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## Preface

Globalization leads to changes in organization management, which, in turn, creates many dilemmas in the organizational, legal, financial or social aspects. The dilemmas have been discussed in the presented articles. The authors raise current issues on both the macro and micro scale. They present new trends in management sciences and point out problems faced by contemporary organization management. The trends and problems concern, in particular, the management of human, physical or financial capital. Many articles provide several practical solutions as well as methods and tools that may significantly contribute to resolving central dilemmas of contemporary management. They undoubtedly result from scientific cooperation as it is interdisciplinary activities that spawn new knowledge.

The presented issue within Volume XV consists of 12 articles which, due to their thematic differences, were divided into two parts depending on their topics.

Articles contained in the first part address issues of human resources – considered to be the crucial value of the organization nowadays. Without competent employees, it is difficult to pursue ambitious goals and achieve an appropriate position on the market. At the time of fierce competition, contemporary enterprises lay great emphasis on personnel which has to be highly efficient and effective in its work. That is made possible by the continuous development of the staff. Therefore, training and professional development are deemed to be immensely important and determine the success of many companies. Those issues are raised by Halina Sobocka-Szczapa in her article entitled *Employees' education as an element of the Human Resource Management – Polish experience*. She presents both quantitative and qualitative results of scientific research.

The issue of competence development, in particular innovative managerial competence Dorota Nawrat raises also in the article *Developing innovative competencies in view of biographies of innovative managers*. The author presents fragments of personal research concerning, among other factors affecting the competence of managers in the field of innovation. Underlines the importance of their development, adding that they are a source of building a spirit of innovation in teams of employees, which is extremely important in the era of improving an economy based on knowledge and innovation.

In turn, Barbara Kamińska and Kamila Szymańczyk in the article *Professional Evaluation. Application of the PageRank Algorithm in Employee Rating* draw attention to the importance of employee performance appraisal in the

process of personnel management. They identify factors that determine the manner of appraisal and present selected methods and techniques of appraisal, among others, the PageRank algorithm which can be a good solution for creating employee rankings.

Zofia Warzyńska-Bartczak in her article *Psychiatrists and patients suffering from depressive disorders and schizophrenia in one organization basing on the hospitals in Lodz region* mentions about the problems concerning inter alia the relationship or interpersonal communication.

It is especially important in the context of the provided example of collaboration and communication. The author shows several communication barriers and factors hindering cooperation, simultaneously pointing out willingness to come to an agreement and collaborate.

The topic of human resources (HR) management and, in particular, the issue of recruitment trends concerning social media used in modern recruitment are discussed in the article by Łukasz Sułkowski and Michał Chmielecki *The use of Social Networking Sites in modern recruitment – empirical study*. The authors show that Internet-based social forms of communication offer new opportunities for companies to both communicate and recruit talented people. The authors emphasize that information systems and appropriate information technology tools allow to streamline many processes taking place in enterprises, including those related to recruitment.

The first part also includes the article entitled *New system of employment forecasting in Poland*. Its author, Łukasz Arendt, describes theoretical and methodological aspects of employment forecasting in Poland. He argues that it is necessary to create such a system to take on challenges to be faced by Poland in the near future. The author has also presented forecasts of results for Poland, Poland's regions and selected small professional groups.

The other thematic part covers issues of organization management in its broad sense, concerning, among others: competitiveness and innovativeness of enterprises, legal dilemmas or financial management. It presents interesting methods and tools that support managers in decision-making.

Issues of competitiveness and innovativeness were raised in the article by Danuta Janczewska *Competitive factors for microenterprises in the process of marketing and logistic management based on the Kuyavian-Pomeranian Voivodeship*. The author presented her own research on small and medium enterprises in the kujawsko-pomorskie voivodeship in the aspect of factor competitiveness growth in the management process, especially the management of marketing and logistic process.

In turn, Anna Korzeniowska i Wojciech Misterek in the article *Innovation in view of entrepreneurs* presents the entrepreneurs' view on innovation in Lublin Voivodship. As a result the paper shows discrepancies of opinions between

entrepreneurs implementing and non implementing innovations It points out that a more innovative entrepreneur is less afraid of negative results of innovation although he is more aware of they can occur.

*The effectiveness of capital management strategies used by the investment funds in Poland* is an article by Paweł Trippner. The main purpose of the submitted paper is to characterize the essence of investment funds operation in their role as financial intermediaries, to present the investment strategies and to characterize the methodology for measuring the effectiveness of capital management entrusted by the clients.

A current and vital issue is also addressed by Iwona Czechowska in the article *The importance of older people's participation in the financial services market* presents definitions on population aging, characterises the analysed group of population, and discusses selected aspects of its activity in the financial services market. Its purpose has been to determine the importance of the elderly as the users of financial services. As demonstrated, the activity of customers aged 60+ in the financial services market is of significance for various players in this market, as well as from the micro and macro perspective.

Maciej Janowicz, Arkadiusz Orłowski and Franciszek M. Warzyński in the article *Optimization of investment management in Warsaw stock market* describe the simplest applications of technical analysis on the Warsaw Stock Exchange on the example of selected WIG20 companies. Two from among a great number of technical analysis indices were used: Donchian channels and Relative Strength Index (RSI). The authors show that speculation on the stock exchange, based on both the above-mentioned indices, tends to produce better results than a simple "buy and hold" strategy for optimum parameter values. The article offers other interesting conclusions too.

A crucial problem is also discussed by Radosław Jadczyk, the author of the article entitled *Traveling salesman problem: approach to optimality*. It highlights the problem of many logistic companies – the so called travelling salesman problem. It is basic in its nature as one of the most important transportation problems in operational logistics. The author starts with presenting the mathematical formulation of the decision-making problem and proceeds to describe TSP solution strategies by showing their advantages and disadvantages. In the last part of the article, he presents calculation results for selected methods.

The authors invite you to read their articles and hope that the raised issues will be of interest to the reader. They do not only summarize abundant specialist literature but also present results of research and analyses made by specialists in various disciplines as well as solutions that may be used both in the teaching process and everyday work by those who manage organizations.

Łukasz Sułkowski  
Barbara Kamińska



**Human Resources in the organization.**

**Managerial and psychological problems**



Halina Sobocka-Szczapa

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## Employees' education as an element of the Human Resource Management – Polish experience

**Abstract:** The importance of professional training cannot be overemphasized. In any organization, it is conducive to a better implementation of the tasks, and through it – increasing efficiency. For those directly involved – employees – lifelong learning is the premise of job retention. The aim of this paper is to present the results of research study – both quantitative and qualitative – describing ways in which employers may support employees' educational activity.

**Key-words:** Human Resource Management, education, activity, lifelong learning.

### Introduction

The importance of employees' vocational education and training (VET) cannot be overestimated. It fosters better fulfilment of tasks in every organization, thus increasing efficiency. For employees, VET is a premise of maintaining certain job due to the possibility of adapting skills and qualifications to the employer's expectations.

VET is a part of human resources policy, that is implemented in the company. It reflects the personnel function, which belongs – next to the marketing, finance, and manufacturing (service) functions – to basic functions of the enterprise [Pocztowski 2007, p. 15]. At the same time, it should be emphasized that the nature of this function is extremely complex, due to the dual character of human resources employed in companies – human resources are both the most important and the most unreliable component of all the resources of an organization [Listwan (ed.) 2006, p. 2].

