to strengthening the current system of international influences.

The outbreak of the global financial crisis was a turning point for the change of balance of power in the world. The US, until recently holding world dominance, had to give way to communist China. The position of the European Union also decreases. Major economies are forced to transform their economic and political strategies. If in the future China limits its expansion mainly to the economic area, the currently outlining structure of influence in the world should be expected to strengthen.

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## STRUCTURE AND BANKRUPTCY OF ENTERPRISES IN POLAND

**Abstract:** In the following article the most important parameters characterising the enterprises' structure in Poland have been presented, with special regard to the SMEs (small and medium enterprises) sector. Furthermore, the attempt was taken to determine key bankruptcy causes, including financial problems, globalization and macroeconomic shocks. The study is based on the data culled from the annual reports of Coface Poland, a credit reporting agency, on company bankruptcy in Poland and macroeconomic data disclosed by the Central Statistical Office (CSO).

**Keywords:** enterprise, bankruptcy, insolvency, unemployment rate.

### INTRODUCTION

The main objective of the study presented in the article is the analysis of enterprises' structure diversification in Poland under threats caused by the decision on setting up a business entity. The described aim is achieved by formulating a research hypothesis, according to which the higher the increase of enterprise bankruptcy, the higher the unemployment rate. Verification of the mentioned aims was conducted under: correlation analysis and cause analysis, which means analysing factors logically related with economic situation of company and factors affecting business failure. In the following study data from annual reports prepared by Coface Poland<sup>11</sup> on enterprise bankruptcy in Poland and the CSO macroeconomic database were used.

Enterprises in Poland can be divided into micro-, small, medium and big<sup>12</sup> (see Table 1):

Table 1. Employment threshold and financial limits describing enterprises categories

Enterprise	Employment number	Annual turnover	Total annual balance sheet
Micro	from 2 to 9	≤ 2 mln EUR	≤ 2 mln EUR
Small	from 10 to 49	≤ 10 mln EUR	≤ 10 mln EUR
Medium	from 50 to 249	≤ 50 mln EUR	≤ 43 mln EUR
Big	from 250		

Source: Own elaboration based on [9]

### SELECTED REASONS OF ENTERPRISE BANKRUPTCY

#### 1. Financial problems and weak payment discipline

Financial problems often have their source in bad enterprise management. They take place when appearing threats are noticed too late and then it is hard to find a proper solution. It also happens when the chosen concept and fighting with tough financial condition tactics appear to be fatal – what leads to a new problem [7]. Financial problems involve losses which a company cannot cover, while lack of enough cash results in weak payment discipline. In this way worsening financial liquidity threatens the relation between supplier and receiver. As a result, the same problem occurs in indirect enterprises [2].

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<sup>11</sup> Coface Poland – Polish credit reporting agency operating on the domestic market since 1992. It publishes quarterly reports on enterprises' insolvency. It deals with collecting informations on versatile assessment of a particular contractor or market

<sup>12</sup> EC Regulation nr 364/2004.

## 2. Globalization: its multi-dimensional influence on enterprises' operating

The globalization effect enables any enterprise to internationalize its activity, what causes inter alia: conquering new marketplaces, mechanism and production-related technology change, new advertisement tools, action plans and company structures. The biggest problem with such an effect occurs in enterprises which are forming and improving their actions and organization of work for long period of time. Routine work and employees' habits are hard to change at that stage. Client's attachment to a brand may also weaken and as a consequence he will change his preferences. Moreover, as a result of globalization, the ideas, techniques, markets and products get old far quicker. Innovations become the main enterprise development stimulant and usually they are the domain of big companies. As a result, the biggest chance to survive on the international market have big enterprises which are highly innovative [10]. Therefore, the major part of enterprises in Poland, which consists of microenterprises, very often disappears from the market.

## 3. Macroeconomic shocks, company's economic activity turning points

Macroeconomic shocks often take place suddenly, in moments when the entrepreneur is not expecting such big changes, which may lead to the necessity to decide on company insolvency. For example, exchange rate change automatically alters the so-far beneficial conditions which a company got credit on, while foreign trade may no longer be that profitable.

## ENTERPRISE BANKRUPTCY IN POLAND FROM 2008 TO 2011

Using the information published by Coface Poland, it is possible to indicate time series for monthly data on enterprise insolvency in Poland between 2008-2011 (Table 2).

Table 2. Insolvency in particular months in Poland between 2008-2011

Month	Years			
	2008	2009	2010	2011
January	30	31	54	57
February	34	52	57	54
March	37	51	68	68
April	31	57	46	56
May	27	71	70	58
June	43	61	57	55
July	37	63	63	74
August	31	46	38	54
September	47	77	58	60
October	30	54	56	60
November	26	59	45	64
December	38	69	43	63
Sum	411	691	655	723

Source: Own elaboration based on [12]

The number of bankrupt companies in particular months between 2008-2011 is presented on the diagram below Figure 1.

When analysing each year globally (Figure 1), it can be said that a particular growing trend takes place. The number of bankrupt companies increases each year, taking into account the change occurred comparing to the same month in the previous year. A full compatibility with time series in July and September each year (see Table1) can also be noted, when a drastic decrease of bankrupt companies is announced. Therefore, it is possible that there is stabilization in companies during summer months. Such an effect can be explained by huge positive tourism influence on enterprises' activity. Certainly tourism is one of the main stimulants of Polish economy. As a result of the following data analysis, it is also worth noticing that with the end of the year there is a definite

increase in bankrupt enterprises, which converges with the more frequent effect of insolvency in tourism agencies happening during the summer vacation period.

As a result of the Polish company insolvency trend in particular years, it can be said that each year the average number of bankruptcies increases by 90 companies. The monthly average rate of change amounts to approx. 1,6 per cent. The estimated trend line for monthly data is characterized by a relatively low value of  $R^2$ , so an estimated model for quarterly data was formulated. The trend lines for particular quarters are as follows.

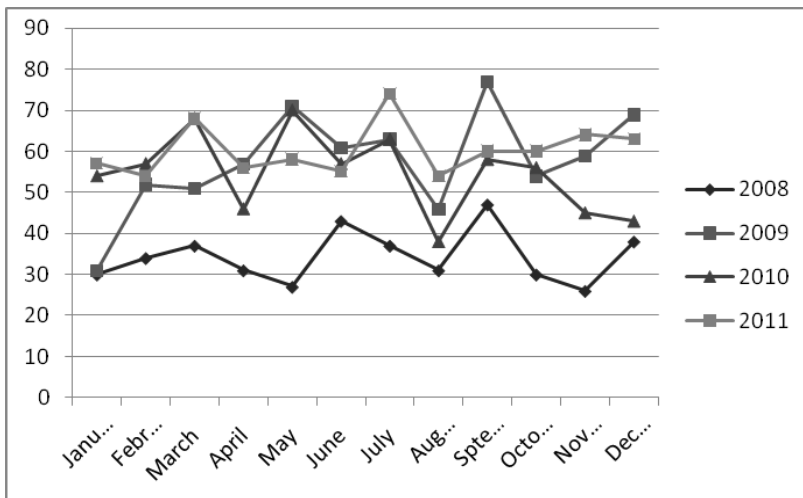


Fig. 1. Polish bankrupt companies in particular months between 2008-2011

Source: Own elaboration based on [12]

$$\hat{y}_1 = 5,625t + 108,88 ,$$

(1,49) (16,87) (26,6)

$$\hat{y}_2 = 5,625t + 113 ,$$

(1,49) (17,84) (26,6)

$$\hat{y}_3 = 5,625t + 111,38 ,$$

(1,49) (18,86) (26,6)

$$\hat{y}_4 = 5,625t + 95,5 ,$$

(1,49) (19,94) (26,6)

where  $t$  means the number of the year (counted from 1-year of 2008) and  $\hat{y}_i$  - the estimated number of bankrupt enterprises in  $i$ -quarter of  $t$ -year. The real number of bankruptcies differs by 26 from the model numbers and the estimated trend lines in 98 per cent are adjusted to real data.

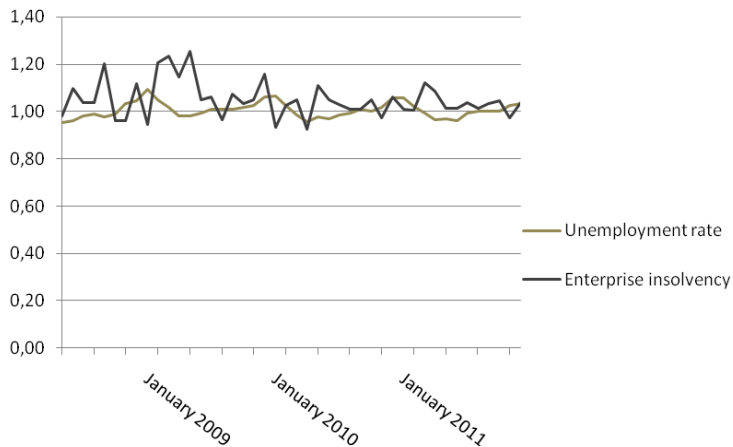


Fig. 2. The change in enterprise insolvency and unemployment rate between 2008-2011

Source: Own elaboration based on [11,12]

In the conducted study the method of four period moving average was used. The received results, along with monthly unemployment rate changes between 2008-2011, are presented in the form of a diagram. On the basis of the presented figure (Figure 2) the following conclusion can be expressed: in the early years the unemployment rate and number of bankrupt enterprises were characterized by a clear discrepancy and only in the middle of 2009 (19<sup>th</sup> month) the received results are convergent; the differences between conducted variables have lower values. In order to conduct a relation between unemployment rate and the change in the number of bankrupt enterprises the Pearson line correlation indicator was calculated, which, in this case, is 0,04. The received value means that a weak positive line relation exists between the conducted variables.

## CONCLUSIONS

According to the studies conducted by Coface Poland and report analyses on enterprises' insolvency, it can be said that the first signal which indicates problems and a company's financial threats is weak financial discipline. It negatively influences the liquidity in the supplier-receiver chain, which then causes problems for intermediaries as well as for the whole branch. A huge impact on the dynamics of enterprise activity is made by globalization processes, which result in change in every field of company activity. Macroeconomic shocks, in an unexpected way, can change the enterprise's condition into an irreversible blind spot for which the only solution is the decision on termination of activity. Since the middle of 2009 there has been a decline of rests between the unemployment rate and the number of enterprises' insolvencies. What is surprising, according to the Coface Poland report, comparing to 2005, the highest number of enterprise bankruptcies was announced in the third quarter of this year and the number has doubled since the same quarter of 2008.

A further subject of the conducted studies and analyses will be the problem of enterprise insolvency forecasting, for which methodological aspects have been described by researchers such as Józef Pociecha [8].

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## THE PROCESS MODELLING OF WORKFLOW IN MATERIALS MANAGEMENT

**Abstract:** A materials management company provides a comprehensive system for ensuring the procurement of inputs into the production process, efficient movement, handling and storage of material input into the company through transition to production to distribution of finished products to customers. Materials management also involves the important activities of preparation for production and standardization, while the correct choice of the material for a product, real norms of consumption, efficient standard and quality of material already begins at the stage of preparing production conditions of technically correct and economically efficient supply.

**Keywords:** management, workflow, stock, material, supply.

### INTRODUCTION

A materials management business does not exist in isolation from its surroundings, but is a part of it. Most manufacturing companies have a complex materials management system with many inputs, outputs and interactions. The typical flow of materials and its realization in the area of transformation process in a manufacturing company is shown in Figure 1.

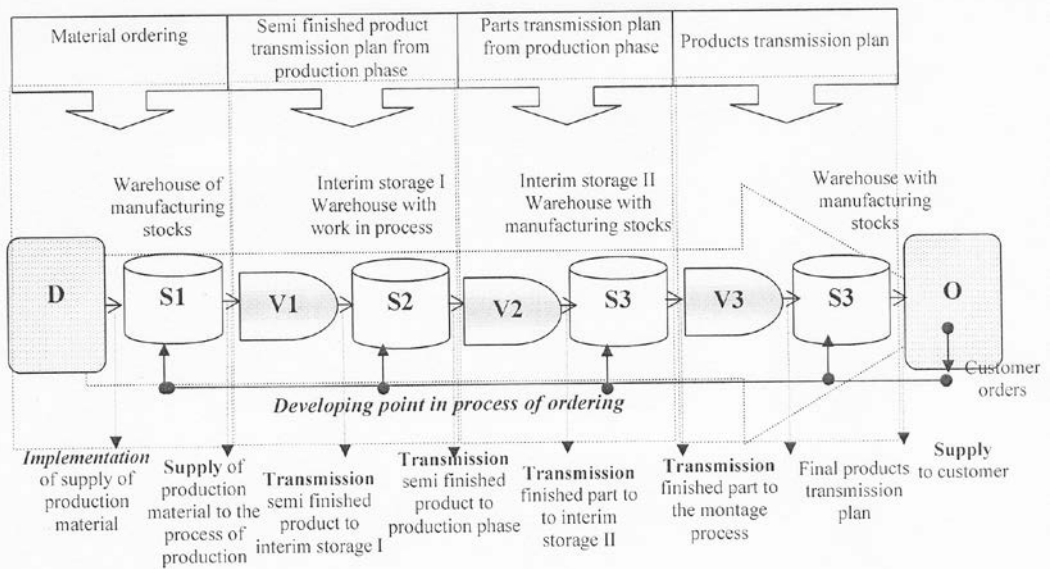


Fig. 1. The typical material flow in the production company [9]

### MODELLING OF WORKFLOW IN MATERIALS MANAGEMENT

The structure of this system is based on material elements, the movement of which constitutes the base of the system; it also includes organizational and technological chains such as warehouses, manufacturing operations, workplaces and the buffer stores through which the elements pass, as well as their mutual arrangement and the resulting relationships.

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The interconnections between material elements and chains form a tangible bond. Real parts of the system also include information, temporal and spatial links. The structure of the main activities of the system of a materials management business is shown in Figure 2.

Activities related to materials management, whether directly or indirectly, are scattered throughout the enterprise logistics chain. The natural bearer of the main activities in the system of materials management is *supply logistics*.

The supply logistics subsystem is basically purchase and supply, i.e. provides substantive inputs for the business transformation process. A part of supply logistics is also purchase planning and delivery control, receipt and inventory management. Management activities in this subsystem can be understood as planning or control actions, e.g. developing standards of material consumption, the choice of a technological process, developing an operational plan for production, ensuring transportation of materials, exposure orders, etc.).

The specification of implementation activities is determined by the type of production, product assortment, enterprise size and other characteristics that define the enterprise. Depending on specific actions, the company either carries them out separately or merges them into one, resp. they provide a specific unit (e.g. future consumption of materials is determined by a unit in the preparation stage).

*Stock management* is often a direct task of the supply department, but there are also cases where stock management is organizationally independent (e.g. industrial buffer stores, fuel storage, lubricants, spare parts, packaging, tools).

*Material evidence and liquidity of invoice* is frequently part of the economic section. There is always a need for mutual communication in order to exchange various information between departments.

In some companies *waste management* is part of supply activities, although there are cases where this section is part of the marketing department and is assigned to the production section (e.g. through the return of materials and components in the production process).

*Materials preparation* is often a direct task of the supply department (particularly in cases involving material cutting and waste re-used for intermediate consumption). The preparation department may ensure on its own not only the supply of materials for production, but also its distribution - including ensuring the flow of material in the production process, i.e. in-house micro-transport.

When it comes to the other activities, shown in Figure 2, they tend to be provided by other departments, such as the supply department, which include:

- Establishing standards of materials consumption - exclusive task of the supply department,
- Creating materials' standards - provided by the technical department with an active role by the supply department,
- Creating materials and technology - provided by the technical production department with an active role by the supply department and department of sales,
- Choice of an operational production plan - provided by the production management department responsible for change control in collaboration with the supply department,
- Stock management work in progress - provided by the warehouse management department,
- Transport - usually an independent business unit, or the joint work of small enterprises within the supply department,
- Management with tools - usually provided by the technical section, but requires close cooperation with the supply department for the purchase of special tools and fixtures,
- Packing and shipping - provided by the marketing department in conjunction with the departments of supply and technical production,
- Rationalization of consumption – provided by the supply department in cooperation with technical units.