The aim of the paper is to present the results of a research study - both quantitative and qualitative – focused on the issues of supporting the employ-

ees' educational activity by employers. For the purpose of the analysis was formulated hypothesis testing, allowing both to verify the tendency of employers to participate in the process of training for workers, as well as identify the main determinants of this phenomenon. This research study, commissioned by the Ministry of Labour and Social Policy, was carried out between 2006 and 2007 by the Institute of Labour and Social Studies<sup>1</sup>. The research study was exploratory and representative, which allows to draw conclusions that are of a general nature for the whole population<sup>2</sup>.

### 1. Employees' development

Human development is a process that aims to expand unlimited and constantly changing human capabilities. This process encompasses mainly actions that are to prepare persons to take positions with greater responsibility [Listwan 1995, p. 73], as well as to increase their involvement in the production (service-providing) process, and to match persons' skills and qualifications with requirements of the workplace [Kostera 2001, pp. 109]. However, the direction of this development and its dynamics depend on the individual approach, the needs and aspirations of employees, as well as the goals and strategy of the company. Therefore, understanding human resources as a factor in which company may invest makes them and object of economic analysis. It's not only about the costs associated with the investment done by the organization, but also about multiplication of the investment return in the future [Pocztowski 2007, p. 275].

In the process of development of every person the educational system is of a great importance. The educational system or the educational offer should, first of all, reflect the person's needs, but also ensuring the fulfillment of vacancies reported by employers. Because the education system<sup>3</sup> in a given period is a relatively stable, to fulfill the educational needs of both the demand side and the supply side of the labour market, this system contains training activities. Their usefulness in the adjustment process between the employees' stock of skills and employers needs should not be questioned. Therefore, we would like to look in more detail at the issue of supporting employees' training by the Polish employers.

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<sup>1</sup> The quantitative survey of employers has been made using the questionnaire interview. Such interviews were conducted with 380 randomly chosen employers that operate throughout the country. The sample was drawn from a set of entities, with the exception of single entities (ie self employed). The study was representative. A qualitative study was exploratory in nature and was conducted using focus group interviews (FGI). In interviews attended by 45 employers.

<sup>2</sup> The results of the research study were presented extensively in Kryńska (ed.) 2008.

<sup>3</sup> This type of training is also an integral part of the education work, which consists of the following components: pre-vocational education, pro-vocational education, vocational education and training, further education and training for adults, which are conducted largely outside the school system [Jeruszka 2002, p. 145].

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## 2. Characteristic of training activities in the Polish companies

The need for education and training in Polish companies is caused mainly by the processes of structural changes that take place within these companies, as well as technical and technological progress, which affects the need for a permanent adaptation of employees' qualifications and skills to the employers' requirements.

In light of these considerations, the way, mode and the type of training organized by the company are substantial.

Available results of research studies, there are different ways in which companies provide education and training. More than half of surveyed employers declared that in their companies employees participate in organized forms of training. Generally, these are external trainings (provided by specialized training providers) or, rarely, internal trainings. The suitability of the training activities for the companies may be related to the fact, that in the majority of the surveyed companies more than half or all employees participated in trainings. The employers were mainly interested in such training activities, which significantly improve the quality and organization of their business. In small companies training plans are prepared sporadically – more often these companies prepare elements of training plans, mainly in the form of annual technical-economic development plans. The situation is completely different in large companies, where most of them have training plan in a form of a document (this is particularly characteristic for the public institutions). Thus, employers in small businesses are in an inconvenient situation, because they have to determine the type of course, its duration, and the way of financing it by their own. This can affect their discouragement and passive approach to lifelong learning. The way in which employers from the small companies make decisions about providing trainings to their employees, may affect their mood at work and perception of job stability.

Lack of education policies in companies hinders employees from participation in lifelong learning. This statement is true even if we take into account that employers report relatively high propensity to organize the educational process and the fact that, according to employers, all categories of employees participate in the training provided, so it is difficult to point a group that would participate in training more often than others. It should also be emphasized that, generally, employees from public-owned entities and those working in large companies participated in training more often than employees from, respectively, private and small companies.

Employers' opinions about the educational activities undertaken by their companies were not reflected in the views of employees. According to employees, training courses were usually held in companies and provided by external training providers. There were also examples of on-the-job trainings with

experienced employees in the role of trainers. The training was attended by more than two thirds of surveyed employees in the past 12 months. The most common training courses organized by companies were those enforced by law (mandatory training, eg. health and safety procedures) or those connected with certain situation and company needs. In other words - employers initiate various forms of training only when they are forced to do so or when the interests of the company demand it.

### **3. The main determinants of employers' propensity to train employees**

One of the activities, which should strengthen the employees' employability is improving skills in various areas related to the company profile. As a result of these actions, employment security, understood as the possibility of obtaining and maintenance of the job, should be increased. For businesses, the benefit of increasing employees' knowledge and skills is supporting the use of new technologies and innovative solutions in order to increase efficiency and improve companies' competitiveness on the market.

It stems from the research results that the idea of employees' lifelong learning is fully accepted by employers. The vast majority of employers are aware of the benefits of employees' training and believes that it is worthwhile to train employees primarily due to: an increase of company effectiveness, employees' creativity, matching employees' skills to the requirements of the workplace, which lead to the satisfaction of employers and employees. The arguments associated with the possibility of introduction of the technical and technological progress in companies as well as stabilization of the personnel were of a great importance. At the same time it was emphasized, that there is a need to adapt the content of training for the type of work, ensure high quality of training, as well as to link training activities to the motivation systems for employees.

As in the case of employers, one of the issue taken into account during the interviews with employees was to explore and identify factors that affect their propensity to active participation in lifelong learning.

Generally, the majority of employees would like to increase their present stock of professional skills as a result of training activities. Slightly less employees were interested in participating in training in order to acquire new skills and then change job for a better one. In individual cases, the motive for taking part in training was to look for a job abroad. Some employees were going to take up the educational efforts to pursue their interests and dreams come true. Other motives were related to development of individual interests.

So we can see that there are many individual preferences which have a significant impact on the employees' propensity to initiate training in order to raise or supplement their qualifications and skills. However, the employees' behaviour is, to a large extent, determined by the attitudes and views of employers

– one of the most important elements, which is quite prosaic, but certainly very important for the growth of the interest in improving qualifications and skills or acquiring new ones - both among employers and employees – is to have the financial resources for this purpose. But we have to remember that financial issues are not the only problem. An equally important factors determining the propensity of both parties, employers and employees, to participate in lifelong learning are: their intentions and attitudes toward the learning process and improvement of the human resources' quality; the current situation in the labor market; increasing demand for highly qualified employees; plans of market expansion and the need to comply with the legal requirements related to business operation. Additionally, the level of propensity of employees to participate in various forms of lifelong learning is linked with a reward (salary increase, an additional money bonus, promotion, etc.). According to the employees, there is no better incentive than linking their educational activities with higher pay. In the employees' opinion, the organization of work and the possibility to balance the educational activities and the work performance as well as leisure is also an important factor. The other factor enhancing the interest in taking part in educational activities is a prospect of the launching an own business by the employee. Element that encourages employees to upgrade their qualifications and skills or acquiring new ones is the quality and scope of the training courses and competencies of trainers. Training courses that are boring and conducted by incompetent people who are not prepared for the course can discourage even those employees who really want to take up a variety of educational activities. It is this reason that may be one of the barriers to employees' lifelong learning. Let us look closer at how this problem was evaluated by all the respondents.

#### **4. Barriers to employees' lifelong learning**

Only few respondents did not see any benefit from employees' training. The views of this group may indicate lifelong learning barriers associated with organizational factors, the current process within the company and the quality of learning processes. The main reasons why employees' educational activities were not beneficial for the company were following: high turnover of employees, appropriate employees' skills, inadequate training content.

It seems that the first reason is very important, because – like in other research studies – employers often pointed out that many employees leave companies after completing training. The other reasons are rather of a subjective nature and may change along with changes in the quality of learning processes. However, it would be good to pay attention to quality of offered training and the institutions that provide it. It seems, that the diagnosis in this area should be done mainly by the employers who may, on the basis of observation of the education market, determine ranking of training providers and identify those

that are best to conduct training for their employees. It is probably not a complex issue, because only few employers were dissatisfied with training in which their employees participated in the previous year, emphasizing the poor quality of the training.

Employers also assessed employees' attitudes towards training. These attitudes may be regarded as primary lifelong learning barriers, because only about every fourth surveyed employer declared that employees have a very positive attitude to training and are keen on taking part in trainings. Those employers pointed to age as a determinant of employees' propensity to undertake lifelong learning. However, one out of five employers thought that employees tend to have a negative and indifferent attitude toward organized training – this situation applies also to the obligatory trainings.

The rest of surveyed employers (that is more than half) agreed that the employees' attitudes towards lifelong learning are dependent on various factors such as: the age of the employee, skills and work experience in a company, the form of financing training, the individual attitudes, the topic of training, forms of knowledge transfer during the training, whether the training is combined with an attractive travel and whether or not participation in training is associated with specific benefits for the employee (raise of salary, promotion, issuing a certificate or license, etc.)

Therefore, it can be concluded that the factors causing reduced employees' propensity to participate in educational activities are their individual preferences connected with the choice of learning content and methods of education. These are a major barriers from the point of view of employers who have fairly high expectations connected with employees' training, mainly due to the improvement of the company operation and competitiveness.

However, shaping employees' educational activity meets also other barriers – mainly the lack of financial resources allocated to training, lack of time to search for suitable training courses, lack of the appropriate institutions that could help to verify the quality of training course, as well as bureaucratic barriers and complicated procedures. Thus, these factors should be considered as general barriers to employees' education, taking place in small enterprises in Poland.

The main barriers significantly hindering or even precluding employees' participation in various forms of lifelong learning is the lack of financial resources and willingness. A particularly dangerous, from the point of view of employees, is the employers' reluctance to provide training for employees, resulting from their focus on profit maximization. The barrier may also be the attitude of the employees, who do not want to participate in training – in this case each training proposal is treated as a punishment without recognizing the benefits of taking this kind of action. Another element limiting the employ-

ees' propensity to participate in training is their unwillingness to cover the related costs. When there is a need to invest in own professional development, employees do not want to finance this from their own resources. In addition, employees may be discouraged by employers' shortsightedness and their limited willingness to introduce all kinds of novelties and technical innovations. Discriminatory criteria used by the employers also discourage employees from participating in training. The forms of discrimination may differ - most often they are associated with the socio-demographic characteristics of persons such as age. Employers in the recruitment process select mainly young people. The level and type of education, as well as type of workplace which are used by the employers as main criteria in the selection of employees for training courses also discourage other employees. The education barrier for employees is also the use of informal criteria by employers in selecting employees for training. As a result - in employees' opinion - not always those who need to improve their qualifications and skills are sent to training courses. One of the factors that significantly reduce the employees' and employers' willingness to lifelong learning activities is bad organization of work and work overload. This reason is particularly important in the case of small businesses, where there is no possibility of replacing one employee by the other, and usually sending an employee to training means problems in maintaining normal company operation.

Another argument discouraging employers - in the employees' opinion - from investing in the education of their employees, is recent increase in emigration of Poles to other EU member states. Employers are afraid that money spent on employee training will not pay off, because the employee after completing training would change company or go to work abroad. It is true, that employers are trying to minimize this risk by signing training contracts in which an employee agrees to work for the current company for a specified period of time. However, such action discourages employees from participation in lifelong learning.

The study shows that the main factor discouraging employees from participating in various forms and types of lifelong learning is the lack of linkage between the training and the level of wages or the possibility of career advancement.

The development of lifelong learning in Poland is also limited by high taxes and the type of business carried out by the company. For sure, discouraging element is low quality of provided training.

## **5. The role of the company training fund in supporting employees' lifelong learning**

The study showed that 55.8% of surveyed people did not have any knowledge about the rules of the establishment and use of the Company's Training Fund

(CTF). Only 22.1% of respondents declared their knowledge about the rules governing the operation of CTF and the same number stated that “something heard about it”. The lack of knowledge on the CTF was declared more often by companies operating in rural areas, from the private sector, “young” companies and small enterprises. Among respondents who had knowledge about CTF, the vast majority acknowledged that there are no difficulties in creating CTF (38.7%), difficulties are of a temporary nature (19.6%) or that with the right amount of effort these difficulties can be eliminated (19.0%). Only 3.6% of respondents felt that the difficulties are practically insuperable.

The most serious difficulties in the process of creating CTF, according to the employers, are following:

- lack of sufficient funds for the establishment of CTF,
- unclear legal regulations and procedures for creating CTF,
- difficulty in identifying and anticipating training needs, lack of experience in this field,,
- lack of a department within the company that would be responsible for the establishment and operation of CTF.

Additionally, the difficulties in creating CTF are related to the lack of full and transparent information about regulations of its creation. The representatives of employers’ organizations and trade unions stressed, on the one hand, that they do not know where to look for such information, on the other hand, if they find it, they still have many problems connected with its interpretation. As a result, the employers are afraid to create such an instrument in their company. The lack of transparency in legal regulations applies – according to the respondents – to the formula of the training. A controversial issue for employers are also rules and funding opportunities for training that takes place at the workplace, under the guidance of the other, more experienced employee. Such trainings are often used, and – according to the respondents – the quality and effectiveness of this kind of actions may be much higher than in case of other forms of training.

Employers had also difficulties with preparation of training plans that are obligatory in companies with CTF. These plans must take into account many determinants, including macroeconomic factors – these, as surveyed persons stated, often change, due to for instance the lack of political stability affecting economic stability.

Finally, a barrier that may discourage from CTF creation are potential monitoring activities undertaken by institutions controlling funded training courses, especially those that are to be reimbursed from labour offices funds. Employers do not want to be exposed to constant checks. In addition, many of them fear the additional actions that are needed to administer the CTF and, consequently, will raise bureaucracy burden put on businesses.

Difficulties associated with the use of CTF were reported by significantly fewer respondents. Almost half of the respondents who had knowledge about the CTF (48.8%) did not see any problems, and one in ten employers saw only problems easy to overcome as for the use of CTF. The same number of respondents felt that the difficulties with the use of CTF are significant and require a lot of work to cope with them. Only 2.4% of companies saw insuperable difficulties. The main barriers to the use of CTF were:

- inability to reconcile work and training,
- the problem of accurate planning of training,
- lack of educational offer that would be in line with company's needs,
- inability to motivate employees to participate in lifelong learning.

Moreover, the employers are often not convinced about the need to initiate and support employees' training. This may be due to the lack of need for employees' training, resulting from not recognizing direct benefits related to these actions or a misunderstanding of lifelong learning idea. The latter can be applied to both the employers and the employees. Employers, who would contribute to the costs of employees' training, would prefer to limit this activity to those employees who after completing the course would have specific qualifications required in particular profession. Employers are not interested in forms of education that are focused on development of employees' general human capital. According to employers the employees are not always convinced of the need to undertake training. Employees quite often think that if they have a learned profession, and, in particular, higher education, their education process has ended. Sometimes, attempts taken by employers to send an employee for training are perceived as danger of losing position in the company.