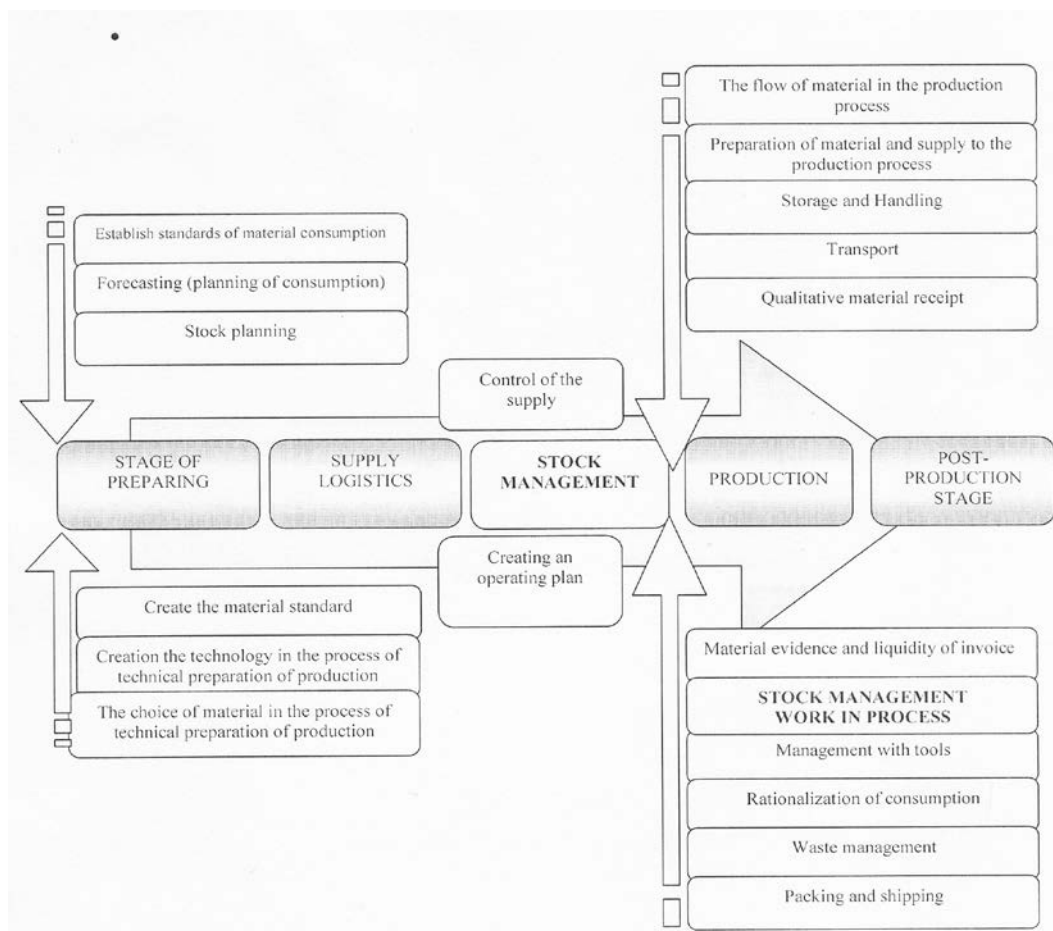


Fig. 2. Structure of the main activities of materials management in a company [9]

## CONCLUSION

Management of materials is the directing, respectively control and regulation of individual elements of the system and the system as a whole. Input information plays a decisive role in the management of materials. An important source of information, as well as a prerequisite for sound decision-making, is the economic analysis of materials management, which should ensure that the production functions of the company are in accordance with the implementation of economic criteria.

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## THE EXPENDITURES BORNE BY LOCAL COMMUNES AND CITIES WITH COUNTY RIGHTS IN LIGHT OF WAGNER'S LAW

**Abstract:** Wagners' Law applies to increasing public expenditure borne by the central government and local governments. In this article the notion of local self-government spending is explained along with its role in satisfying local communities' needs. The study involves a discussion of budget expenditures borne by local communes (municipalities, gminas) and cities with county rights and details the expenditures of the capitals of provinces (voivodships) in Poland. A hypothesis is put forward that in the years 1995-2011 the aforementioned governments allocated continuously increasing expenditures to satisfy public needs. Moreover, the aim of the article is to analyze the level and dynamics of budget expenditures of gminas and cities with county rights in the years 1995-2011. For these years, particular types of expenditures per capita shall be analyzed along with those borne by the voivodship capitals and their share in the general expenditure of the discussed administrative units.

**Keywords:** local self-government finances, social and economic development, investments, the public sector, Wagner's Law.

### INTRODUCTION

In 1892 Wagner observed that public expenditure rises in pace with social development. Moreover, the development and progress of any modern state requires continuously growing spending (the law of increasing state spending, also known as the law of continuously growing financial needs, [4, p. 261]). According to Wagner's Law, there is an increasing rise in public spending (a relative one with respect to the GDP, as well as an absolute one), in other words financial means must be allocated to carry out government projects as well as those implemented by local self-governments. The main aim of this article is to analyze the level and dynamics of budget expenditure of local communes and cities with county rights, whereas the other aims include defining per capita budget expenditure borne by the discussed government units in voivodships in the years 2002-2010, analyzing the expenditure of the voivodship capitals in the years 2002-2010 and its share in general expenditure borne by gminas and cities with county rights in all voivodships. The reason behind this publication is the ongoing vivid discussion on public spending by local self-governments in the difficult period of economic slowdown in Poland.

### SCIENTIFIC HYPOTHESIS

Self-government finances constitute part of the public sector's finances and they are to be used to fulfill local self-government tasks which aim to satisfy the needs of local communities. The share of self-government expenditure in the total expenditure of public finances sector amounted to 28.4 per cent in 2009. This percentage points to the size of public spending allocated by self-governments. The share of local expenditure in public spending may define the level of spending decentralization which, along with revenue decentralization, is one of the manifestations of public sector decentralization [6].

Public spending, its classification and aims are precisely defined by the Act of 27<sup>th</sup> August 2009 on Public Finances with subsequent amendments (which shall be further referred to as the Public Finances Act, the Act). The units of the self-government allocate their expenditure to concrete tasks which must be included in the unit's decision as its duties [2, p. 166]. According to Article 44 of the Act, self-government expenditure may be allocated to tasks and in the amounts

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defined in the budget decision. Moreover, it must be exercised in a frugal manner in order to achieve the best cost efficiency and the optimum choice of methods and means to achieve the given aims. The expenditure must guarantee timely realization of tasks; its amounts and terms must result from previously stated duties and liabilities. The expenditure is allocated to exercise the tasks specified in all the relevant regulations, especially in the Public Finances Act (Article 216):

- the territorial self-government's own tasks;
- the tasks related to central government administration as well as other tasks delegated to local self-government by relevant acts of law;
- the tasks delegated to local self-government units as a result of contracts or agreements;
- the tasks exercised together with other units of territorial self-government;
- the in-kind aid or financial aid offered to other units of territorial self-government as stipulated in separate decisions issued by the unit's decision making body;
- financial programs using the means specified in Art.5, Par.1, points 2 and 3.

The socio-political governance of the state along with the level of decentralization and delegation of tasks between the central and local governments has an impact on the scope and structure of local self-government budget expenditure. Financial decentralization understood as allocating appropriate financial means to local self-governments and the power to spend them gave self-governments the right to decide on their spending exercised to satisfy the local needs and to determine their own priorities [5, p.74]. The basic unit of territorial governance is the gmina which is responsible for exercising various tasks imposed on it by the law for the benefit of local communities. The aggregate budgets of the gminas and cities with county rights are bigger than the aggregate budgets of counties and voivodships which results from the scope of tasks and responsibilities. This rule has not been changed by the recently growing scope of responsibilities of the voivodship self-governments [8, p. 216].

In view of the above, this study deals with budget expenditure exercised by all gminas and municipalities with county rights. Therefore, the subject of the study is the answer to the following question: if, according to Wagner's Law, there is a permanent rise in public spending, i.e. the central and local governments' expenditure, does the same dependency refer to the expenditure of gminas and cities with county rights? It is assumed that there is increasing local government spending. A hypothesis is therefore put forward that there was a continuous rise of local communes and cities with county rights budgets expenditure in the years 1995-2011. The time span covered by this study pertains to the period of economic transformations in Poland. Due to their high socio-economic potential and rapid development, the voivodship capital cities' expenditure was detailed (18 cities). The study is based on descriptive statistics and ex post analysis.

#### **DETAILED DESCRIPTION OF THE RESEARCH ISSUE OR RESEARCH RESULTS**

The budget expenditure of all gminas and cities with county rights had been continuously increasing in the years 1995-2011 (Figure 1). There is one exception to this rule, however, namely the year 2003 when a slight decrease of expenditure in relation to the previous year was observed (ca. 2 per cent). Simultaneously, in the same year a drop of the discussed expenditure was observed in all of the voivodship capitals except Olsztyn. The above is due to a slight economic slowdown which occurred in Poland in 2002 and 2003. Since 2003 there has been a systematic increase of budget spending. In 1996-2000, the dynamics of economic changes were relatively high (in 1996 – a 59 per cent increase and in 2000 – a 12.5 per cent increase). In the following three years there was a smaller increase and decrease (7.5 per cent in 2001 and -2 per cent in 2003). In the years 2004-2008 the decrease and increase tendencies intertwined, whereas since 2009 the dynamics increase has been getting lower and lower. In the period under examination, the dynamics of budget expenditure have been continuously lower from one year to another.

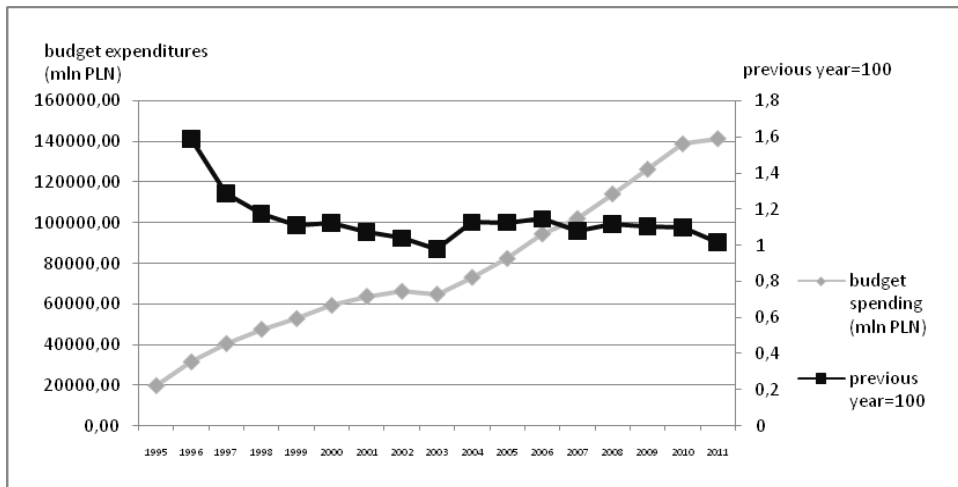


Fig. 1. Budget expenditures borne by gminas and cities with county rights (mln PLN)

Source: The author's own study based on the statistical data published by the Central Statistical Office GUS [1]

In the years 1995-2001 all of the voivodship capitals spent more funds from their budget. In 2002 a growing tendency was observed in Łódź, Warszawa, Kielce, Poznań, Toruń and Olsztyn. In 2003, however, the only capital which retained the tendency was Olsztyn, where incidentally budget spending was continuously increasing in each year of the discussed period. This was the time preceding Poland's accession to the European Union, hence the intensive utilization of non returnable pre-accession funds allocated to all prospective member states within such European programs as PHARE, SAPARD, ISPA. In the years 2004-2006 all of the voivodship capitals allocated higher sums to their budget expenditure. At that time Poland was undergoing substantial economic recovery and produced relatively high economic growth (2006– 6.2 per cent). Once the accession became a fact, further “consumption” of European funds was observed, especially in the financial prospects of the years 2007-2013. The gminas which use the European funds are obliged to invest their own means along with those funds (the amounts depend on the principles which were binding in particular projects). In 2007 all of the voivodship capitals continued to increase their previous year's spending. The only exception was Katowice, and in 2008 – Opole. In 2009 the expenditure was lower compared to the previous year in the city of Opole and Bydgoszcz and in 2010 – in Łódź, Kraków and Wrocław. In 2011 the same situation was observed in Kraków, Katowice, Gorzów Wielkopolski and Zielona Góra. Since 2009 the decreased dynamics of investment expenditure may be connected to the global slump. The beginning of the worldwide economic, financial and banking crisis was marked by year 2007 when high-risk mortgage loans triggered the slump in the United States.

The sums spent from the budgets of gminas and cities with county rights are particularly interesting when they are compared to the number of inhabitants. The period of 2002-2010 was chosen for a detailed analysis. Between 2003 and 2010, the spending per capita was continuously increasing [Fig. 2]. In the years 2002-2010 the highest amount of per capita budget expenditure of gminas and cities with county rights repeatedly occurred in the Masovian voivodship, whereas the lowest value was observed in the Świętokrzyskie voivodship (2002-2004, 2007-2008), Lubelskie voivodship (2005-2006) and Opolskie voivodship (2009-2010).

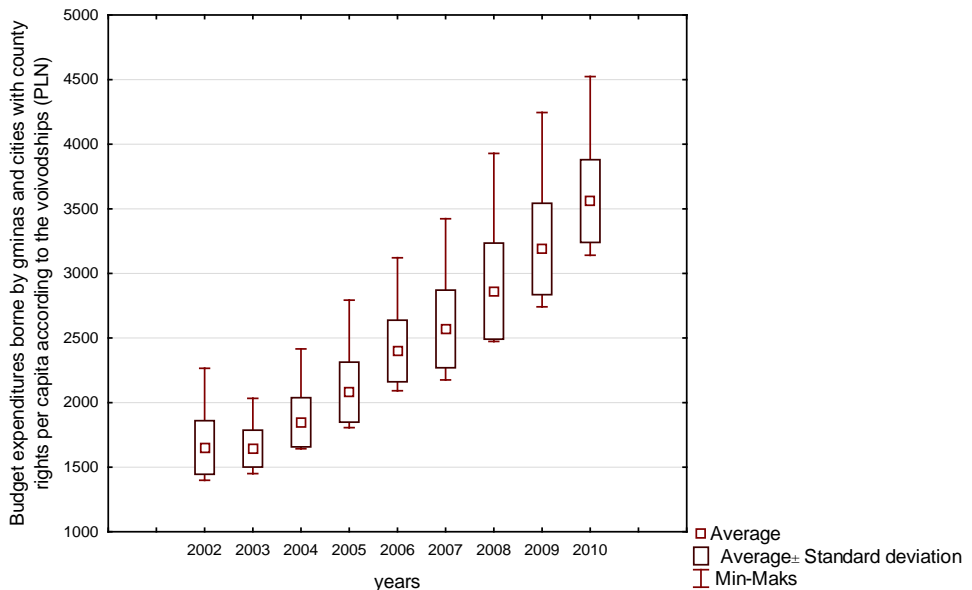


Fig. 2. Budget expenditures borne by gminas and cities with county rights per capita (PLN)

Source: The author's own study based on the statistical data published by the Central Statistical Office GUS [1]

In 2002, the highest expenditure per capita was noted in the Masovian voivodship (2265.7 PLN), whereas the lowest expenditure was observed in the Świętokrzyskie voivodship (1398.54 PLN). In 2010 the highest value was in the Masovian voivodship (4523.29 PLN) and the lowest in the Opolskie voivodship (3140.22 PLN). In 2002 in exactly 50 per cent of the studied voivodships the average budget expenditures per capita was below 1619.7 PLN, but in 2010 it was below 3483.61 PLN. For the above two years, the medians are slightly lower than the arithmetic means. This points to the fact that the majority of voivodships is characterized by slightly lower expenditure per capita than it would have resulted from the arithmetic mean. This phenomenon is defined as an asymmetry of empirical distribution, here with a positive skew (a right side skew). In 2002 the voivodships under discussion differed from the mean which was 1652.56 PLN by  $\pm 207.65$  PLN. In 2010 however, the average difference from the mean was 3560.08 PLN by  $\pm 320.03$  PLN. In 2002 the average relative differentiation of the feature amounted to 12.57 per cent. In 2010 the level of the differentiation of the variable was 8.99 per cent. In 2010 the average budget expenditure was characterized by a lower differentiation than in 2002. The minimum value of the feature under discussion was continuously increasing in the period of study, whereas the maximum value had been growing since 2003 (the distance increased between 2003 and 2009). In 2003-2008 an increasing absolute differentiation of the feature was observed (a growing value of the standard deviation: the higher the standard deviation, the more dispersed is the data). The coefficient of variability is a relative measure, and in the years 2002-2007 it was unstable. Since 2008 the coefficient has been decreasing steadily.