Another aspect of supporting lifelong learning by employers is related to a situation in which a trained employee (with the use of CTF) leaves the company. Employer investing in employees' training is never sure if the rate of return would be positive. The employers are not prepared to prevent this risk.

Although the knowledge about CTF is quite poor, and employers notice some difficulties in its creation and use, the majority of them (57.4% of surveyed population) clearly recognizes the need for its existence. Only 13.4% of respondents declared that there is no need or necessity to introduce such instrument. Employers who were in favour of the CTF existence presented the following arguments:

- readiness, qualifications and professional skills of employees are not always suitable to perform the specific tasks (66%); CTF supports employees' lifelong learning and may help the company to have a better qualified human resources,
- existence of CTF can cause that employees' lifelong learning will be planned in accordance with the development of the company (13%),

- lifelong learning brings benefits for employers and employees (14%),
- training courses can motivate employees to increase work quality and productivity (14%).

More varied arguments appeared in the statements of the group of respondents who were against the existence of CTF. In their view, there is no need to invoke such a fund for the following reasons:

- if people want to be employed or earn more money they should invest in their own education. This should not have an impact on company finances and working time (82.6 %),
- employers hire only people prepared to work (81.6%),
- training courses do not always bring the expected result in a higher efficiency, and thus do not result in higher company's revenues (80.8%),
- training courses are of a temporary nature, they are run if employees' skills are insufficient – so there is no need to freeze financial resources (81.1 %),
- such a fund may be required in large companies, but not in small ones (83.4 %),
- financial and economic factors make it impossible to create such a fund, besides labor costs are already too high, so why we should increase them (78.7 %).

Among all surveyed employers only 12.9% declared that they had a training fund, including 4.2% of those who had the Company Training Fund. The vast majority of companies (85%) did not have any training fund. This means that the number of companies using this instrument in Poland is marginal.

## Conclusions

Results of this research study indicate that employers recognize significant benefits associated with employees' lifelong learning, but are aware of the difficulties which may occur while organizing training. This may be a prerequisite for structuring factors of a micro-and macroeconomic nature, which would make lifelong learning be promoted by employers.

Firstly – a factor that seems to be of major importance is the company's competitive position on the market, that is reflected by the demand for its products. This is undoubtedly related to the economic situation. However, a significant role is also played by employees' skills, and the process of education – which was emphasized by the respondents – has a positive effect on their productivity, creativity and job satisfaction.

Secondly – a factor positively influencing employers' propensity to make decisions about investing in employees' training is the technical and technological progress that force companies to adapt employees' skills to new require-

ments. Therefore, it seems that access of the Polish companies to new technologies and solutions, and their willingness to introduce these technologies in small enterprises, is a fundamental problem<sup>4</sup>.

Thirdly – a positive factor for the propensity of employers to shape the employees' educational activity is the situation on the labor market. If employers cannot find candidates with suitable skills, they are forced to undertake training activities within companies. Simultaneously, stabilization of the personnel should be an additional stimulus for increasing the educational activity focused in employees' skills.

Fourthly – most employers do not know the rules for the creation and use of the Company's Training Fund, while more than 70% do not want to create such a fund. Despite this, most employers recognized a need for its existence.

Fifthly – employers did not and are, only to a limited extent, planning to cooperate with labor offices in activities related to the use of CTF.

Therefore, it would be important to cope with fundamental barriers to employees' lifelong learning and creation and use of Company's Training Fund, which was indicated by the employers, as well as with the uncertainty of keeping employees in the parent company after completing training.

## References

Janiak-Rejno I. (2001), *Wybrane formy kształcenia i doskonalenia zawodowego w kontekście obecnej sytuacji na rynku pracy* [in:] Z. Hasińska (ed.), *Kształcenie ustawiczne w procesie przemian rynku pracy*, Wydawnictwo Wyższej Szkoły Zarządzania, Wrocław.

Jeruszka U. (2002), *Kształcenie zawodowe wobec integracji z Unią Europejską* [in:] R. Gerlach (ed.), *Kształcenie prozawodowe i zawodowe w kontekście integracji Europy*, Wydawnictwo Akademii Bydgoskiej, Bydgoszcz.

Kostera M. (2001), *Kształcenie i rozwój personelu*, PWE, Warszawa.

Kryńska E. (ed.) (2008), *Kształcenie ustawiczne pracowników*, Ministerstwo Pracy i Polityki Społecznej. Departament Rynku Pracy, Warszawa.

Listwan T. (ed.) (2006), *Zarządzanie kadrami*, Wydawnictwo C.H.Beck, Warszawa.

Listwan T. (1995), *Kształtowanie kadry menedżerskiej firm*, Kadry, Wrocław.

Pocztowski A. (2007), *Zarządzanie zasobami ludzkimi*, Polskie Wydawnictwo Ekonomiczne, Warszawa.

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<sup>4</sup> More on this topic see Janiak-Rejno [Janiak-Rejno 2001, p. 35].



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## Developing innovative competencies in view of biographies of innovative managers

**Abstract:** The article presents fragments of the author's own research, which was conducted among innovative managers. A thesis is advanced, that competencies and innovative behaviors of managers are also sources of formation of team and organizational spirit that fosters creativity and innovation of employees. The study focused on the factors influencing the innovation competence. The author pays particular attention to the subjective conditioning as well as to the educational and organizational factors, emphasizing their importance. Based on the results of the research, the article also presents a silhouette of an innovative manager. The author also highlights the need to develop innovative competencies, both in the executive and general education.

**Key-words:** silhouette of an innovative manager, managerial competencies, educational biographies of managers, development of innovation.

### Introduction

For several years now, innovative competencies are of particular interest to many scientific disciplines, and are now regarded as „competencies of the future”, as the demand for innovation is growing. Particular attention is paid to competencies of the innovative managers, because „intelligent innovation” of managers [Mroziwicz 2008, p. 97] determines whether the work environment is perceived as innovative or not. These competencies of managers are extensively described in the literature [Cenin 1998, Szopiński 2004 and others], and researchers emphasize their leading role in the shaping of the learning organization and capital building of an innovative enterprise [Mroziwicz 2008 and others]. They provide the opportunity for the organization to continuously learn new values and patterns of thought and action, as well as new ways to

acquire and transfer knowledge [Morawski 2004, p. 118]. Creative and innovative competencies are highlighted as significant in each typology of managerial skills [see A. Rakowska 2000, Sitko-Lutek 2004, Szopiński 2004 and others]. Some researchers, E. Steiner and R. Weber [1993] for example, attributed the dominant role to the creative skills of managers, among them including:

- ability to generate a large number of concepts over a short period of time;
- constant search for new solutions;
- originality – creating innovative connections and ideas;
- ability to choose the optimal solution;
- perseverance in overcoming difficulties;
- motivation as a problem and a challenge;
- vigorousness and efficiency;
- consistency, regularity, courage;
- tolerance and respect for different opinions;
- avoidance of prematurely formed opinions;
- openness to criticism;
- relativistic view of reality;
- independence of judgement.

These competencies of managers provide organizations with openness, flexibility and adaptability, which in turn increase the possibility of reacting quickly to changes in the market environment, contributing to the competitiveness of the organization. They also enable the implementation of change and innovation.

In my researches I present a thesis, that competencies and innovative behaviours of managers are also sources of formation of team and organizational spirit that fosters creativity and innovation of employees (see: Amabile, West, Ekvall, Ryhammar, Basadur, Hausdorf, Isacksen, Karwowski, others]. The working environment is a place particularly important for creativity and innovation, because it is linked with the idea of a learning and transgressive organization, which is characterized by the evolution directed towards flexibility, proactivity, continuous learning and innovation [Sułkowski 2002]. These organizations not only increase their chances of survival and development, but also contribute to raising the capital of an innovative society.

### **Developing innovative competencies in view of managers' educational biographies**

Presented here research excerpts of educational biographies of managers are a part of a larger research project, which includes a survey of creative atti-

tudes (of managers and employees) and innovation climate in seven Polish enterprises. The project was conducted by the author in 2008–2009, and the research is now continuing. The whole study was quantitative and qualitative in nature, and the parts of qualitative analyses presented in the article are based on empirical material gathered in the course of biographical and thematic interviews, conducted with 15 deliberately selected innovative managers, out of 93 managers surveyed earlier. The presented research analyzes those aspects of the educational and professional biography of managers that had an impact on the development of their innovative competencies. Specific analysis categories have been identified on the basis of a qualitative empirical data. This article presents only a small part of research and discusses two specific aspects: *how the respondents define the silhouette of an innovative manager and the main educational factors influencing the development of their innovative competence.*

### **Silhouette of an innovative manager**

Respondents defined the silhouette of an „innovative manager” in many various ways. They characterized it as: *a good manager who diligently carries out his/her duties, a person who creatively solves problems and conflicts, a unique person: a creator, a visionary, who introduces new concepts and trends in management.* Some characteristics of the innovative manager were pointed out by almost all of the respondents, namely: openness, broad perspective on the issues, the ability to creatively solve problems and conflicts, being up to date with changes, creativity. An innovative manager is (according to most respondents): *confident, constantly seeking, constantly introducing changes and improvements, communicative and good with people, able to inspire subordinates, listen to their opinions and to recognize good ideas.*

*The ability of independent construction and improvement of management tools* were also mentioned. Three respondents pointed to the personal development: *an innovative manager consciously develops as a person, knows him/herself, works on his/her weaknesses.* At the same time, according to respondents, an innovative manager should possess the typical characteristics of a „good manager”: *high motivation, the ability to respond quickly to new situations, the ability to make difficult decisions, orientation on goal achievements.* The distinguishing features of an innovative manager are also: *the ability to respond quickly to new situations, being people-oriented, having „soft” skills in people management, team-building and relation-building, able to inspire and to put to use human potential.* Managers identified mostly with silhouettes of innovative managers presented by themselves. When describing the „model”, they often referred to their own experience, their characteristics and skills, successes, and even failures. The difficulty in defining the model lies in the fact that what some call innovation or even creativity, others consider only as minor enhancements, improvements.

Based on the statements the author has identified sub-competencies and drew up the list of innovative managerial skills. The table below shows the effects:

**Table 1. Innovative managerial competencies in view of research on educational biographies of managers**

INTRAPERSONAL COMPETENCIES	open popular, entrepreneurial, clever, consciously developing his own personality, knows himself, working on his weaknesses, outstanding, creative, honestly fulfills duties, calm, knows how to make right decisions, avoids biased decisions, <i>a decision can not hurt other people,</i>
INTERPERSONAL COMPETENCIES	is aware of the effects of what he/she wants to achieve, paves the way for reaching this goal, develops spiritually (values).  communicative and having skills in making professional contacts, good observer, people-oriented, having „soft” skills in managing people, team-building and relation-building, able to inspire and to put to use human potential , knows how to inspire subordinates, listen to their opinions and to recognize good ideas, has the ability to negotiate, open, knows how to put to use other people’s potential, resources, and knowledge, consults important decisions with a team / department, is open to the staff’s suggestions, knows how to discuss and is not close-minded, open to the human aspects of life, <i>because something can always happen,</i>

	<p>allows for the possibility that subordinates can make a mistake, <i>because different people learn in different ways at different rates, an employee can make a bad, wrong decision at any given time,</i></p> <p>helps employees solve their problems, supports them,</p> <p>is able to communicate as well with a cleaning lady as with the president,</p> <p>takes responsibility for subordinates,</p> <p>follows the development of subordinates: do they improve? are they suitable for the job?</p> <p>knows how to create a sense of community and at the same time is aware of the importance of a single action,</p> <p>when building a team, knows that <i>there can not be a situation with one person being alienated; it is good when there is some healthy competition - people's interactions will be entirely different,</i></p> <p>open to other cultures and experiences of others.</p>
CREATIVE COMPETECIES	<p>has a broad perspective on issues,</p> <p>has the ability to creatively solve problems and conflicts,</p> <p>follows changes,</p> <p>creative,</p> <p>a visionary who introduces new concepts and trends in management,</p> <p>has the ability to respond quickly to new situations,</p> <p>seeking better solutions for himself and other people, organizations,</p> <p>does not stop at one solution to any given problem,</p> <p>solves problems not in a standard way,</p> <p>does not stop at what he/she has already achieved. Looks for new areas for development,</p> <p>benefits from the knowledge and bends that knowledge to fit his / her place of work, a specific problem, so as to use it in a very active way,</p> <p>constantly seeking,</p> <p>able to create something, form several versions or ideas to create a single one,</p> <p>has the ability to see "the big picture" from many various sides, aware of different perceptions - economic, spiritual, human,</p>

	open to all ideas, likes changes, has new ideas that embrace changes, shows tolerance and openness to change.
INNOVATIVE MANAGEMENT SKILLS	has the ability to independently design and improve management tools, effectively carries out missions and strategies, introduces a new way to manage, adapts company's tools and structures to the needs, constantly improves and changes <i>activities, procedures</i> .
CHARACTERISTICS OF A "GOOD MANAGER"	high motivation, ability to react to new situations, ability to make difficult decisions, oriented on goal achievement, well prepared, takes responsibility for his/her decisions, quickly makes decisions, quickly responds, knows what his/her team and subordinates are doing in order to properly assign work, propriety, well-developed planning and strategic skills.

Source: own research, Nawrat 2009.

An analysis of the innovative manager was used to develop a model of innovative managerial competencies [Nawrat 2009].

Another part of the interview focused on the educational factors that have shaped the innovative skills of the respondents. The interlocutors pointed to a wide variety of factors, which the author then grouped into narrower analytic categories. Respondents were also asked to rank the categories, and so, as key they have chosen: subject's background (predispositions, character traits, abilities, temperament), and the second, equally important, factor was the influence of the work environment - which was also found to be extremely important. These factors, however, must be interlocking and mutually reinforcing: *even an outstanding manager or employee will not use his abilities in adverse conditions* – said one of the respondents. Even though these two categories were distinguished, the respondents felt that all the other groups of factors (including: family, education and environment) have played an important role in the formation of their innovation as well. Presented below are parts of the research, categorized analytically.