All of the voivodship capital cities reached the level of average per capita expenditure in the years 2002-2010 which was higher than the value of average budget spending of gminas and cities with county rights in the same years. The highest value of the discussed feature was observed in Warsaw (4979.67 PLN), Wrocław (3812.03 PLN) and Poznań (3560.20 PLN). If there are two capital cities in one voivodship, a higher average per capita budget expenditure was observed in the cities which are the seats of the voivodship self-governments such as Zielona Góra in Lubuskie and Toruń in the Kuyavian-Pomeranian voivodship. The highest average rate of changes in budget

expenditure per capita in the period of 2002-2010 was observed in Białystok, Kielce and Gdańsk, whereas the lowest rate was observed in Katowice, Szczecin and Łódź. A relatively high average rate of changes in budget expenditure may be explained by their relatively low level at the beginning of the period. A. Patrzalek reports that the interventions exercised by self-government authorities by means of revenue and expenditure instruments are primarily focused on the development of technical infrastructure, businesses and human capital development [7, p. 48]. In order to ensure appropriate services to their inhabitants and to keep the high level of attractiveness of the areas, the authorities allocate higher funds to investments into social and technical infrastructure, which is especially asset-intensive.

The share of budget expenditure of the voivodship capitals in the total expenditure of gminas and cities with county rights varied in time. In 2002 the share ranged from 10.2 per cent (Katowice and the Silesian voivodship) to 54.6 per cent (Warsaw and the Masovian voivodship). In 2011 the share ranged from 8.7 per cent (Katowice and the Silesian voivodship) to 51.2 per cent in Warsaw and the Masovian voivodship. In those voivodships whose capital city is the main city, the share of budget expenditure with respect to the expenditures of gminas and cities with county rights was higher than the share in voivodships with several equally important municipal centers (e.g. the Silesian voivodship and the Upper Silesian Conurbation). In five cases the average annual rate of shifting in the share of the capital cities' expenditures in relation to those borne by gminas and cities with county rights was positive (Białystok/ Podlaskie, Kielce/ Świętokrzyskie, Gdańsk/ Pomeranian, Wrocław/ Lower Silesian, Toruń/ Kuyavian-Pomeranian), whereas in the remaining 13 voivodships the rate was negative. The highest average rate of changes in the discussed share was observed in Białystok in the Podlaskie voivodship (1.5 per cent), whereas the lowest was observed in Gorzów Wielkopolski in the Lubuskie voivodship (-2.2 per cent).

## CONCLUSIONS

In the paper, an attempt was made to relate Wagner's Law to budget expenditure borne by gminas and cities with county rights. The hypothesis of the continuous increase of budget spending in the aforementioned gminas and cities with county rights in the years 1995-2011 was partially confirmed. In 2003 a decrease in the discussed expenditure was observed. It probably resulted from the economic slowdown in Poland. It is noteworthy that the decrease was relatively small (c.a. 2 per cent) and that in the remaining period years the expenditure was indeed continuously increasing. Certain administrative units seem to be more sensitive to changes in the macro-environment (regardless of whether the changes are positive or negative). Olsztyn was the only capital of voivodships where the increase of budget expenditure was steadily growing in each year of the discussed period. In 2010 the average budget spending of gminas and cities with county rights per capita was less differentiated than in 2002. All of the voivodship capitals had higher budget expenditures per capita in the years 2002-2010 than those borne by gminas and cities with county rights in the same voivodships in the same period.

The increase of budget expenditure borne by gminas and cities with county rights is a positive phenomenon which is reflected in the local development of these units. Such an increase is a necessary condition for the social and economic progress of local units [3, p. 21]. It would be interesting to define the impact of budget expenditure borne by gminas and cities with county rights on their social and economic development. It seems very likely that expenditures contribute to progress, which seems to be stimulated by them. However, the question whether there is such a dependency or not requires further studies. Another direction of future research should include an analysis of the efficacy of self-government budget expenditure. Moreover, the exploitation costs of the newly built social and technical infrastructure need to be examined. Have self-governments been able to forecast these costs accurately? These questions might only be answered after the completion of empirical studies, which should follow the research discussed in this paper.

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## THE INFLUENCE OF BUSINESS CYCLE FLUCTUATIONS ON STRUCTURAL MISMATCHES ON THE LABOR MARKET

**Abstract:** In the literature structural mismatches on the labor market are often characterized as insensitive to economic growth fluctuations. However, in this article the following hypothesis has been stated: that business cycle fluctuations affect the level of structural mismatches on the labor market in terms of qualifications; moreover, the higher the rate of economic growth, the lower is the level of structural mismatches. Verification of this hypothesis was based both on a qualitative and quantitative analysis. The quantitative one was done with the use of Granger causality tests conducted for a group of 29 developed countries for the period 2004q3 - 2012q2 with the use of two different indicators of structural mismatches. Both the quantitative and qualitative analyses confirm the stated hypothesis.

**Keywords:** labor market, unemployment, structural unemployment, structural mismatches, business cycle, economic growth.

### INTRODUCTION

The structural mismatches on the labor market can be generally defined as a situation when the structure of demand for work is different from the structure of labor supply in terms of qualifications, occupations or location [10, 11, 13]. The existence of structural mismatches on the labor market is the primary cause of the existence of structural unemployment [8]. Structural mismatch between labor demand and supply is often treated in the Polish literature as one of the most important determinants of the persistence of the relatively high level of unemployment (in comparison to highly developed countries) during the period of transformation in Poland [4, 9, 16]. An often highlighted in literature characteristic of the structural mismatches on the labor market is also their low sensitivity to economic growth fluctuations [1, 4, 12, 13, 18].

### RESEARCH HYPOTHESIS

However, in this article the following hypothesis is stated: that business cycle fluctuations affect the level of structural mismatches on the labor market in terms of qualifications; moreover, the higher the rate of economic growth, the lower is the level of structural mismatches. Qualifications are understood as a set of knowledge and skills used in work that is the result of education and experience. Therefore the analysis will not be conducted for mismatches in terms of occupations and location.

The structure of the article is following. Section 1 (which is dedicated to the qualitative analysis) shows the mechanism of influence of economic growth fluctuations on the structural mismatches on the labor market in terms of qualifications. This description is based on the analysis of entrepreneurs' microeconomic decisions on the level of production and employment of differently qualified workers, depending on the level of prices on the goods market. Section 2 (dedicated to the quantitative analysis) shows the results of Granger causality tests conducted for a group of 29 developed countries for the period 2004q3-2012q2 with the use of two indicators of structural mismatches:  $\sigma$  and MM. The study is completed with a short summary that briefly presents the most important conclusions.

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## 1. THE MECHANISM OF INFLUENCE OF BUSINESS CYCLE FLUCTUATIONS ON STRUCTURAL MISMATCHES

Let's assume that the production function of each firm in the national economy is the Cobb-Douglas type:

$$Y = AL^\beta K^{1-\beta} \quad (1)$$

where  $A$  and  $\beta$  ( $0 < \beta < 1$ ) are parameters dependent on the technology used in a particular firm and sector of the economy, and  $K$  is the level of employed capital. Let's assume that  $A$ ,  $K$  and  $\beta$  remain constant in our analysis. Transforming equation (1) we get:

$$\frac{Y}{L} = A \left( \frac{K}{L} \right)^{1-\beta} \quad (2)$$

Each firm is trying to maximize the following profit function:

$$\pi = p_Y * AL^\beta K^{1-\beta} - wL - rK \quad (3)$$

where  $\pi$  symbolizes profit,  $p_Y$  is the market determined price for goods produced by the firm,  $w$  is the level of nominal wages, and  $r$  is the cost of capital (nominal interest rate).

From the necessary condition for extremum:

$$\begin{aligned} \frac{\partial \pi}{\partial L} = 0 &\Rightarrow \\ \beta p_Y A K^{1-\beta} L^{\beta-1} - w = 0 &\Rightarrow \\ \beta p_Y A \left( \frac{K}{L} \right)^{1-\beta} = w & \end{aligned} \quad (4)$$

Substituting equation (2) with equation (4) we get:

$$\beta \frac{Y * p_Y}{L} = w \quad (5)$$

Now let's assume that:

$$L = \sum_{n=1}^N t_n * q_n \quad (6)$$

where  $N$  is the number of employees,  $t_n$  is the amount of working hours of the  $n$ -th employee in the period of analysis (for instance week or month), and  $q_n$  is the level of qualifications offered by the  $n$ -th employee. In the further analysis we assume that the amount of working hours for all employees is fixed (e.g. 40 hours per week) and equal to  $t$ , which allows to simplify the equation (6):

$$L = t * \sum_{n=1}^N q_n \quad (7)$$

The entrepreneur's decision whether to employ or dismiss a particular  $i$ -th person should be based on the relation between the increase in the value of production (which would be the result of the  $i$ -th's person work) and the wage expected by that person. This relationship can be determined from equations (1) and (5). In consequence two situations can be taken under consideration:

$$\beta \frac{[A[t * (q_i + \sum_{n=1}^N q_n)]^\beta K^{1-\beta} - A[t * \sum_{n=1}^N q_n]^\beta K^{1-\beta}] * p_Y}{t * q_i} = \quad (8)$$
$$= \beta \frac{\Delta Y * p_Y}{t * q_i} \geq w_i$$

$$\beta \frac{[A[t * (q_i + \sum_{n=1}^N q_n)]^\beta K^{1-\beta} - A[t * \sum_{n=1}^N q_n]^\beta K^{1-\beta}] * p_Y}{t * q_i} = \quad (9)$$
$$= \beta \frac{\Delta Y * p_Y}{t * q_i} < w_i$$

In the situation described by the inequality (8) it would be profitable for the entrepreneur to hire the  $i$ -th worker, who by offering his or her skills of  $q_i$  and using the technologies employed in the firm ( $A$  and  $\beta$ ) at time  $t$  would contribute to the production of  $\Delta Y$  goods, whose value  $p_Y * \Delta Y$  exceeds the costs of employing the  $i$ -th worker  $w_i$ . While inequality (9) describes a situation in which an employee with a given level of qualifications  $q_i$  an expected wage of  $w_i$  the entrepreneur should not employ, since it would not be profitable.

It was assumed that the level of used technology remains constant, i.e. constant are the  $A$  and  $\beta$  parameters. In the short term the level of qualifications  $q_i$  offered by particular employees will also be constant. Let's assume further that the level of wages  $w$  is characterized by a slower pace of changes than the level of prices on the goods market  $p_Y$ . This assumption may be justified by the costliness of the wage bargaining process, by trade unions' activity and by the imperfect information about the situation on the labor and goods market possessed both by employers and employees [13, 14].

In such a situation a variable that can have the greatest influence (in the short term) on the employer's decision to dismiss or employ a particular person is the level of prices on the goods market  $p_Y$ . The growth of prices on the goods market will cause that the employer will be willing to hire a person whose qualifications were previously insufficient for him. This person would remain employed until he or she would increase his or her wage expectations above the value of his or her productivity or until the level of prices on the goods market falls. This increase in price levels may be caused by an economic recovery and an increase in demand on the goods market. Thus, it can be concluded that in time of economic recovery and prices' growth also the employment of persons whose skills were so far insufficient to find work, might increase. Therefore, increase in price levels on the goods market would, in the short term, reduce mismatches on the labor market in terms of qualifications (since the amount of vacant jobs and unemployed persons would also be reduced). Analogous reasoning can be made for the situation when the level of prices on the goods market declines in times of an economic downturn. In such a situation the level of structural mismatches on the labor market should increase.

## 2. THE INFLUENCE OF BUSINESS CYCLE FLUCTUATIONS ON STRUCTURAL MISMATCHES – QUANTITATIVE ANALYSIS

One of the indicators of structural mismatches on the labor market is the MM indicator proposed by R. Jackman, R. Layard and S. Savouri [13], which is given by the following formula:

$$MM = \frac{1}{2} var \left( \frac{u_1}{u}, \frac{u_2}{u}, \dots, \frac{u_n}{u} \right) \quad (10)$$

where  $u_i$  is the unemployment rate in the  $i$ -th group of population,  $n$  is the total number of analyzed groups,  $u$  is the unemployment rate in the whole economy, and  $var$  means the variance. The second indicator used in the research is the  $\sigma$ , whose construction refers to the standard deviation:



$$\sigma = \sqrt{\frac{\sum_{i=1}^n (u_i - u)^2}{n}} \quad (11)$$

Both indicators are based on the assumption that the lack of structural mismatches on the labor market is a situation when unemployment rates in all analyzed social groups are equal. Thus, the diversity in unemployment rates indicates that some social groups have more difficulties in finding and keeping work, which is a symptom of structural mismatches on the labor market. These indicators can take disproportionate values for the same levels of unemployment rates – for instance the MM indicator disproportionately assigns small values (compared with the  $\sigma$  indicator) to small differences in unemployment rates.

The estimations were based on the values of real gross domestic product *per capita* and the values of unemployment rates for three subpopulations, diversified due to the highest level of education attained (defined on the basis of the International Standard Classification of Education – ISCED 97). The level of education only partially depicts the level of qualifications, though it was used, because it is an indicator that can be collected for all developed countries and is internationally comparable. The subject of analysis were the unemployment rates in: subpopulation with primary and incomplete primary education (ISCED 0-2), upper secondary and post-secondary non-tertiary education (ISCED 3-4), and with tertiary education (ISCED 5-6). Data was collected for 29 developed countries<sup>16</sup> for the period 2004q3-2012q2 from the following databases: LABORSTA [6], OECD.Stat [15] Eurostat [3] and CEIC Data [7]. Therefore, the selected period covers two sub-periods of economic recovery and a sub-period of the strong economic downturn which has affected all of the analyzed countries. All collected time series were 32 quarters long and were complete (there were not any values missing). In the beginning the values of MM and  $\sigma$  indicators were calculated. Then, for these indicators and for the real GDP *per capita* the growth indices were calculated according to the following formula:

$$i\_X_t = X_t / X_{t-4} \quad (12)$$

Therefore these indices measure the changes over the same quarter from the previous year. This approach has allowed to avoid the problem of seasonality; calculated indices occurred also to be stationary (verification with the use of the KPSS test). Further analysis was based only on calculated indices.

In the presented study the verification whether economic growth fluctuation can influence structural mismatches on the labor market was done with the use of Granger's concept of causality and was based on the following equations:

$$i\_str_t = A_0 D_t + \sum_{j=1}^p \alpha_j i\_str_{i,t-j} + \gamma_i + \varepsilon_{i,t} \quad (13)$$

$$i\_str_t = A_0 D_t + \sum_{j=1}^p \alpha_j i\_str_{i,t-j} + \sum_{j=1}^p \beta_j i\_pkb_{i,t-j} + \gamma_i + \eta_t \quad (14)$$

where  $i$  indicates country and  $t$  denotes time,  $A_0 D_t$  denotes deterministic part (absolute coefficient, time trend),  $i\_str$  is the growth index of the indicator of structural mismatches on labor market (MM or  $\sigma$ ),  $i\_pkb$  is the growth index of real GDP *per capita*,  $\gamma_i$  is a country fixed effect, while  $\varepsilon$  and  $\eta$  are error terms. If equation (14) allows to model the  $i\_str$  variable more precisely (at the statistically significant scale) than equation (13) then there is a premise to conclude that the fluctuations in economic growth can be considered as a cause in Granger sense of changes in the

<sup>16</sup> These were: Austria, Belgium, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, Spain, USA, United Kingdom.

level of structural mismatches on labor market [5]. Thus, the tested hypothesis can be formally written as follows:  $\beta_1 = \beta_2 = \dots = \beta_q = 0$ . This hypothesis was tested with the use of the Wald test, which is given by the following formula:

$$W = T * (\hat{\sigma}^2(\varepsilon_t) - \hat{\sigma}^2(\eta_t)) / \hat{\sigma}^2(\eta_t) \quad (15)$$

where  $T$  is the number of observation,  $\hat{\sigma}^2(\varepsilon_t)$  and  $\hat{\sigma}^2(\eta_t)$  are estimators of residual variance in equations (13) and (14) respectively. This statistic has a  $X^2(p)$  distribution.

Estimations were conducted for 6 different lags (values of  $p$ ), with the use of the two-steps system GMM estimator [2] with Windmeijer's correction [17]. The variables were logarithmically transformed before the estimations. Final results of conducted tests (empirical and critical values of the Wald tests) are presented in Table 1. Tests for which there were premises to conclude the existence of a causality relationship (these were the tests in which the empirical value was greater than the critical one) were boldfaced.

Table 1. Results of conducted Granger tests

Lag (value of $p$ )	1		2		3		4		5		6	
Number of observations	783		754		725		696		667		638	
Empirical and critical values of the Wald test	Emp.	Crit.	Emp.	Crit.	Emp.	Crit.	Emp.	Crit.	Emp.	Crit.	Emp.	Crit.
<i>i_MM</i>	2,8	3,8	6,7	6	-5,3	7,8	-12,3	9,5	-31	11	-29,8	12,6
<i>i_σ</i>	43,5	3,8	29,7	6	30,7	7,8	28,3	9,5	-38,4	11	-142	12,6

Source: Own estimations.