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### Subject's background

The respondents talked about their internal predispositions, already existing in childhood, that contributed to the subsequent choice of becoming a manager, while shaping an innovative attitude. They exchanged the following characteristics: *desire to lead, leadership skills, charisma, a seeking attitude, early independence, the need for independence and personal freedom, a strong intrinsic motivation to learn and succeed, high aspirations, the desire to rise in the world, the ability to set him/herself goals, perseverance in pursuing goals, high tolerance for change, the ability to rise to the challenges, resistance to failures or rather ability to use them (learning from mistakes)*. These are the predispositions, which helped the test subject during school years to learn new skills associated with social functioning, and to cope with social and life situations. A characteristic feature of the managers' biographies was also the early independence in making educational and life choices. Most respondents made important choices between the ages of 12 and 15 (choice of profession, high school, the decision to study in another city). This was the result of combining the personal factor of favorable family circumstances. Respondents also demonstrated resourcefulness, charisma, courage very early (primary school, high school). Here is an example:

As a child, at the age of 15, I was trading by myself, abroad. At the age of 12, I was hitchhiking all over Poland.

The development of one skill group has stimulated the development and learning of other, new skills. The number and diversity of experiences multiplied, resulting in a wider range of possibilities: in the area of activities, decision making, problem solving.

Seven of the respondents exercised various social functions in the course of school education (class president etc.). These social functions developed, according to the respondents, the skills involved in managing people, building relationships, cooperation and coordination. Below is the statement of one of the respondents:

I've always liked to be an organizer. I preferred organizing than being organized. I believed that, in many situations, if I took doing something upon myself, then I would stay in control and the thing would get done.

The desire to control – him/herself, the situation, and sometimes other people, appeared repeatedly in the statements of the respondents. Moreover, the majority of respondents pursued simultaneously with education their extracurricular interests (sports, playing in a band, scouting, etc.). This allowed them to develop not only the interests and passions, but also skills in social interactions in different contexts.

### Family considerations

Family had an impact on the development of innovative attitudes in most subjects by providing them at an early stage of development (childhood, primary school) with adequate stimulation while supporting and giving enough space for independence and self-reliance (our interviewees). Impact of the family consisted of:

- showing various possibilities,
- development of cognitive curiosity,
- stimulation of courage in independent decision-making,
- development of ambition and motivation to learn.

Characteristic of the respondents' experience is a sense of freedom and independence, which is *an area of freedom* experienced in childhood. Several respondents described this area as a very important learning experience shaping innovation. Experiencing a sense of freedom prompted the first recalled attempt to take responsibility for themselves, which resulted in increased self-reliance and a sense of independence, autonomy, and subjectivity. Space for independence has allowed the respondents to better understand themselves, discover their strengths and weaknesses, increased their trust in themselves and self-confidence.

### Educational considerations

Shaping of respondents' innovation was greatly influenced by informal and non-formal education, which, according to them, was mostly subjective, because it resulted from already formed (in childhood) attitude manifested by *desire, curiosity, openness, reflexivity, ability to combine different elements*. The relatively small role of formal education in shaping innovative attitudes of respondents is found to be interesting by them. Overall, in managers' minds, formal education played a very important role in their lives and careers – it enabled acquisition of knowledge and skills, development of thinking, memory, analytic skills, ambition, and desire to learn. However, it was of little importance in shaping innovative attitudes. The respondents indicated few significant school events and relatively little role-models – teachers stimulating creativity and innovation. Respondents with higher education in humanities listed the highest number of experiences in the field of formal education that contributed to the development of innovative attitudes. According to them, these studies opened them to other people, to diversity (especially ethnology, cultural anthropology), gave basic tools and skills relevant to managerial work such as: tools of effective communication, conflict resolution skills, negotiation, knowledge about people and their behaviours (pedagogy, education studies). Below a statement of one of the interviewees:

I have a degree in ethnology, cultural anthropology, it involved trips, interviews with new people; here I gained skills in networking, I've always been an open person, but during an internship I gained those skills, going away for our internships we tried to find interesting places far away, I conducted a lot of interviews with people, on very particular subjects, distant from what we're talking about now, but I learned a lot.

School education has been recognized by the respondents as a „springboard” for further development and career, but not as a source of significant experiences, especially those that shape innovation.

### **Organizational considerations (including work-related considerations)**

An early career start (first jobs in high school, right after graduating from high school or during the first two years of college) is typical of the respondents (except for one person). Work commencement accelerated *maturation to adulthood*. Combining work and studies resulted in the need for *more effective time management and multitasking*, which to some extent prepared the subjects to perform managerial functions, which among other things require such competencies, and developed creative skills of *combining different areas*. According to the respondents, the environment that contributed most to forming their innovative approach is professional work environment, and especially being a manager. All respondents emphasized that they learned through working most of what they now need to perform professional tasks, especially in terms of practical skills, but also in terms of innovation. Working as a manager *compels an innovative approach* – as stated by one of the respondents. Another interviewee noted that: *now you can not be a non-innovative manager, because nowadays innovativeness is a must in this profession*. The link between functioning in an innovative company and shaping an innovative approach, was described by one of the respondents:

I haven't learned that, you have to have certain personality traits that one does or does not have. You have to be a conscious man, because only then you can develop certain character traits. Awareness is the ability to understand the specific mechanisms, touching upon the true understanding, and not learning something. In this company you can learn how to be an innovative manager by participating in the culture of the company, working here and participating in various types of training.

This statement shows how greatly the coupling of two key factors: on the one hand the organization, on the other hand specific subject characteristics; influences formation of innovation attitudes. Another respondent noted that everyday work tasks and situations are a factor in innovativeness formation:

I am often confronted with problems of legal nature, when there is a conflict, I have to face it, together with legal counsel, I have to decide whether a certain solution is good. The company is the place where you can profit, experiment. This is what shapes my innovation attitude, not knowledge. Work is a form of education, an ability to exercise. You don't always have it. You can have it, when you have the right attitude.

Another respondent said that working as a manager brings with it daily a number of „exercises” and „trainings” in creativity and innovation. This statement appeared in majority of responses. Below are examples of „training” situations selected from the various statements of managers:

pulling the plan; finding something; doing something difficult, that had to be done; conflict resolution, negotiation with a client, preparation of a strategic plan, designing a new course of action, dividing responsibilities, being up to date with what is going on, motivating subordinates, decisions and choices, obtaining information, improving sales.

According to respondents, organization educates an innovative manager by creating the right conditions, working environment fostering innovative attitudes.

In the last sequence of questions, the respondents were asked to describe a way to enrich their education, so it would serve the development of innovative competencies. Managers indicated the following:

planning development activities, interpersonal skills: negotiation, contact with people, noticing other people and their needs, cooperation and communication at a higher level, teamwork, talking and listening, sharing responsibility, the ability to develop intrinsic motivation, prioritizing, building and strengthening each other, developing independence and responsibility, ability to follow what is happening, openness, ability to see the big picture, look at the problems from different sides and levels (economic, spiritual, human), ability to adapt company's tools and structures to the needs, ability to build a vision and paths to goal achievement, using the capabilities, resources and expertise of other people, spiritual development, opening up to other cultures, experiences of others, travel, climate and environment change.

According to the respondents, forming innovative skills in the process of formal education would require to expand education programs and content, as well as directing students rather towards developing their attitudes and personal qualities, than the acquisition of knowledge and intellectual skills training only. The attitude of innovation is related, according to the respondents,

to: opening up to „the new”, to other people’s differences; the search for self-identity and autonomy; non-standard approach, crossing borders, flexibility. In most cases, formal education failed to provide educational opportunities for these key attributes and skills for innovation. The two exceptions are people who showed a pro-innovation impact of higher education, as was mentioned above, they were both graduates of the humanities.

## Summary

Biographical research excerpts quoted in the article do not cover the entire spectrum of the complexity of the issues discussed here, they are only a voice in the discussion. Analysis of managers’ educational biographies draws attention to the need and necessity to incorporate programs developing innovative skills into formal education, as well as, once again highlighting the role of work environment in shaping the attitudes and behaviors of innovation. The importance of the problem becomes apparent when faced with higher expectations of modern world which employees and managers have to meet. The European Union Strategy for 2020 serves as a good example of this. One of the priority areas it rests on is „smart growth – developing an economy based on knowledge and innovation” [Communication from the Commission, Europe 2020, p. 5], and one of the seven key projects has been defined as: „Innovation Union”<sup>5</sup>. In addition, one of the main objectives of lifelong learning is now becoming the creation of an “innovative person” – a person that is independent, innovative, knows how to recognize new opportunities and creatively transform reality and him/herself.

## Bibliography

Amabile T.M., Gryskiewicz N. (1989), *The creative environment scales: The work environment inventory*, “Creative Research Journal”, 2, Volume 2, Issue 4, pp. 231–253.

Ames M., Runco M.A. (2005), *Predicting Entrepreneurship From Ideation and Divergent Thinking*, „Creativity and Innovation Management”, Volume 14, Issue 3, pp. 311–315.

Basadur M., Hausdorf P.A. (1996), *Measuring Divergent Thinking Attitudes Related to Creative Problem Solving and Innovation Management*, “Creativity Research Journal”, 9, pp. 21–32.

Cenin M. (1998), *W poszukiwaniu wzorca osobowego szefa 2000 [In search of a role model boss 2000]*, Acta Universitatis Wratislavis, No. 2035, „Prace Psychologiczne”, XLVII, pp. 125–135.

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<sup>5</sup> Innovation Union – a project to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services, which in turn will contribute to economic growth and job creation” [Communication from the Commission, Europe 2020, pp. 5–6].

Communication from the Commission, Europe 2020, Strategy for smart, sustainable and inclusive growth, Brussels, 3 March 2010, p. 5.

Isaksen S.G., Lauer K.J. (2002), *The Climate for Creativity and Change in Teams*, "Creativity And Innovation Management", Volume 11, Issue 1, Main St, Malden, USA: Blackwell Publishers Ltd., pp. 74–86.

Karwowski M. (2009), *Klimat dla kreatywności. Koncepcje, metody, badania*. [Climate for creativity. Concepts, methods, research], Warszawa: Difin.

Morawski M. (2004), *Kompetencje menedżerów w procesie zarządzania wiedzą* [Competencies of managers in the process of knowledge management] [in:] *Sukces w zarządzaniu kadrami* [Success in Human Resources Management], Wrocław: Wyd. Akademii Ekonomicznej we Wrocławiu.

Mroziewski M. (2008), *Kapitał intelektualny współczesnego przedsiębiorstwa* [The intellectual capital of a modern company], Warszawa: Difin.

Nawrat D. (2009), *Kompetencje menedżerskie w zarządzaniu innowacyjnym* [Managerial competencies in innovation management] [in:] *Współczesne koncepcje w zarządzaniu* [Modern concepts in management], red. J. Gonicka, Łódź: AHE, pp. 167–183.

Rakowska A. (2008), *Samooocena kompetencji menedżerskich kadry kierowniczej współczesnych organizacji – wyniki badań* [Self-assessment of managerial skills by management staff of modern organizations – results of the research] [in:] S.A. Witkowski, T. Listwan (red.), *Kompetencje a sukces zarządzania organizacją* [Competencies and success of organization management], Warszawa: Difin.

Rakowska A., Sitko-Lutek A. (2000), *Doskonalenie kompetencji menedżerskich* [Improving managerial skills], Warszawa: Wydawnictwo Naukowe PAN.

Sitko-Lutek A. (2004), *Kulturowe uwarunkowania doskonalenia menedżerów* [Cultural determinants of managers' improvement], Lublin: Wydawnictwo UMCS.

Sitko-Lutek A. (2008), *Istota i cechy kompetencji organizacji* [The nature and characteristics of an organization's competencies] [in:] S.A. Witkowski, T. Listwan, *Kompetencje a sukces zarządzania organizacją* [Competencies and success of organizational management], Warszawa: Difin.

Steiner E., Weber R. (1993), *Ekonomika i organizacja produkcji* [Economics and organization of production], No. 3.

Sułkowski Ł. (2002), *Kulturowa zmienność organizacji* [Cultural variability of organization], Warszawa: PWE.

Szmidt K.J. (2001a), *Szkice do pedagogiki twórczości* [Sketches for education work], Kraków: Oficyna Wydawnicza Impuls.

Szopiński J. (2004), *Kreatywność menedżerów a ich funkcjonowanie rodzinne, zawodowe i osobowościowe* [Creativity of managers and their family, professional and personality functioning], Kraków: Wydawnictwo UJ.

---

Unsworth K.L., West M.A. (2003), *Zespoły: wyzwania pracy w grupie [Teams: the challenges of cooperative work]* [in:] N.Chmiel (red.) *Psychologia pracy i organizacji [Work and Organizational Psychology]*, Gdańsk: GWP.

West M. (2000), *Rozwijanie kreatywności w organizacji [Developing Creativity in Organisations]*, Warszawa: PWN.



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## Professional Evaluation. Application of the PageRank Algorithm in Employee Rating

**Abstract:** Appraisal is a tool used by both management and employees to attain their goals. Properly carried out employee performance appraisal allows to monitor the employee's actions and provides information on the level of his or her performance. Feedback in the form of appraisal motivates the employee to work more effectively and productively. Appraisal also enables to shape the personnel policy – it allows to chart employee career paths and determine training needs of an organization. For appraisal, however, to fulfil the attributed role, it needs to be carried out in a professional manner.

The aim of the article is to draw attention to the importance of employee performance appraisal in the personnel management process and to provide information on the core principles of appraisal. It describes, among others, determinants, criteria as well as selected methods and techniques of appraisal. An interesting point can be the use of the PageRank algorithm which can be a good solution for rating employees.

**Key-words:** employee performance appraisal, techniques and methods of appraisal, PageRank algorithm.

### Introduction

Employee performance appraisals are among important elements of personnel management in an organization. They provide information on employee per-

formance and may form a basis for many personnel decisions. Appraisals are also a vital communication tool between the superior and employee, a guidepost for professional development, training choices and constant optimization of the process of work. For the superior, appraisals are a valuable source of knowledge of the appraised employee, while they offer the employee feedback on his or her performance. Nevertheless, employee performance appraisals are often criticised by employers and employees alike because, as a result of contemporary trends, more and more companies introduce employee appraisal schemes that are merely a formality with no practical importance. Thus, it is of crucial importance to approach appraisal professionally and, first and foremost, think of a solution to satisfy both the parties concerned.

### **Employee Performance Appraisal and Factors Determining the Appraisal Manner**

Generally speaking, it can be quoted from many authors that appraisal is a value judgement applied in the management process and formed as a result of comparing features, qualifications, behaviours or effects of work of a specific employee with those of other employees or an established standard [Król, Ludwiczynski 2006, p. 289]. A similar view is expressed by Pocztowski who states that it is an opinion expressed orally or in writing that evaluates personality traits, behaviours and effects of work [Pocztowski, p. 224]. Employee performance appraisal is a basis for making many rational and fair personnel decisions; thus, creating conditions for the proper development of employees and institutions [Adamiec, Kożusznik 2007, p. 171]. In practice, periodic appraisal of employees' achievements is perceived as a crucial element of human resources management while its form and ways in which its results are used depend, to a large extent, on the management strategy, read literature and tradition of a company [Sajkiewicz 2000, p. 229]. The specialist literature offers various employee performance appraisal classifications. The most commonly applied include current and periodic appraisals. Current appraisal is made in the scope of day-to-day activities, e.g. by superiors or fellow workers. It is used to instruct and correct human behaviours in the process of work by giving feedback on the manner and effects of performed work. Periodic appraisal, most often comprehensive, is carried out from time to time and employs standard systems of periodic employee performance appraisal. It serves not only operating but also strategic purpose by, for example, identifying development potential of appraised individuals [Pocztowski 2007, p. 225].