The conducted tests allow to conclude the existence of a causal relationship in Granger's sense in case of four analyzed lags for the  $\sigma$  indicator and one lag in case of the MM indicator.

The different results for both indicators should be connected with different methods of their calculation and the different weights they assign to small variations in the unemployment rates among analyzed subpopulations, which was characteristic for many analyzed countries. However, obtained results for the  $\sigma$  indicator are sufficient to conclude that business cycle fluctuations in a statistically significant way had influenced the level of structural mismatches on the labor market during the analyzed period.

## SUMMARY

Conducted qualitative and quantitative analyses have allowed to confirm the stated hypothesis that fluctuations in economic growth affect the degree of structural mismatches on the labor market in terms of qualifications, and to conclude that the higher the rate of economic growth is, the lower the level of structural mismatches. Therefore it can be concluded that the opinion, frequently cited in literature, stating that structural mismatches on the labor market are insensitive to fluctuations in the business cycle is unjustified. Thus, it is also worth to emphasize that in labor market analysis a far-reaching caution should be applied to the use of "structural unemployment" and "cyclical unemployment" terms, which, as it was shown in the presented analysis, could not be considered as mutually exclusive.

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*Lukasz Puślecki*<sup>17</sup>

## SECTORAL ANALYSIS OF STRATEGIC TECHNOLOGY ALLIANCES IN THE YEARS 1980-2006

**Abstract:** The aim of this paper is to conduct a sectoral analysis of strategic technology alliances in the years 1980-2006, based on data obtained from the CATI-MERIT database and the National Science Board. The analysis will verify the Triad countries: US, EU and Japan and a group of countries outside the Triad (NT – Non Triad Countries).

**Keywords:** Strategic Technology Alliance, Strategic Alliance, Technological Cooperation

### INTRODUCTION

Analysis of strategic alliances, including technology ones, in the contemporary world economy shows some regularity. Many companies seek to implement joint projects using various types of agreements: joint-venture (JV), R&D research contracts, R & D agreements, joint R&D agreements, research contracts, technology exchange agreements, minority investments and cross holdings, customer-supplier relationships, and one-directional technology flows [Duysters, Hagedoorn, 2000, pp. 640-649 and Puślecki, 2008, 2009, 2010, 2011]. Due to the different situations on the market partners decide on various forms of alliances - complementary alliances, joint integration, pseudo-concentration (additive), informal and formal alliances (equity and non-equity). The implementation of broader cooperation in strategic alliances, including technology, allows collaborating companies gain significant synergies (including production, sales, purchasing, inventory, finance and management) [Gorynia, 2007, pp. 109-135] and reduce the risk resulting from high-tech projects. In case of the lack of success of the project, the risk is covered by all partners involved in the co-operation, and not just by one company in a situation of individual action.

The purpose of this article is to conduct a sectoral analysis of strategic technology alliances. The analysis will be carried out on the basis of data from the CATI-MERIT<sup>18</sup> database, University of Maastricht as well as on the basis of data obtained from the National Science Board (2006, 2008, 2010) and the ASAP (Association of Strategic Alliance Professionals). Issues related to strategic technology partnerships were also consulted with experts in this field: Professor Geert Duysters from Eindhoven University of Technology and Professor Ard-Pieter de Man from the VU University in Amsterdam.

### STRATEGIC TECHNOLOGY ALLIANCE

Strategic alliance can be understood as a special kind of cooperation between at least two parties (competitors or partners) operating in the same or related sectors to achieve common goals that have been set up, with the use of available resources, while preserving the autonomy of each partner, in a range of fields and areas not covered by the Partnership Agreement [Drewniak, 2004, pp. 17-18]. While technological alliance is implemented primarily through joint ventures (an alliance of two or more participants forming a separate entity fulfilling common goals), so-called equity alliances or, within capital alliances and R&D cooperation agreements, so-called non-equity alliances [Romanowska, 1997, pp. 80-90].

Strategic alliances were mainly created to consolidate or outsource additional business (non-core activity). Today, we may observe an increase in the conclusion of technological alliances

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<sup>18</sup> CATI database (The Cooperative Agreements and Technology Indicators - CATI Information System) - MERIT (Maastricht Economic and Social Research and Training Centre on Innovation and Technology) - provides information about 20,000 cooperative agreements established by companies in the years 1980-2006. [Duysters, Hagedoorn, 2000, pp. 640-649]

aimed at creating a completely new technology or entering new markets. Technological alliances are seen as strategic provided at least one company involved aims to improve the long-term perspective of product market combinations. Such strategic technology partnerships differ from other forms of partnerships, for example, established in order to reduce costs, which are more related to control transactions or the operating costs of companies [Duysters, Hagedoorn, 2000, op. cit].

An agreement on cooperation may take any of the various forms of such marketing agreements, production or research. Technology partnerships are defined as a form of cooperation, which includes at least an innovative activity or an exchange of technology between partners [Hagedoorn, 1993, pp. 371-385].

### TECHNOLOGICAL CO-OPERATION IN YEARS 1980-2006

Research figures based on database CATI-MERIT carried out in 1980-2006<sup>19</sup> on the number of newly established strategic technology alliances represent a trend in the behaviour of entities performing co-operation in R&D activities<sup>20</sup>. The results of the total number of newly established strategic technology agreements suggest that the positive upward trend, of course with some minor adjustments, has been preserved for over twenty years.

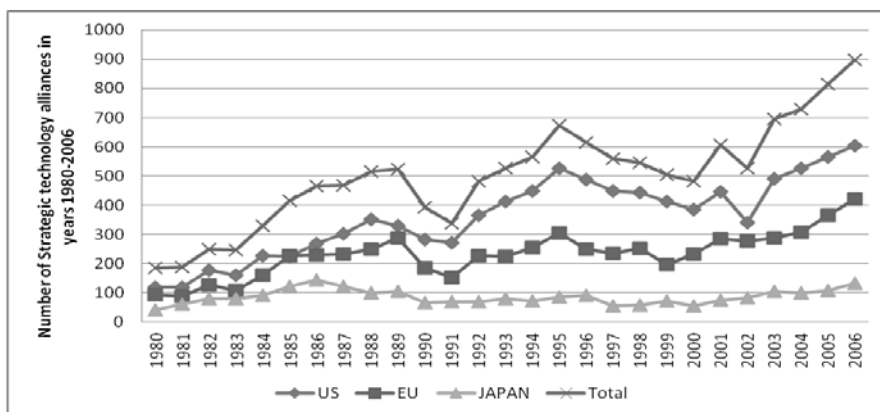


Fig. 1. Number of strategic technology alliances in 1980-2006

Source: Own calculations based on data from the National Science Board, 2006. *Science and Engineering Indicators 2006*, Volume 2, pp. 293-299 (Industrial technology alliances classified by country of ultimate parent company, by technology and type: 1980-2003, Maastricht Economic Research Institute on Innovation and Technology, Cooperative Agreements and Technology Indicators (CATI-MERIT) database, special tabulations) and the *Science and Engineering Indicators 2010*, as well as on data from the CATI-MERIT database, provided by prof. J. Hagedoorn and prof. G. Duysters.

On the basis of data from the NSB and the CATI-MERIT database in 2006, 898 newly technological alliances between the companies were established worldwide. These alliances were mostly concluded by companies in the U.S., EU and Japan, primarily in the field of biotechnology, information technology and services. Other areas include advanced materials technology, the

<sup>19</sup> Data on the number of newly established technology alliances between companies in the Triad, in the R&D sector for the years from 1980 to 2006 were obtained in 2010 from the CATI-MERIT database and the National Science Board (NSB - Science and Engineering Indicators 2010). These are the latest available data on the number of newly established technology alliances in R&D. Possible expansion of the database on the number of technological alliances in 2006-2009 is planned by NSB to be available in 2012-2014.

<sup>20</sup> These are annual data on new technology alliances formed by national or multinational corporations. Alliances can be classified in more than one technology. Country assignment is determined by the headquarters of the analyzed companies participating in the alliance.



aviation and defence industries, the automotive and the chemical industry (Figure 2). Through analysing each year we may observe the annually growing number of new technology agreements, with some minor adjustments. Determining factors of R&D technological cooperation the following has to be primarily included: reduction of costs and risk allocation provided by sharing measures, strategic or long-term activities to overtake innovation capacity, entering new markets and acquiring new technologies [Science and Engineering Indicators 2008, pp. 4 -59]. An important prerequisite for the implementation of technological cooperation in strategic technology partnerships is the positive impact of technological alliances in R&D on technical knowledge transfer and its absorption. Transfer of knowledge in the field addresses the largest multinational companies, and the smallest of the individual companies that do not operate under any agreements. Absorption of knowledge and a more competitive technological development will take place in companies involved in an alliance, rather than those not participating in any agreement.

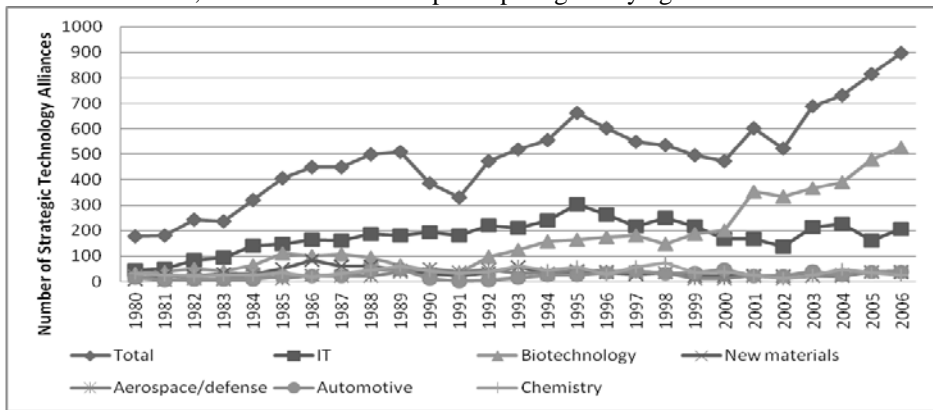


Fig. 2. Number of strategic technology alliances in 1980-2006 in various industries

Source: Own calculations based on data from the National Science Board, 2010. Science and Engineering Indicators 2010.

Taking into consideration the number of strategic technology alliances in the IT industry it is noticeable that many agreements have been concluded between American companies, followed by European and Japanese. Most alliances in the IT sector were concluded in 1995.

*NT = alliances in countries outside the Triad countries (USA, EU, Japan)*

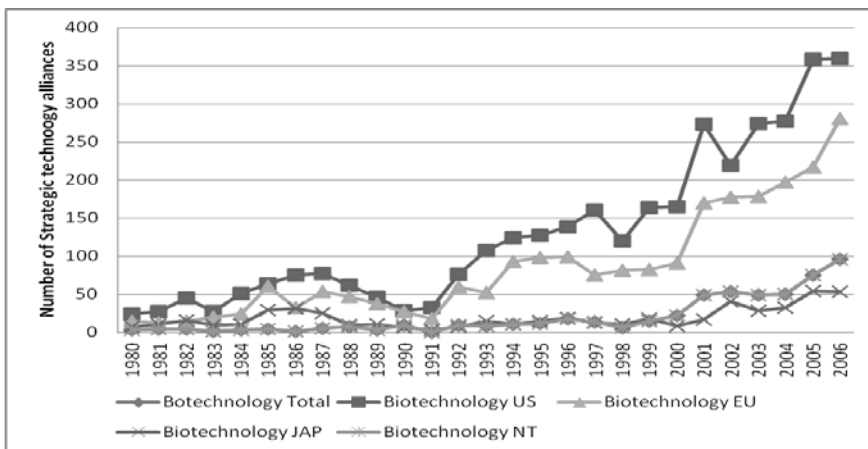


Fig. 3. Number of strategic technology alliances in 1980-2006 in the IT industry

Source: Own calculations based on data from the National Science Board, 2010. Science and Engineering Indicators 2010.



Taking into account the implementation of technological alliances in the biotechnology industry, it may be observed the most strategic technology alliances were concluded in the U.S., the EU and outside of the Triad (NT). Since the year 2000, a significant increase in biotechnology alliances is evident. Most agreements were concluded in 2006.

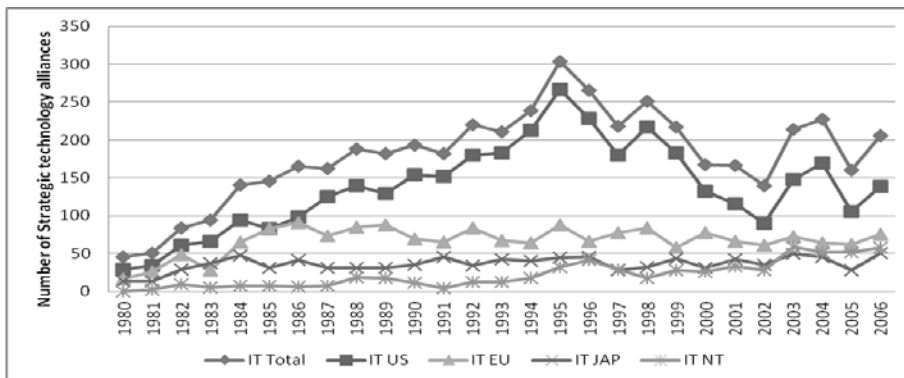


Fig. 4. Number of strategic technology alliances in 1980-2006 in the biotechnology industry

Source: Own calculations based on data from the National Science Board, 2010. *Science and Engineering Indicators 2010*.

## CONCLUSION

The conducted empirical analysis of strategic technology alliances in 1980-2006 showed a significant increase in new technology agreements. Empirical studies show the increasing importance which is being given to strategic partnerships in various fields of technology and their impact on the strengthening of international competitiveness. Companies are guided by a rational approach in the search for strategic partners with a view to primarily ally powers and resources. A significant increase in the number of alliances in the analysed period pertains not only to the intensive co-operation of companies, but also to its important role in enhancing their international competitiveness, and - through joint R&D research - also in their technological development.

The sector analysis showed a significant dominance of American agreements, followed by European and Japanese. Strategic technology alliances should be implemented mainly in modern sectors such as biotechnology and IT (the largest number of technological alliances in the years 1980 to 2010 in these sectors), where product development costs are particularly high and the product life cycle is shortened. In a situation where we are dealing with custom knowledge, the source of innovation are networks, not individual companies. It is very important for these companies to learn. The faster the learning process is, the greater the participation of firms in collaborative networks (access to knowledge) and the greater the company's ability to use that knowledge and to create on its basis (absorptive capacity). Joining networks of cooperation is a key growth strategy, for instance, for biotechnology companies [Wojnicka, 2004, p. 7].

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## EVALUATION OF THE IMPACT OF COSMETICS WITH NANOSILVER ON THE ENVIRONMENT

**Abstract:** More and more household products and cosmetics containing nanosilver may be found on store shelves. However, the impact of nanosilver has not been fully explored. An analysis of the Polish market of cosmetic products allows us to specify the sources (products) that nanosilver is coming from and the main areas of the environment that can be affected (water, soil, air). To determine this, scenarios for the environmental circulation of cosmetic products with nanosilver have been created. Next, elements of the environment that are potentially exposed to silver particles have been defined, as well as the products they come from. The areas for further research in this field have been also identified.

**Keywords:** nanosilver, cosmetics, personal care products, the environment

### INTRODUCTION

The development of research on nanomaterials helps scientists to obtain improved or entirely new properties of materials known to date. Thus they are used in many products [2,3,6]. It should, however, be borne in mind that new substances which are in use should be previously tested, also in the case of their environmental impact. Unfortunately, products are often placed on the market before proceeding with an adequate amount of toxicity and eco-toxicity tests [1,5].

The aim of this study is to determine the areas of the environment that can be potentially affected with nanosilver contained in cosmetics available on the market. Therefore, a review of the Polish market of cosmetic products with nanosilver has been conducted.

The growing frequency of use of nanosilver in many products, including everyday products results in the increase of exposure to nanosilver. Still, there is no sufficient data to clearly define the level of safety or hazards posed by silver nanoparticles, both for human health and the environment.

Nanocosmetics were chosen for the analysis, because according to a list of all available consumer nanoproducts on the world market [7] they are one of the largest groups of nanoproducts. Silver is the most commonly used material in nanoproducts. Therefore an attempt was made to analyse this category of products. It allowed the author to create a set of information that will help in assessing the risk of exposure to nanomaterials.

### SCIENTIFIC HYPOTHESIS

#### 1. Subject of research.

The behaviour of nanoparticles in the environment, not yet fully explored, makes the environment exposed to its potentially harmful effects. It is important to identify which areas and to what extent are affected by nanosilver in products. Very little data available relates to mixtures of nanosilver as a component of everyday products such as personal care products and cosmetics.

#### 2. Scope of research.

Attention is drawn to the lack of reliable data to assess the risk of exposure to nanomaterials and nanoproducts [5]. Therefore measures have been taken in order to obtain the necessary data for consumer products [4] or the nanotech industry [8] and to systematise and analyse them. The presented study corresponds to the indicated trend. As a result this study intends to identify the environmental area most exposed to nanosilver as an ingredient in cosmetic products. A scheme for the assessment of the impact of cosmetics with nanosilver on the environment will be created. It will

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show what data and at what stages needs to be collected in order to fully analyse the impact of these products on the environment.

### 3. Description of research methodology.

The Polish market of cosmetic products was analysed taking into account the use of nanosilver and resulting in a list of cosmetic products available on the Polish market containing nanosilver. Products were qualified to the list according to manufacturers' suggestion of using nanosilver, silver particles or silver ions. This indication is evident either in the product name (e.g. 'Silver Foot Cream'), the name of the underlying technology (e.g. 'Silver Protection') or direct product description.

Next, scenarios of circulation in the environment were defined, starting from the moment of use by the consumer. This allowed to determine the areas of the environment exposed to nanosilver in cosmetics.

### DETAILED DESCRIPTION OF THE RESEARCH ISSUE OR RESEARCH RESULTS

The list of products is based on a review of the Polish cosmetics market in the period from January to April 2011. The list of nanosilver cosmetic products available on the Polish market consists of a set of 53 products from 10 manufacturers. A review of the market was repeated in the same period of 2012 - there were no significant differences, however.

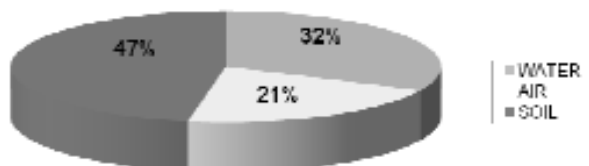


Fig. 1. Classification of cosmetics with nanosilver due to their direct impact on water, air and soil

Source: own elaboration

The cosmetics were divided into product groups and for each group a specific circulation in the environment scenario was identified. Then, in each case, the author has indicated which areas are the most exposed to the effects of given cosmetics. It was found that cosmetics can be classified due to their direct impact on water, air and soil. The results are shown in Figure 1. It was considered that cosmetics such as soap, shampoos, shower gels, face wash gels and shaving gels reveal a direct impact on water. 32 per cent of the products in the list belong to these categories. 47 per cent of cosmetics, such as foot creams, face creams, lotions and antiperspirants interact with the soil. While 21 per cent of the products contained in the list directly affect the air, namely: eau de toilette, aftershaves, antiperspirant sprays.

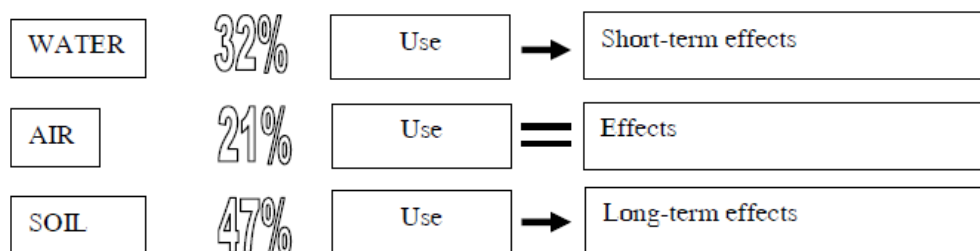


Fig. 2. The relation between effects and use

Source: own elaboration

The relation between effects and use is also important (Figure 2). In the case of the largest group of cosmetics affecting the soil, effects occur over a long period of time relative to use. In the case of cosmetics directly affecting the air impact occurs at the time of use, however, this group of products forms the least number in the list; while for products interacting directly with water the interaction takes place in a very short time after use and these products are one-third of all products in the list.

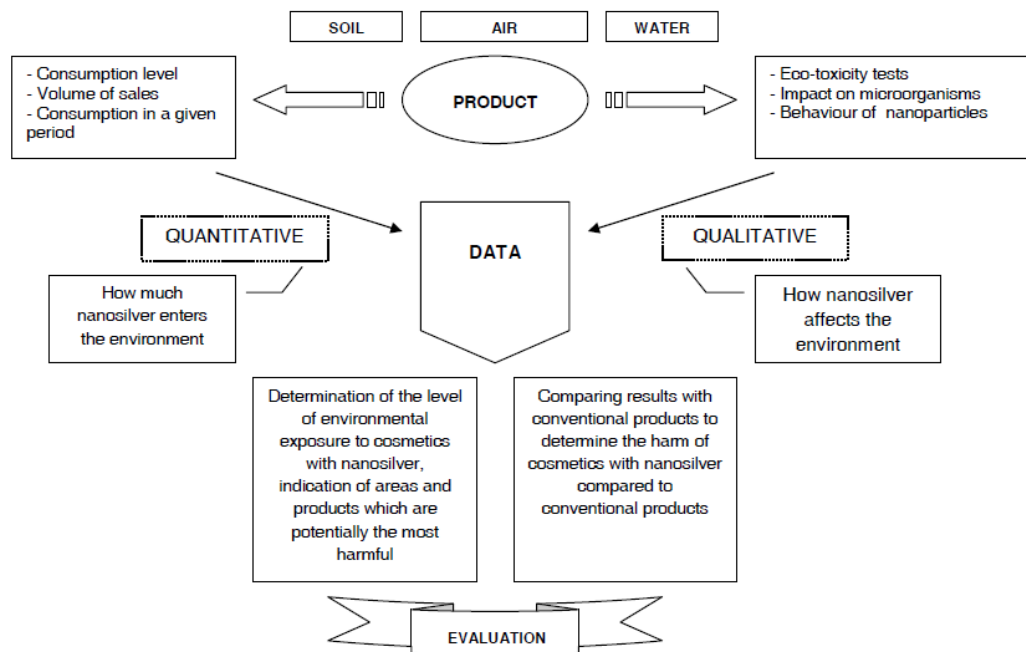


Fig. 3. The scheme of impact assessment of nanosilver cosmetics on the environment

Source: own elaboration

In the last stage, on the basis of the analyses, the scheme of impact assessment of nanosilver cosmetics on the environment was created (Figure 3). It is suggested that each products' group (described above) should be analysed separately. In order to make a full assessment both quantitative and qualitative data is needed. Quantitative data provides information on how much nanosilver gets into the environment. This data can be obtained by specifying the level of consumption of the product, the volume of sales or consumption in a given period (e.g. one year). Whereas qualitative data informs about how nanosilver affects the environment and can be derived from eco-toxicity tests, tests of impact on microorganisms and studies of the behaviour of nanoparticles (degradation, bioaccumulation).

Collecting and analysing the mentioned data makes it possible to determine the level of environmental exposure to cosmetics with nanosilver. It will also allow us to indicate the areas and products which are potentially the most harmful. It would be also appropriate to compare the results with conventional products to determine the harm of cosmetics with nanosilver compared to conventional products. The results of these studies would be the basis for evaluating the impact of nanosilver cosmetics on the environment.

## CONCLUSIONS

Using the unique properties of nanoparticles in everyday products we should bear in mind their potential impact on the environment. Because of their unique properties nanoparticles do not need to

be added into the product in large quantities to achieve the desired effect. However, the use of nanoparticles in a growing number of products increases exposure to them.

Currently scientists around the world are trying to characterise the behaviour of silver nanoparticles and their impact on the environment. It is also important to consider the path of silver particles as components of products (such as cosmetics) after they have entered the environment.

As a result of the presented work the elements of the environment potentially most exposed to silver particles have been determined, as well as the products from which they come.

The areas for further research in this field have also been indicated. This might help in the collection of data enabling a full analysis of the impact of nanosilver coming from cosmetic products.

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## CUSTOMER-INNOVATIVE MODULAR PRODUCTION IN A SMALL BUSINESS

**Abstract:** The article deals with the application of modular production sites in terms of small machinery production. Documents practically work output for breast work processed in different software systems.

**Keywords:** ergonomic design, modular workstations, design of workstations, Al-profile kit systems, innovative production, production configurations

### 1. INTRODUCTION

Production demands can change rapidly, whether they are changing quantities, new product variants, or product generations – manual production systems based on aluminium profile technology can be flexibly adjusted to fit any need. The inventors of the aluminium profile technology, in the field of assembly construction, offer an alternative to welded steel constructions in the form of basic mechanical elements and a modular profile system.

### 2. ERGONOMIC DESIGN OF MODULAR WORKSTATIONS

An ergonomic workstation facilitates work, maintains health and motivates employees, thereby providing a solid foundation for high productivity and economic success. Ergonomic movements make processes safer, faster and smoother.

Ergonomic workstations pay for themselves by facilitating work, reducing downtime, and increasing productivity.

Manual workstations must accommodate a wide range of body heights to ensure that the largest percentage of the population is covered. Country-specific differences and regional requirements must also be taken into account. The design of working systems by ergonomics is described under e.g. DIN ENV 26 385 [2]. The objective of ergonomic design is, among others, the adaptation of workplace, working space, environment and lighting to human properties and skills. The modular system for designing individual workplaces enables optimal adaptation to a specific task and an individual employee.

Correct workplace design has, to a high degree, positive effects on employees' health, performance, endurance and concentration. The most important factors for designing work equipment are the working height, proper sizing of the reach zones and required legroom, as well as definition of the appropriate range of vision. All of these dimensions are derived from a “standardized” body height.

Further criteria that must be taken into account [2]:

- foot and legroom, depth and adjustment range of the footrest;
- size and variation of the work-piece's dimensions;
- occurring forces and weights;
- changing types of equipment and insert heights;
- greatly varying vision distances;
- local specifications (deviating body heights, legal requirements, etc.);
- aspects related to methods, safety, and efficiency.

By incorporating ergonomic aspects into the design of production equipment in assembly workstations, we allow for optimized working conditions and thus increase the motivation of workers.

Ergonomically and individually designed production systems ensure:

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- work with reduced fatigue;
- increased productivity;
- targeted and optimized use of capacities;
- motivated workers.

An ergonomic workstation design plays a decisive role in reducing waste during production. Thus, for example, the movements for grabbing parts and the distances workers have to walk are directly related to the design of the individual workplace. From the point of view of ergonomics, the main focus is on the worker. This is why these workstations are designed to fit each worker and not the other way round.

Well-designed stand up/move and sit down/stand up concepts are the foundation for dynamic, stress-free work. Both concepts are based on individually adaptable workstations with perfectly matched chairs. The building block profile systems provide all the modules that are needed to ergonomically design and arrange workstations. An ergonomics checklist (Figure 1) has been developed that assists during workstation planning and design, which will help attain the greatest possible performance, safety, and motivation from workers.

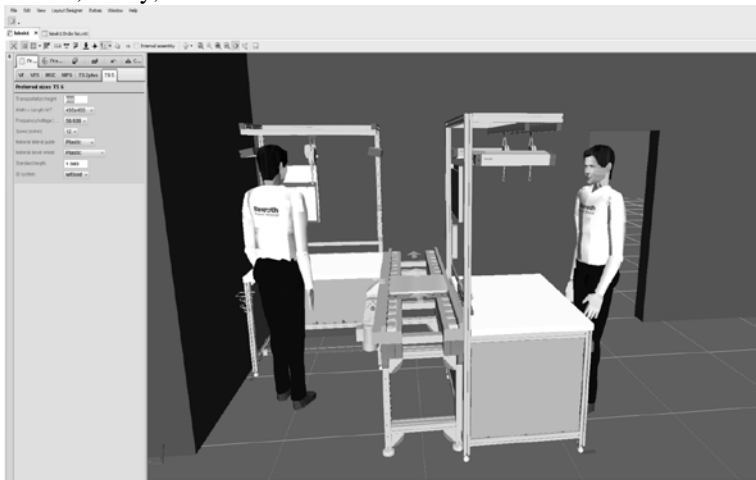


Fig. 1. Design of sit down/stand up workstation concept by ergonomic standards

Workstation systems and a complete range of accessories for construction systems based on building blocks may be individually adapted to different production needs. Custom designed workstations offer a wide range of variable dimensions and individual solutions or you may select a system from standard products with fixed dimensions.

The dimensions and position of the table top results from the dimensions selected for the workstation height, width, and depth. Height-adjustable feet levelling makes it possible to compensate for floor irregularities and casters can be used to create mobile workstations. Height-adjustable workstations are the most flexible solution for dealing with extremely varied work-piece/component dimensions and large differences in employee heights. Height-adjustable workstations are perfectly suited for visual inspection and manual work (e.g. in wristwatch assembly or jewellery manufacturing).

An example of application of building-block principle equipment on the basis of Al-construction profiles is presented in Figure 2.

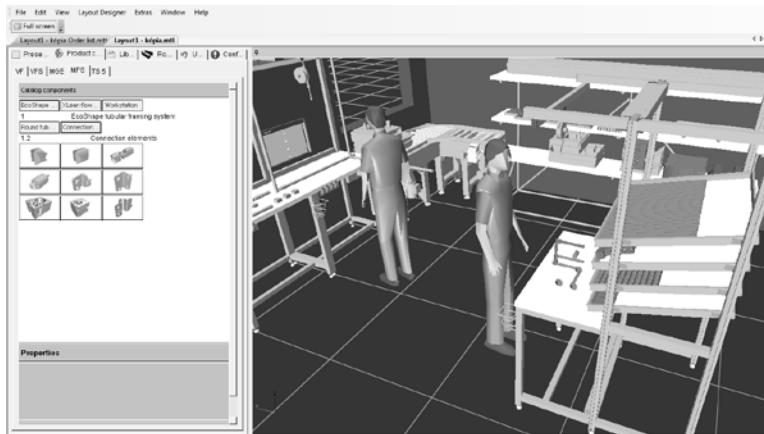


Fig. 2. Layout of a manual assembly/disassembly workstation - mobile modular workstation

It is possible to create ergonomically ideal working conditions by using an electrically height-adjustable workstation. The dimensions indicated for the width, height, and depth always refer to the outer dimensions of the workstation. The work area height should always be between 800 mm and 1500 mm.

Workstation accessories - these functional workstation components can be used at any station and increase the efficiency of workers. They offer defined storage spaces, support work processes and ensure optimum transparency and ergonomics. All workstations can be equipped with side panels and footrests, as well as clothing and bottle holders. It is possible to equip the workstations with socket strips, system lamps, and compressed air strips. Suitable accessories make it possible to supply grab containers, tools and information at the workstation. An accessory upright enables, for example, the installation of material shelves for supplying parts at the workstation [3].

All reach distances should be as short as possible to avoid redundant, no-value-added movements. Grab containers and parts' containers that are in direct reach of the employee are ideal. In addition, a comprehensive program of accessories consisting of workstation lighting, power supply, as well as information provision and positioning of tools, components and swivel work chairs, is available.

To maintain performance and promote productivity, all work equipment near the workstation must be precisely adjusted to the employees and their activity. Correct adjustment of the table, chair, footrest and grab containers, as well as the position of tools and material shuttles, minimizes movement, thus reducing physical exertion and employee absences.

A few important considerations [5]:

- when adjusting the chair and footrest, make sure that the thighs and calves form a right angle,
- information boards should be hung at eye level to avoid unnecessary head movements,
- the angle of the shelves for material supply should be adjusted to create short, direct reach distances,
- use lifting aids to supply heavy parts,
- monitor brackets and tool shelves can be adjusted to any height via the profile groove,
- with height-adjustable workstations, the optimum working height can be adjusted according to the size of the person or product,
- information on how to adjust work equipment can be provided on information boards.

It is just the small things that often count: handy accessories are a necessary addition to the perfect design of an optimal workplace. Everything must be in its proper place and instructions or information should be provided properly and be clearly visible. Auxiliary equipment, helping to

avoid loads and allowing for good workplace overview, noticeably supports efficiency at reduced employees' stress.

Open system dimensions and numerous components enable individual designs for sit-down and stand-up workstations. It makes an almost unlimited number of designs possible with just a few components.

Individual constructions and assemblies in the manual production systems are the foundation for continual improvements and gradual investments in production equipment and thus guarantee even more efficiency.

The following points underline the positive results of such continuous improvement [1]:

- reduction of work area;
- shortening of distances walked by workers;
- increased employee motivation;
- considerable increase in transparency and flexibility.

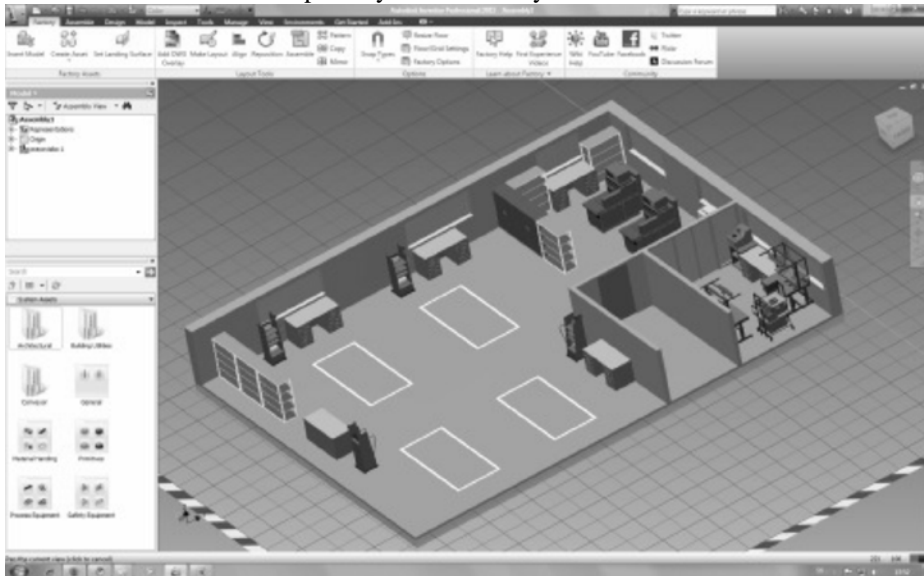


Fig. 3. Insertion of 3D models into the layout of a workplace

Modular assembly workstations have been tested in practice and are constantly developing further. The workstation can be constructed from individual components or purchased as a complete and fully assembled system. The profile system contains a broad and high-quality accessory program, which guarantees an optimal adjustment to individual requirements. An adequate modification allows the working table to be easily integrated into existing assembly lines. A future-oriented concept of flexible assembly systems of workstations is based on standardized structural frame designs, as well as process modules with compact dimensions. An example of a modular solution for an assembly workplace is shown in Figure 3.

Lean and waste-free production begins with efficient and low-waste planning of individually designed workstations and material supply systems.

### 3. CONCLUSIONS

The flexibility of modular building blocks profile system in assembly workstations provides a long list of benefits: start-up costs are lower, there is a shorter debug time, reuse reduces later capital investments, they can be reconfigured when production requirements change, simple fast assembly, short planning time, simple disassembly, easy construction, retrospective modifications, reassembling of all elements because it offers a comprehensive, harmonised profile system.



The modular, standardized design of all building components means they can be shipped quickly for replacement, resulting in minimum downtime.

All profiles can be combined in any way imaginable; the accessories provide functional and aesthetic solutions for a wide range of applications: machine bases, enclosures, guarding, work-assembly and inspection stations, transfer and supply trolleys, partitions and protective walls and cabins, special shelves etc.

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*Andrzej Szymkowiak*<sup>23</sup>

## DUALITY OF DECISION-MAKING PROCESS

**Abstract:** The aim of this article is to present the results of a study on differences between the place where the consumer makes purchase decisions, and the actual place of their execution. Taking prudent decision, the consumer is aware of the possibility of purchasing the product through various sales channels: stationary shops or through e-commerce. Place of the finalization of the selected goods purchase may not be the same as the place taking decision about its desire to purchase, but the choice of a specific good may be the result of employee effort of another business entity.

**Keywords:** Purchase decisions, e-commerce, e-consumer, sales promotion

### INTRODUCTION

Development of tools with access to the Internet provides consumers with easy and fast access to information, which affects the consciousness of decision-making. Note, however, that such a fragmented and incoherent stream can create limitations in the assimilation of knowledge and simultaneously difficult decisions. Pejorative attitude of consumers to advertising as an information medium, as confirmed by research [1], paying particular attention to the opinion of the people, both friends and strangers, as a valuable source of knowledge. In particular, the opinion of relatives, friends, but also unknown internet users have spoken out on the subject and sellers somehow unbiased experts in the field.

Through personal contact with the seller, the consumer is able to obtain information on various products, and through interactions vendor can advise on which model would be best suited to meet specific needs of the limitations. Element of consultancy is therefore added value to the customer [2], who does not incur any additional costs due to the use of knowledge seller. For the seller appropriate level of knowledge is the result of experience, and gained education or training. In the case of hiring salespeople, possessed knowledge and skills affect, which is a real cost. In the absence of a separate salary for service element in the trade, entrepreneur includes the total cost of in the price the final product.

### PLACE OF DECISION AND PLACE OF PURCHASE

The decision-making process be taken into account the situation where the information obtained from the seller for the customer been valuable and the situation when a client decides independently. For the first example, in this article, particular attention was paid to the situation in which on the basis of received information and opinions, the customer decides to purchase a specific, but not at this place and the time. In the situation when it comes to the use of knowledge and advice seller or the use of information materials, technical studies and developed their own opinion resulting work of the company is to be determined, as no acquisition cost of services in trade.

Below are the results of the survey conducted in the first half of 2012 of 109 people aged 20-26 years who are students of the University of Economics in Poznań. Among the 109 persons 71 per cent claimed they had taken the decision in a stationary store and made a purchase in the online store. Only 29 per cent of respondents confirmed that this was the case. This means that in the case of 2/3 subjects there were other factors affecting the selection a different channel of the sale and purchase of another dealer. Among the 77 who happened to make a decision in a stationary store and complete the purchasing process in the online store asked what factors decided the situation. With the ability to display up to 3 factors, including the importance of the different components, 72 per cent of respondents pointed to the price criterion, as the determining factor.

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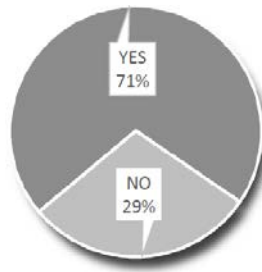


Fig. 1. Participation of decision makers in a stationary store and buying in the online store

*Source: own elaboration*

Among the 109 persons 71 per cent claimed they had taken the decision in a stationary store and made a purchase in the online store. Only 29 per cent of respondents confirmed that this was the case. This means that in the case of 2/3 subjects there were other factors affecting the selection a different channel of the sale and purchase of another dealer. Among the 77 who happened to make a decision in a stationary store and complete the purchasing process in the online store asked what factors decided the situation. With the ability to display up to 3 factors, including the importance of the different components, 72 per cent of respondents pointed to the price criterion, as the determining factor. It should be noted that the preferred way to receiving is courier [3], which price ranges from about 15 PLN to 60 PLN [4]. This means that 72 per cent of the selectable items on the Internet and the ordered sales channel are available at a lower price, respectively, balancing the cost of transport, or allowing to save more. 43 per cent of respondents indicated as important a determinant of their decision on a change of the traditional purchase of an electronic store for product availability. There are no restrictions on premises with a special focus exhibition space enables us to offer an extensive range of products both in terms of vertical and horizontal diversification. Diversity affects the image of the store, of course, in the context of its specialization, flexibility or complementary offerings.

In case of unavailability of the product with a specific parameter selected product such as a lack of desired color or size of the product, the customer is not possible to make a purchase. In this situation, search for an alternative place of purchase does not result directly from the willingness of the customer. In among the following factors: quality of service, speed of execution, transaction security, participation in loyalty programs, convenience shopping, contact your dealer or others, 5 of 77 respondents indicated that as a given factor was the most important and the greatest impact on the decision. With 2 persons identified the quality of service and shopping convenience, and speed of execution of one person.

Respondents who answered affirmatively to the question of separation of places to make purchasing decisions and complete the transaction, were asked to write down the products to which the situation was to refer. Based on the responses made categorization in which electronic transactions related to previous decision made in a stationary store. 66 per cent. respondents indicated products for computers (desktops, laptops, tablets, etc.), the second group of products indicated by the respondents (59 per cent) were equipment and household appliances.

One in two people declare buying shoe by online shops. It should be noted that the responses to the respondents (about 34 per cent) refine selected footwear brand name, which may restrict the use of the internet especially in a situation where the product is characterized by a relatively constant quality and limited product diversity (e.g. shoe length and the use of uniform sizes). Cited product homogeneity and lack of physical contact with the product in the case of clothing may be factors in the situation. Indirectly, it can also indicate a more impulsive nature of the purchases of clothing and difficulties with finding the same clothes in online stores. In the category of products classified respondents indicated: pocketknife, hub caps and a board game.

The survey was also carried out analysis of the opposite situation to that described above. Respondents were asked about the situation of the decision to want to buy the product in the online store and make a purchase in stationary store. Among the 59,6 per cent of respondents declared that this situation is consistent with their behavior, and 40,4 per cent, was disputed.

The share of people who have decided elsewhere and made the actual purchase, is smaller by about 10 percentage points relative to the situation described in this article, but it should be noted that they still constitute the majority. In comparison to the stationary shops user as a potential customer can alone see the full description and make comparisons with other products in terms of different specifications and prices.

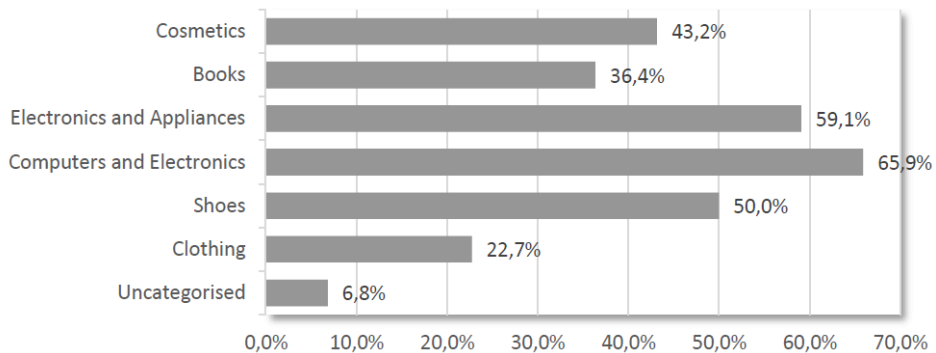


Fig. 2. Categories of products bought in online stores based on the knowledge obtained in stationary stores

Source: own elaboration

Online shops often provide the opportunity to comment on the products of their respective owners, which is to user's perception of subjective, but a reliable source of information about the product and its operation. The source of the information posted by the seller are made pictures and description. Familiarizing with the user gain knowledge and based on that defines the priorities and weights constituting the basis for rational decision. No time limits and continuous access to information related to the effect of the decision to choosing the product. As shown by the results of the study, nearly 60 per cent of users, even though the decision is not finalized by the Internet channel, but in a stationary store. For online stores effect is the lack of income from the sale despite of dedicated work to the virtual presentation of the product and the costs associated with the promotion on the Internet, in effect, that user found a website with a sought-after product, and interest in the presented content.



Fig. 3. Participation of decision makers in the online store and purchasing in a stationary store.

Source: own elaboration

Among those who declared the existence of this situation, were asked the question about the causes of this situation. As previously able to identify the three factors of significance factor, where

the number 1 on the item meant that it is crucial for a mutandis 2 and 3 as an important but less important. Among the three most frequently indicated factors regardless of their rank indicated speed of execution (73 per cent), security transaction (59 per cent) and direct contact (59 per cent). The first recalled item that was also the most often (in 40 per cent of cases) as the most important. As the second most important factor most frequently indicated (41 per cent) element habits. Elements associated with the element of service indicated nearly every 4 person.

This indicates that for those who have decided to using the electronic sources of information, "retail trade service element" is not a value, and they are determined on a product without the need for additional communication-related consulting on the maintenance staff. Price in 18 per cent of cases has been described as an important element in determining the cessation of online purchasing process and selection of the traditional form of transaction. The result shown is not clearly understood, that the prices in the shops were cheaper fixed, because economic calculation should take into account the cost of logistics.

The study enabled the groups of products that users make a decision at online stores and physical purchase and payment of goods takes place in stationary stores. All boot examples of goods indicated by respondents were grouped into seven product categories and the group produced elsewhere classified. These include: Ski equipment, lenses, automotive parts. Other items are classified into groups: clothing, shoes, toys, cosmetics, jewelery and electronics, mobile consumer electronics and ADG. Respondents indicated the most common groups of products: footwear (55,4 per cent) and clothing (44,6 per cent). In relation to the previous situation, there was a significant increase in the area of clothing. Correlation is high (at 78 per cent) among those who have pointed out the group, and at the same time between the important factors identified element of the possibility of direct tangency with the product. Accounted for a large group of people who chose home electronics & appliances or electronics in an area with particular emphasis on mobile phones. Products included in all groups are characterized by the fact that not a single transaction when a customer buys a single copy. This reduces the cost of transport between the ordered that should be added to the cost of shopping at online stores. In the case of jewelery and children's toys, virtual presentation could be insufficient because of the need for verification of quality items that can not be evaluated remotely.

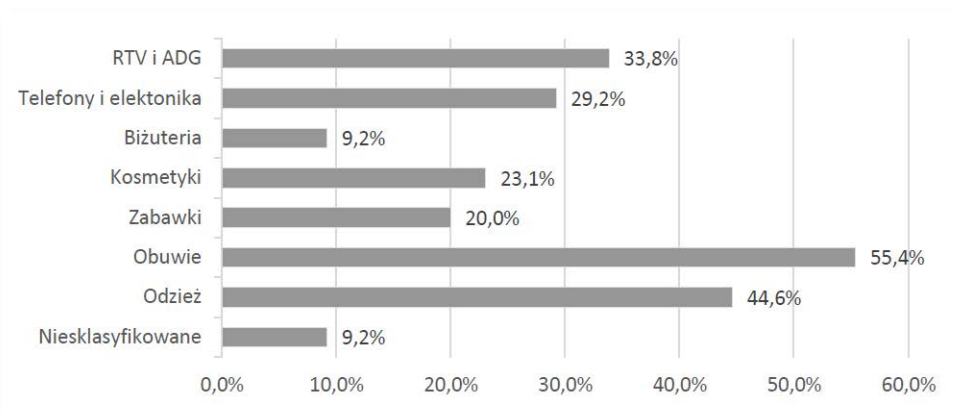


Fig. 4. Categories of products purchased in stationary stores based on the knowledge acquired through online stores (per cent)

Source: own elaboration



## CONCLUSIONS

The purpose of the article was to show two perspectives of competitiveness stationary stores and online, and assess their impact on the decision-making process. The results point to the need to separate the decision-making phase for product selection and choice of place of transaction separately in terms of traditional or electronic. It has been shown that there are situations in which the user decides in store for example on the basis of the opinion of the seller or the try-and tested, and then on the basis of the information obtained is looking for selected goods available on the internet in order to minimize such costs. Despite certain financial expenditures: labor costs, the cost of renting the property, the cost of the goods, the seller does not generate revenue. It should however be noted that there are also situations reversed. Identified examples of where the user is looking at online stores right product, and then goes to a stationary store to complete the transaction with another company. Can avoid the same time waiting for the product and does not assume the additional costs associated with the delivery and use in the effort time e-retailer.

These situations are not impulsive purchases and rational decisions to maximize their own benefits. Proper identification of potential clients taking into account the structure of the described behavior will enable the optimization of working capital and improving the efficiency of invested funds. Trade organizations understood the changes in the market and aware of the bi-directional flow of customers from stationary stores to online stores, and vice versa: from online stores stationary stores should strengthen sales promotion and more flexible terms and conditions so as to alleviate the factors that determine the customer to seek alternative plane of the trade.

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*Dariusz Walczak*<sup>24</sup>

## **PARTICIPATORY SENSING NETWORKS IN SMART CITIES: REVIEW OF BUSINESS MODELS**

**Abstract:** Future Internet and global competition among cities pushes us towards a connected world where people are the source of data for governments and enterprises. The technology is out there but the number of intelligent cities increases slowly. Required infrastructure is expensive and only the richest cities can afford it. Luckily, a "smart" alternative does exist - participatory sensing. It promises sustainability by engaging citizens and enterprises in building and maintaining sensing infrastructure. This paper reviews projects based on this paradigm in terms of business models.

**Keywords:** Sensor networks, participatory sensing, business models, smart cities

### **INTRODUCTION**

The term "Smart City" has been known for many years. After the economic crisis in 2008-2009 the term has been revived. The global competition for high-skilled labour force and enterprises has started [12]. Unfortunately, there is no strict formula for a city to become smart. H. Chourabi et al. in [3] made a comprehensive review of different definitions of "Smart Cities". The one which suits this paper best is as follows:

"A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens" [10].

So, smart cities are built on sensing technologies. Researchers for many years were focused on the deployment and communication aspects of sensor networks in cities. Corporations see the new trend as a big market opportunity. I.B.M. has started a huge initiative called Smart Planet [20], Cisco has its own Smart+Connected programme [22]. The government can pay the corporations to build sensing infrastructure and label the city as "smart". This is known as the top-down model. It is, however, very expensive and inflexible. Usman Haque calls this "one-size fits all" approach. In his opinion existing solutions are not really scalable and ignore citizen needs [13].

Luckily, a "smart" alternative does exist - participatory sensing. It promises sustainability by engaging citizens and enterprises in building and maintaining a sensing infrastructure. This paper reviews projects based on this paradigm in terms of business models. The research has no territorial or time constraints. The "smart" phenomenon covers whole planet and the technology is relatively new. To the best of the author's knowledge this is the first review of business models for participatory sensing networks.

Participatory sensing fits in very well with three important initiatives: Future Internet (FI), Future Internet Public-Private Partnership Programme (FI-PPP) and of course the European Commission's (EC) initiative for smart cities.

We are entering the era of FI. One of its pillars is Internet of Things (IoT). It promises a world where all our devices are constantly connected to the Internet. This is a natural environment for participatory networks and makes the top-down model irrelevant. A lot of telecommunication and IT researches have been done in this area, also in Poland - within the Future Internet Engineering Project. But FI is not only infrastructure or protocol change.

The EC has launched a programme called Future Internet Public-Private Partnership - which supports the idea of collaboration between citizens, enterprises and governments. New networks

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will create great opportunities for new businesses. Participatory sensing suits this trend perfectly. Projects based on this approach can benefit from the FI-PPP programme.

Last but not least, the Initiative on Smart Cities started by the EC. According to their site [23], Europe will spend 10000 - 12000 M € on intelligent cities by 2020.

### **SENSOR NETWORKS AS A BASE FOR SMART CITIES**

Participatory sensor networks analyse and share information gathered from mobile devices owned by public or professional users. Usually this process requires the device operator's collaboration or at least his acceptance [2]. Some data might be captured as background activity without interaction with users, which is then called opportunistic sensing [15].

Participatory networks can replace the top-down approach if collected data is put in context - the location and time of measurement. For all three, algorithms may produce full information. The context is also a privacy issue. Participants might refuse to share such sensitive data.

The key to success in participatory sensing are engaged users. But being a part of a sensor network costs them resources - e.g. mobile phone battery and time to maintain sharing. Users will drop out if they will not see any benefits. The business model is crucial. The Return on Investment has to be greater than their costs and expectations [16].

### **BUSINESS MODELS OF PARTICIPATORY SENSING**

#### **BARTER**

Barter is one of the most popular ways for exchanging data in participatory networks. Users are rewarded for sharing data with useful output information. This is rational for some domains, e.g. traffic information - most drivers are interested in information about road barriers, bottlenecks and jams. Participant-based traffic detection systems are not only the subject of research, but they are also publicly available on the market. Good examples are Waze [9] and NaviExpert [6]; both are GPS navigation systems with traffic information based on data from their users. Y. F. Dong described the barter participatory system for collective full prices [5]. The drivers send pictures from their mobile phones to the server. Then, video processing is conducted. As a reward users know where the cheapest fuel in the neighbourhood is located.

Sometimes the output information is important but not popular or desirable, e.g. the level of air pollution or noise are important but only a small percentage of citizens cares about it. Small number of users might decrease the quality of information and increase dropouts. Some networks use gamification to bring and hold users active.

Gamification is the use of game design elements in non-game contexts. It usually refers to the usage and design of a service. It motivates users and encourages them to compete [4]. This paradigm is quite popular in social networks e.g. Foursquare .

PEIR, a project by Nokia, enables children to measure carbon footprints by registering their transportation behaviours. To make it more attractive, PEIR has now a connection with Facebook so users can share their impact on the environment [18]. By sharing impact publicly users motivate their friends to join the "game" and compete. The reward is to be the best at making the impact. Users are invited to analyse data collected by PEIR and change their daily routines, e.g. change their route to school or to work.

Most such projects are still in their research phase or work in small groups of personally engaged people.

### **SELL YOUR EXPERIENCE**

The simplest way to attract users is to pay them. The owner or coordinator of a network can hire people to carry the hardware and sense the environment. Intel hired 7 taxi drivers and 3 students to sense the air quality over the city of Accra in Ghana. This was a part of the "Urban Atmospheres" project. They used seven GPS loggers, tubes with monoxide sensors and three mobile clip sensors with the same equipment. The participants had to use these sensors during most of their



daily activities [19]. Such a small number of users enabled the authors of the experiment to create an air quality heat map of the whole city.

Participants may also sell data on auctions. This is very popular in participatory networking. In [16] Juong-Sik Lee and Baik Hoh propose a Reverse Auction-based Dynamic Price (RADP) – a mechanism which gives users credits for sharing sensed data and for participation. In RADP users bid for selling their data and the service provider chooses the few best offers. This simplifies pricing decisions and enables users to play an active role in the process. The participant registers himself and downloads an application. Then, for each auction, the following steps occur:

- 1) the mobile applications send measurements and bid prices to the service provider,
- 2) the service provider checks the data for quality and filters private data,
- 3) the service provider selects the winners based on the bid price and notifies both: winners and losers.

This pattern repeats itself in other projects, too.

Lee and Hoh noticed that in this model some users might lose often, which leads to participants' drop outs. In order to prevent this, they propose a retaining mechanism - Virtual Participation Credit (VPC). A user who lost in the previous auction round receives this credit as a reward for participation. Assuming  $r$  - round number,  $i$  - user identifier,  $\alpha$  - virtual credit for participation, the VPC is defined in [16] as:

- $v_i^r = V_i^{r-1} + \alpha$ , if user  $i$  lost auction in round  $r - 1$
- $v_i^r = 0$ , otherwise,.

Earned credit can be used in the next round to decrease the bid price and as a consequence increase the probability of winning. So the users claim bids ( $b_i^r$ ), but the service provider uses a competition bid  $b_i^{r*}$  defined as:  $b_i^{r*} = b_i^r - v_i^r$ . High probability of winning encourages participants to rejoin the auction and increase competition.

An alternative approach is the Generalized Vickrey Auction (GVA). For each participant the number of wins and bids are stored. Then, parameter  $\mu$  is counted as the average bidding term. The winners are selected based on this measure. In forward auctions the highest score wins, in reverse - the smallest, counted based on negation of bids. It is effective for recurring auctions and easy to understand[11].

Holzbauer et al. propose a socially-aware market based on first price: "Privacy, Power, and Participation-aware Auction Mechanism" (P3AM). The auction has  $N$  winners, where  $P_{cheapest}$  is selected by the cheapest bids and the rest based on the lowest "return on investment" -  $P_{base}$

[11]. The auctioneer sees the bid:  $b = p_{base} \times f_{power} \times f_{privacy}$ , where:  $f_{power} = \frac{1}{\lambda_{pow}}$ ,

$$f_{privacy} = \begin{cases} 2^{(1/t_{last})}, & t_{last} > 0 \\ 1, & t_{last} = 0 \end{cases}$$

$f_{privacy}$  - function based on the time since the last auction win -  $t_{last}$  e.g. the number of rounds.  $f_{power}$  and  $f_{privacy}$  address the social issues of users. The first one controls the battery status - user will not be able to send the data when battery level are low. The second one controls how often the device will be sending data about its position to the system - users do not want to reveal very detailed information about their location [11].

## SOCIAL NETWORKING

Some participatory systems are inspired by social networks. They let users share data to support the community. The best known - Pachube - was started in 2008 by UsmanHaque. He believes that people own the data generated by their devices and have right to exploit their full potential. He is against controlling the data by city managers, limiting usage to pre-defined services and building smart cities on vendor lock-in technologies [14].

For Usman it is important to make the process of connecting devices and using data as easy as possible. There are a lot of libraries and devices which are compatible with his platform. In the simplest scenario, users have to buy a device, download free software to share the data through Pachube and then choose an application to process it. The platform is capable of pulling data every 15 minutes; if it cannot - the device status is changed to frozen. One can use different well known formats, like CVS, XML or JSON.

Pachube was supposed to make its earnings on privacy – users who share their data for free were able to use platform for free. Those who care about privacy or do not want to share data had to pay. The portal grew rapidly so the owners had to find another source of funding. The privacy business model could not cover the costs. In 2011 Pachube was acquired by LogMeIn - a cloud-based hosting company. The new owner in one of his press releases declares that he will spend \$ 1 million per quarter on operating costs related to the platform [17]. This is probably the cost of hosting the biggest sensor data sharing platform. According to the blog of LogMeIn<sup>25</sup>, in 2011 Pachube users shared more than seven million datapoints per day. Right now it is called Cosm and there is no information about its current business model.

The concept of Sensorpedia is very similar to the one described previously. It is also a "social network" for humans and machines. It is a part of the Southeast Region Research Initiative (SERRI), managed by Oak Ridge National Laboratory (ORNL) and sponsored by the U.S. Department of Homeland Security. In 2010, during beta tests, 4000 sensors were connected to the service, including: land and buoy weather stations, traffic cameras, seismic activity, energy efficiency and water level sensors [7]. Sensorpedia is still in beta phase testing but there are several impressive usage examples [8].

- Haiti - the HaitiServe organization, following the earthquake in 2010, developed a mobile application based on Sensorpedia for volunteers to help them catalogue needs and resources.
- High Flux Isotope Reactor - in this case Sensorpedia was installed in a closed environment, behind firewalls. It provides an information dashboard to assist operators in prioritizing their procedures based on alarms from reactor and radiation sensors.
- Tracking 2.0 - Sensorpedia can be applied to tracking different resources e.g.: packages, containers, vehicles etc. It can be connected to RFID tags and barcode readers. Tracked objects have a unique URL assigned, which points to Sensorpedia's feed with full information about the location and condition of the resource.
- Nuclear Nonproliferation - Sensorpedia has been used to collect information about potential threats of proliferating nuclear materials. This includes collecting data from web cameras, ship tracking and sensors.
- Resource Assurance - Sensorpedia was used in the development of a framework for ensuring the availability of critical resources. A few prototypes were developed, including water shortage in case of mass refugee movement, energy usage and availability in Guam and Hawaii.

Unfortunately there is a lack of information about the future of this project or its planned business model.

Another socially inspired project - Sensetecnic - enables not only sensing but also actuation of devices through the Web. It is based on an MB2 platform, which hosts also other applications, e.g.: mashup framework for sensors and actuators, software that supports spontaneous interactions between real-world and virtual devices. The authors focused on flexibility and simplicity. They chose to use publish-subscribe event broker based on REST with OSGI as the core technology. MB2 holds information on the state of the device for its users and it enables to request  $n$  last events[1]. MB2 and the Sensetecnic focus on household sustainability. They will enable users to monitor their activities related to power consumption [1].

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<sup>25</sup> <https://investor.logmein.com/releasedetail.cfm?ReleaseID=592763> [20.10.2012].



## CONCLUSIONS

We are moving towards Future Internet and a connected world. It is a great opportunity to build a new economy based on data. People provide service, produce goods and content. In the near future we will all be valuable sources of city data.

Actually, we are already a source of data in social networks. We give away our "likes", comments, relations, habits. In return we receive a way of staying in touch with friends, a web photo gallery and a gaming platform - something we already had.

Participatory sensing networks can contribute to Smart Cities in a sustainable and collaborative way. The technology is out there but the solution is not perfect. Participants share data for output information only in specific domains. Users might drop out once they have received the information they needed. Users require constant benefits and motivation. Privacy issues might discourage users because mobile phones are full of sensitive data.

Most of current business models for this kind of sensing are very simple and do not guarantee the forming of a critical mass. More sophisticated ones, like auctions, are able to include user dropouts in their calculations. Other ones engage users with gaming elements. We should build on best solutions and challenge the most important issues of participatory sensing. Users RoI, privacy and engagement should lie in the centre of our interest - without them participatory sensing will not work.

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## WEB USER IDENTITY MODELLING

**Abstract:** Upon the emergence of the Virtual Identity concept, the author analyses Web user modelling possibilities by Identity-related systems. Modelling perspectives and structures that can be used for representing users are examined and available resources that can support the modelling process are compared. Then, a set of recommendations and guidelines for improvement is given for the current solutions in the analysed field.

**Keywords:** Web user modelling, Virtual Identity

### INTRODUCTION

As more and more information about Web users is being used by Internet applications for improving the quality of offered services, the meaning of appropriate Web user representation is ever increasing. In this context the new notion of a Web user's Virtual Identity has emerged, which can be perceived as the way of the user's manifestation in the Web. Virtual Identity is indispensably connected with Web user models and modelling process. In this article the author provides an analysis of current advances in Virtual Identity development, Web user modelling perspectives and structures, as well as available resources that can aid the user modelling process. The analysis results are presented in the form of recommendations, as well as an improvements' proposal considering user-centricity in terms of user-perspective modelling.

### SCIENTIFIC HYPOTHESIS

This paper tries to analyse connections between the new notion of user Identity in the Web and the field of user modelling. We state that building Virtual Identities for Web users requires a well-defined process of user modelling that can address current trends in Web development. The analysis is aimed at showing the possibilities of combining Identity-related and modelling-related solutions, as well as indicating the areas of possible improvements in the modelling process for Web user Virtual Identity. The research was conducted based on extensive literature studies and analysis of the present efforts in the field of Web Identity. The most popular and influential approaches in modelling, as well as the best established Identity solutions were the subject for the analysis presented in this paper.

### IDENTITY OF A WEB USER

One of the recently developed approaches to Web user representation is the use of Virtual Identities, also referred to as Digital Identity. It describes the way in which a Web user manifests his or her presence in the Internet.

The Virtual Identity of an Internet user can be defined as a set of attributes characterising the user [16] or, more generally, as a set of claims about the user, made by himself/herself or by another entity in the Web (a digital subject) [6]. Both, the real-world attributes (name, appearance, address etc.) and the digital ones (passwords, avatar picture, IP address etc.) can be used to establish the Identity of the user [10]. Commonly, user characteristics that can be included as part of his or her Identity are needed by various services providers in the Internet [12].

### WEB USER MODELLING

Based on information coming to a user's Virtual Identity a model of the user is built. A user model can be defined as part of a system that is the source of knowledge about the user, containing explicit assumptions about any user characteristics that are considered as relevant to the said system

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[13]. The central subject of user modelling is the user, who is represented as a collection of information.

## MODELLING PERSPECTIVES

The modelling perspective describes the way of categorisation of a user's personal information and the scope of modelling, posing a kind of guideline set in terms of information relevance. Due to the fact that the user model for the purpose of his or her Virtual Identity is supposed to meet requirements of many heterogeneous systems that may be drawing information from it, choosing an appropriate modelling perspective(s) might prove a challenging task.

Nabeth et al. [15] describe three different perspectives according to which personal information can be categorised:

- temporal perspective – different information can be described by different levels of permanence, depending on how often a user's particular characteristics change,
- functional perspective – personal information can be categorised with respect to the scope of functions which the information is able to perform,
- domain perspective – information concerning users can be divided according to its application domain or real-world activities in which the information is used.

Anrig et al. [2] have constructed a perspective for user description based on authentication technologies. This perspective categorises information with respect to four essential characteristics of users – who they are, what they know, what they have and what they do. The superposition of those characteristics can form personal information categories – Attributes, Roles, Acquisitions and Abilities.

There are many other attempts of enumerating personal information categories and providing new modelling perspectives. The most popular are approaches referring to the functional perspective [15] [9] [17]. Although, there are also more user-oriented solutions [5] [1].

## MODELLING STRUCTURES

The structures of user models define how the information about the user can be stored and presented. The choice of structure implies further possibilities of processing the information, e.g. reasoning. Several modelling structures can be found in literature.

Keywords (bag-of-words). A set of keywords is one of the most common representations of user information. Each keyword can represent a field of interest of the user or can be a single piece of information about the user. As it is a very simple structure, user information can be collected easily, e.g. keywords can come from web pages that the users access [7].

Attribute–value pairs. With this structure (also referred to as a user profile) user information takes the form of pairs representing named features (attributes) and their values. Usually for each attribute the range of valid values is defined. Although, the number of both named features and their values can be infinite[14]. Attribute-based modelling is recently one of the most popular approaches in Identity Management Systems [11].

Stereotyped model. In the stereotyped model the structure of a user representation is also built upon a property–value pair. However, in this model various combinations of these pairs are assigned to predefined stereotypes, which depict standard user roles or behaviours. Each user may be assigned attributes and values from one of the stereotypes. The stereotyped model can be used in general-purpose solutions, but it is insufficient when modelling of individual user traits is needed.

Overlay model. The structure of the overlay model presents the user's knowledge as a sub-set of the domain model - the system's knowledge of the subject. The model stores an estimation of the user's knowledge for each fragment of the domain knowledge. In the pure overlay model the estimation is a binary value, but in more recent forms it can be any qualitative or quantitative measure, e.g. the probability that the user knows the concept [5]. The most common form of the overlay model structure is a hierarchical or semantic network with nodes that relate directly to domain concepts, e.g. from domain ontology. Some systems successfully combine stereotyped and



overlay models, initially assigning a stereotype to the user and then refining the structure gradually with implementation of the overlay model [14].

## MODELLING SOLUTIONS

Elements of user modelling can be found in almost every modern Internet application and service. But especially in terms of creating Virtual Identities building holistic user models is vital. There exist many resources that can support such models generation, e.g. with attribute standardisation or providing domain knowledge.

### *Modelling resources*

To define a set of attributes that can be used for user modelling, various vocabularies have been built according to different modelling perspectives. One of the most common vocabularies used is the FOAF<sup>27</sup>, which lists properties and their classes that can serve for user description, including social relations and interests. Other vocabularies for building more domain-specific models are e.g. Org vocabulary<sup>28</sup> or Bio vocabulary<sup>29</sup>.

Since user modelling for Identity purposes needs to be comprehensive and detailed, general purpose semantic web or ontology resources can be considered as a good starting point for user description. The most valuable sources of knowledge for that purpose include WordNet<sup>30</sup> or OpenCyc<sup>31</sup> ontology. WordNet is an extensive lexical datastore of English nouns, verbs, adjectives and adverbs. They are grouped into synsets (sets of cognitive synonyms) describing particular concepts and are interconnected with semantic and lexical relations. The other resource, OpenCyc ontology, is known to be the largest and the most complete base of general knowledge that can be processed by a common-sense reasoning engine. Since they are well developed and they preserve the general character of the gathered knowledge, these databases are being widely used, also in terms of Web user modelling.

An ontology that was designed especially for user models is GUMO – the General User Model Ontology proposed by Heckmann et al. [9]. The authors strive to resolve the problem of structural and syntactical differences in user description used by various existing modelling systems. They state that providing a specialised, widely accepted user model ontology can simplify information exchange between Identity-related and other user-adaptive systems. The ontology identifies general user model dimensions, and still it allows the more common knowledge to be drawn from other existing ontologies.

During the last years there emerged a new trend in publishing data in the Web called Linked Open Data (LOD) [8]. The notion of LOD was introduced by Tim Berners-Lee in his seminal article on designed issues of the Semantic Web [4], in which he encourages Web content creators to make large datasets available on the Internet by using URIs as identifiers that can be de-referenced by HTTP through using machine-readable open formats (e.g. RDF or OWL<sup>32</sup>) for presenting knowledge, and by including links to other URIs to allow for more data discovery. The growing popularity of linking and opening data, manifested in the Linking Open Data initiative<sup>33</sup> as well as in the emergence of W3C standards concerning the Semantic Web and LOD, resulted in a wide range of datasets<sup>34</sup>, together with extensive linking structures between them, available for machine processing and usage. The availability of Linked Open Data creates new possibilities in the field of user modelling, as well as it poses new research questions [3]. LOD can provide modelling

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27 <http://xmlns.com/foaf/spec/>

28 <http://www.epimorphics.com/public/vocabulary/org.html>

29 <http://vocab.org/bio/0.1/.html>

30 <http://wordnet.princeton.edu/>

31 <http://opencyc.org/>

32 <http://www.w3.org/TR/owl-ref/>

33 <http://www.w3.org/wiki/SweoIG/TaskForces/CommunityProjects/LinkingOpenData>

34 See <http://www4.wiwiss.fu-berlin.de/lodcloud/>

techniques with standard tools and best practices guidelines for designing model structure, and with the knowledge from many diverse sources.

### **Modelling users in Identity-related solutions**

Recently several Identity-related solutions have become popular among Web applications. They present various approaches to Web user modelling, ranging from very minimalistic sets of attributes to an unbounded information scope, that can relate to an arbitrary dictionary.

Authentication-oriented Identity solutions tend to shorten the list of available attributes for building a Web user model, as only few attributes are necessary for successful authentication. OpenId<sup>35</sup> in the version 1.0 supports describing only selected characteristics of a user, including name, birth date, contact information etc. Another similar solution – WebID (FOAF + SSL)<sup>36</sup> – makes use of the FOAF dictionary, but the protocol actively uses only very few attributes of the dictionary. Some additional user information, as other people that the user knows, can be found in a FOAF profile document.

Authorisation-oriented solutions have a different approach to providing structures for user modelling. An example is the SAML<sup>37</sup> framework, which allows business partners to exchange information in the form of assertions. An assertion is not restricted to any specific type of information. Similarly, OAuth<sup>38</sup> protocol is information agnostic – it involves only permission management, making it possible for a service provider to be authorised to access resources of any kind. Although this can be perceived as a very flexible solution, the lack of control over the information makes Web user modelling difficult or even impossible.

Some of the more robust Identity solutions provide a wider range of user modelling possibilities. For example, Information Cards<sup>39</sup> store arbitrary store user information in an attribute-value form, and allow the information to be used within web pages being visited by the user. The extensive use of vocabularies in another solution, the Personal Data Store (PDS) from Higgins<sup>40</sup> project, makes it one of the most convenient Identity-related systems for detailed user modelling. PDS includes many well-known vocabularies, e.g. FOAF, VCard or GeoLocation.

## **RESULTS OF ANALYSIS**

In this paper the author has analysed the current approaches to Web user Identity building, Web user modelling in terms of modelling perspectives and modelling structures. The results of the analysis are presented in the following sections.

### ***User's perspective***

The author believes that, in terms of modelling perspective for Web user Virtual Identity purposes, it's the user who should be in the centre of the process of information categorisation and defining the relevancy scope. It may be concluded that the approach described by Anrig et al. [2] is a good starting point, although it is not complete and it needs to be supplemented in order to create a modelling perspective that is called the *user's perspective*. Based on the mentioned work, a specification for categories of user personal information that was defined by the author has been prepared and the category list was complemented with two additional items as it is shown in Figure 1.

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35 <http://openid.net/>

36 <http://www.w3.org/wiki/WebID>

37 <http://saml.xml.org/>

38 <http://oauth.net/>

39 <http://informationcard.net/>

40 <http://eclipse.org/higgins/>



Fig. 1. Personal information categories from the user’s perspective

Source: own elaboration based on Anrig et al. [2]

- Attributes – properties, that are observable or are stored in records of various institutions, e.g. demographic data or biological features.
- Acquisitions – possessions and knowledge, e.g. virtual and real goods.
- Roles – any user’s relations, such as social and professional roles or citizenship.
- Abilities – any user’s competences and activities that reveal the user’s tacit knowledge or indicate any other feature.
- Context – information about user’s relations to the external world, e.g. people, locations or events.
- Self (meaning reflective consciousness) – any user’s features that are hidden from the external observer and can only be provided directly by the user or deduced, e.g. personality or preferences.

**Modelling structure**

Different modelling structures described in previous sections present various expressiveness and various possibilities of machine processing. As it was shown, one of the most flexible, extendable and comprehensive structures is the structure of the overlay model, which is the primary choice of our analysis. However, the overlay model needs to have a representation of the domain knowledge for mapping user knowledge or other attributes. We analysed the available resources in terms of possible usage as the domain knowledge representation for the overlay model; the results are shown in Table 1.

Table 1. Comparison of selected resources for the overlay modelling

	FOAF	WordNet	OpenCyc	GUMO	LOD
Ontology?	No	No	Yes	Yes	Can integrate
RDF/OWL	Yes	Can be converted	No	Yes	Yes
Heterogeneous?	No	No	No	Partly	Yes
Dynamically updated?	No	No	No	No	Yes
General purpose?	No	Yes	Yes	No	Yes
Can model domain knowledge?	No	No	Yes	Partly	Yes

Source: own elaboration

Concerning the results of analysis, as well as current trends and perspectives in future possibilities of domain knowledge modelling, we believe that the usage of Linked Open Data in the overlay model might bring the best results.

## CONCLUSIONS

The analysis presented in this article leads us to the following conclusions.

- The emerging concept of Web user Virtual Identity needs to be deliberately considered in terms of user modelling.
- Current Identity-related solutions provide insufficient means for comprehensive Web user modelling.
- Advances in Semantic Web technologies, especially in Linked Open Data, give new opportunities for extensive Web user modelling in the process of Virtual Identity creation.
- There is a need for a Virtual Identity solution that can utilise the Linked Open Data resources and the overlay model together with the user's modelling perspective for Web user representation.

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## THE EFFECTIVENESS AND ECONOMIC ACCESSIBILITY OF PHARMACOTHERAPY

**Abstract:** The paper presents the problem of the financial access to medications and possibilities to improve the situation. One of the possibilities is the legal practice of parallel import. The problem of differences in medication prices is vital, for they are substantial between various countries. The paper points out that efforts to enable patients to take efficacious medicine, regardless of the place of residence, are necessary.

**Keywords:** parallel import, medicine prices, economical access, differences

### INTRODUCTION

In the face of the global economic crisis and efforts to reduce expenditure on almost everything, including healthcare, there is a need for analyses and debates, which can lead to saving money without exerting a negative influence on the quality of medical care in the broad sense. Moreover, those analyses should be of great interest to everyone eager to make their country work in an economically efficient way. Nevertheless, because of technological development, access to more and more modern methods of pharmacotherapy and the growing expectations of reducing costs in medical care, this is not a simple task for the health service's decision-makers. The main aim of the paper is to introduce ideas which may benefit the financial optimization of a prescribed treatment. The presented results of the conducted research prove the subject's significance.

Surprisingly, one of the ways to make savings from direct costs, such as hospitalization or diagnostic tests costs [6], is increasing expenditure on modern medications. An example of this may be the search for cost-effective schizophrenia treatment. The disease is a severe chronic condition, which manifests itself at an early adolescence stage, and puts a strain on both finances and well-being [7]. According to research published worldwide [1, 2, 4, 10], the most expensive part of schizophrenia treatment direct costs is hospitalization. Despite the fact that prescribing modern atypical medication might lead to a one-time increase of total direct cost, this should prove cost-effective over the long term, given the reduction of adverse effects and the duration of hospitalization, as well as increase in the patient's and families' quality of life. However, the possibility of taking state-of-the-art medicines is limited due to patients' unequal financial access to them, which is caused by variations in prices in different countries, as well as differences in earnings of citizens. This situation has been clearly depicted on the basis of the analysis of the situation in Poland, Ireland and Ukraine.

Another way to reduce pharmacotherapy costs and to increase access to treatment is the promulgation of parallel import, which is a legal precedent within the European Union. By causing a drop in prices the practice supports competitiveness and influences the internal market of the European Union [11]. In parallel import, one buys a medication in a country where the prices are lower than in the destination country, where the medication is then sold [8]. Since 2004, Poland's accession to the European Union, this market segment has been developing significantly [5]. Up to the first half of 2010 there were 800 imported medications registered in Poland. Compared to 2009, there was a 75 per cent [3] rise in sales of drugs from parallel import, which means there is a demand for cheaper treatment methods. Potential financial access to pharmacotherapy would lead to patients actually following treatment recommendations - a fact that cannot be overstated. This was proven in American research conducted on the cost of treatment for patients with hypertension. The research revealed that the annual cost of treatment of the patient who followed prescriptions

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amounted to 340 dollars, whereas the cost nearly doubled in patients who failed to do so and amounted to 695 dollars. Moreover, the cost rose to 2100 dollars for patients who didn't undergo treatment on a regular basis [9, 12].

Those figures confirm the fact that health education of patients, investment in modern pharmacotherapy and efforts to improve financial access to medication in particular countries should increase the percentage of patients following treatment recommendation and, what's more, reduce health care costs.

## **METHODOLOGY**

Given that the researches are conducted in many countries and research centers, they are carried out continuously. The presented results concern the analyses of parallel import in Poland, Germany and Spain from February to May 2011, on 100 respondents in case of Poland and Germany, and 50 respondents in case of Spain. Financial access to medication was analyzed in Poland, Ireland and Ukraine from September to October 2012. The analyzed data came from the Ministry of Health online proclamations on reimbursable drugs, foods for special medical purposes and medical products [13]. Moreover, the drug prices were obtained through the authors' own analysis during their study trips to research institutions in particular countries and thanks to the collaboration of their home university with partner research centers abroad. The prices were calculated at the mean exchange rate of the National Bank of Poland as of October 9<sup>th</sup> 2012.

## **CONCLUSIONS AND DISCUSSION OF RESULTS**

The analysis of the data on parallel import indicates that most patients buy their medicines at least once a month. Before purchase, many of the respondents (mostly Polish ones) compare the prices in a number of pharmacies. This, in a way, pathological situation on the Polish pharmaceutical market became partially regulated by the Reimbursement Act, which clearly proclaims that the prices of reimbursed medications ought to be the same in every pharmacy in Poland. Nevertheless, prescribed non-reimbursable drugs and non-prescription drugs may be a subject of competition between pharmacies. This confirms the fact that, because of giving certainty of access to cheaper medicines, parallel import should be highly desirable and to some extent even obligatory. The answers to the question about being interested in low-priced generic drugs were in Poland: 'always' (14 per cent), 'often' (19 per cent) and 'sometimes' (30 per cent). German patients thought likewise and gave similar answers: 'always' (12 per cent), 'often' (15 per cent) and 'sometimes' (27 per cent). What's interesting is that 29 per cent of German respondents answered 'never', which may indicate they have better economic access to healthcare. In case of Spain the most popular answers were 'always' (36 per cent) and 'never' (34 per cent), which may indicate that the Spanish vary significantly when it comes to income. The figures mentioned above (Table 1) prove that parallel import may enable many patients to purchase all prescribed medications and keep compliance as well as help improve the efficacy of the treatment and lessen the cost of guaranteed medical care. Moreover, patient's trust in low-priced generic drugs shows that parallel import, which exists in the European Union, is desirable but it needs promotion due to the fact that the process and its regulations are still unclear to the vast majority of Poles (74 per cent) and Spaniards (76 per cent).

Medication prices vary between the countries. A great illustration of the divergence will be an example of the Zyprexa® drug, in composition of which there is an active ingredient used to treat mental diseases: olanzapine. According to the current Minister of Health regulation the price of non-reimbursable Zyprexa® 5mg (28 tablets) in Poland is 101 zlotys and 24 groszy. In Ireland the price is 316 zlotys and 11 groszy, while in Ukraine it costs 397 zlotys and 27 groszy, which is quite a prohibitive price - given the Ukrainian average income.

Table 1. Parallel import in patients' opinion

The frequency of medicine purchases in a pharmacy	Once a week			Twice a month			Once a month			Less					
	Poland	Germany	Spain	Poland	Germany	Spain	Poland	Germany	Spain	Poland	Germany	Spain	Poland	Germany	Spain
	5%	2%	6%	22%	12%	12%	27%	24%	26%	46%	62%	56%			
The frequency of comparing medicines in a few pharmacies	Always			Often			Sometimes			Rarely			Never		
	17%	4%	6%	23%	10%	0%	19%	20%	20%	28%	30%	12%	13%	36%	62%
Patients' interest in cheaper medicine alternatives	Always			Often			Sometimes			Rarely			Never		
	14%	12%	8%	19%	15%	36%	30%	27%	8%	19%	17%	14%	18%	29%	34%
Patients' confidence to cheaper medicines	Yes			Fairly yes			Hard to say			Rather no			No		
	27%	38%	42%	29%	21%	20%	33%	28%	32%	8%	12%	4%	3%	1%	2%

Source: own researches



Similar diversities can be observed not only in case of olanzapine but also other medicinal substances. It means the problem should be recognized as an urgent one among those who are responsible for the quality and accessibility of treatment. The above amounts confirm that parallel import can provide better financial access to medicines for everyone so that each and every patient can undergo effective treatment. The presented results indicate that efforts to develop parallel import not only within the European Union but also in countries aspiring to membership of the EU should be one of the main goals of the EU healthcare ruling body. By its decisions and involvement modern and efficacious pharmacotherapy will be more accessible to citizens of countries where income is relatively low when compared to medication prices.

## CONCLUSIONS

1. Parallel import is a chance to improve financial access to pharmacotherapy, thus it should be of high priority to the EU healthcare ruling body.
2. Patients expect cheaper treatment and aren't biased against low-priced generic drugs.
3. There is a need for education when it comes to parallel import.
4. In particular countries there is limited access to treatment because of differences in prices of the same medicine.
5. Medication prices in some countries are too high compared to the average income.
6. In the long term, modern and comprehensive treatment will bring savings.

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