It stems from the presented definitions that appraisals are an important management tool but it should be emphasized that there are many factors that need to be taken into account at their introduction.

Important factors include, first and foremost, the company size and type of its activities. Different objectives, criteria and techniques apply to small firms,

large corporations, public or academic institutions. In turn, what determines the manner of appraisal is, among others, the type of work, level of requirements or the appraiser's authority. The level of requirements is often connected with an individual approach to the employee. Another approach ought to be adopted to the newly employed, yet another – to experienced employees. Different criteria should also be applied in the appraisal of production workers, salespeople or specialists. Similarly, a specific approach is needed to the appraisal of management and executive personnel. As already mentioned, both the course and result of appraisal are directly influenced by the superior's authority. The higher the authority, the higher the acceptance of appraisal results [Sidor-Rzǎdkowska 2000, pp. 26–45; Oleksyn 1993, p. 58].

Hence, employee performance appraisal is an important component of the management process. It contributes to the efficient functioning of an organization, meeting its goals and developing conditions for achieving a high job satisfaction level by employees. Among numerous functions served by employee performance appraisal, the first to be mentioned is the evaluative function consisting in the appraisal of employee performance to date, the way he or she fulfils duties entrusted to him or her and the degree of his or her usefulness in the occupied position [Atamańczuk 2000, p. 7]. The motivating function should be emphasized (appraisal motivates people to work better and more effectively and impacts on their attitudes) as well as the information and decision-making functions. The information function occurs in two forms. The appraiser gets to know the employee and the subordinate learns what the superior knows about him or her. He or she is informed about what to expect, whether he or she will be punished or rewarded and what decisions will be made concerning his or her career and future. In turn, decision-making appraisal helps to make decisions on the further work of appraised employees. It is worth stressing that it can also be viewed as an element of organizational culture [see Sułkowski 2009].

Results of appraisal, when used, may change a decision or improve it. If decisions are guided by impression or intuition, the appraiser can make a mistake and promote an incompetent person or deny promotion to a competent one.

It should also be added that the consistent application of employee performance appraisal greatly affects the creation of a pro-effective and pro-innovative organizational culture [Dzieńdziora 2008, p. 36].

The above proves that the carrying out of managerial functions and actions in specific areas of human resources management is rather impossible without employee performance appraisal.

### **Appraisal System and Its Elements**

A basic appraisal system consists of objectives, criteria, subject, object and techniques. In practice, it is most commonly assumed that the principal objective of employee performance appraisal is to, first and foremost, improve the effec-

tiveness and quality of work done. Although it seems obvious, it should be emphasized that there may be various appraisal objectives. Moreover, they depend on the strategy adopted by a company. A. Pocztowski mentions organizational and psychosocial goals [Pocztowski 2007, pp. 225–226]. The former serve to obtain information necessary to decide personnel issues, such as hiring, training and training courses planning, career planning, rewarding etc. In turn, the latter consist in shaping behaviours and actions of employees through the regular provision of information that confirms their achievements or failures as well as career development opportunities.

Another classification of objectives is presented by Steward. The author lists the following objectives [Steward 1994, p. 250]:

- Corrective objective – shows weak points of employees to be corrected and eliminated;
- Stabilizing objective – consists in continuing to do what is good. It confirms the rightness of actions carried out properly and without fault;
- Developmental objective – indicates directions for specific employees to follow in order to develop. To meet the developmental objective is to point to the appraisee the direction of his or her development consistent with the direction of the company's development.

However, for the objectives to be fulfilled and for employee performance appraisals to serve their assigned function, be objective and produce information actually related to personnel, they are proposed to be made by applying the below principles. The most important of those include, among others [Pawlak 2003, p. 233]:

- universality of appraisal – everyone is subject to appraisal in an enterprise. There may be no one who is not subject to appraisal. No group of employees can be biased in favour of and no other groups can be biased against;
- knowledge of appraisal principles – allows for the better orientation of the employee's behaviours and actions;
- appropriate structure of appraisal system – an appraisal system should comprise types of appraisal used in a company, objectives, criteria and methods of appraisal. It is to be functional and useful;
- formalization of appraisals – principles of employee performance appraisal should be governed by a company's internal rules and regulations. As a result, they are based on unambiguous criteria and principles;
- compatibility of criteria – appraisal principles applied to specific employee groups should be compatible with the nature of their work;
- appraisers' background – the company should provide appropriate training for management staff so that no mistakes are made in appraisal and subordinates are appraised in a uniform manner;

- 
- fairness of appraisal – appraisal ought to set out the same requirements for all individuals;
  - objectivity of appraisal – appraisal should be based on facts rather than personal impressions and preferences of appraisers;
  - feedback – the appraised employee has the right to get acquainted with the appraisal made. When informed of his or her deficiencies, the employee can work on overcoming them. When informed of his or her strong points, the employee will be assured that his or her actions have been right.

Depending on goals to be met by appraisal, different appraisal criteria are also applied. A criterion is a feature that forms a basis for employee performance appraisal. Employee performance appraisal can use a single criterion when a single feature is compared or rely on several criteria. In the latter case, it is justified to determine weights of specific criteria [Pawlak 2003, p. 221]. Another vital issue is the number of criteria. It varies depending on the type and objective of appraisal. The most commonly used are the following [Sajkiewicz 2000, p. 231]:

- Qualification-related criteria encompass all the knowledge and skills acquired at school and in the course of self-education, and experience gained in previous jobs. Those criteria are connected with specific positions.
- Efficiency-related criteria comprise material and financial results of work. In the case of those criteria, the most important thing is to determine how to measure work efficiency of individual employees or their teams. They should be agreed on with and accepted by employees. They include: quality, standards, meeting deadlines, economies achieved, attracting new customers, reducing production time etc.
- Behavioural criteria serve to appraise employees' behaviours. Their use in a small firm is justified because it can be difficult or impossible to measure results of work in some positions; hence, attempts are made to determine specific patterns of behaviour such as: persistence, regularity in work, diligence, professionalism, honesty, loyalty, attitude to customers and superiors.
- Personality-related criteria include relatively constant traits of human psyche that are significant taking into account requirements in a given position. Such criteria are applied because some positions require certain predispositions such as: creativity, interpersonal skills, firmness, resistance to stress or composure.

Apart from the above-mentioned criteria, there is a mixed type combining the above features. Along with general appraisal criteria, detailed criteria required in a given position can also be adopted [Jasiński 1999, p. 102].

The next stage in the appraisal process is to choose an appropriate assessment technique, adequate for an assessed effect. It is important for the technique to be right to measure the effects concerned, guarantee precision and accuracy. It should also take into account costs of its use. In practice, various techniques of appraisal are employed. They can be divided into relative and absolute ones [Kostera 1997, p. 472]. Several of them are presented below.

One of employee performance appraisal methods is **paired comparison**. As the name suggests, it consists of comparing each employee with any other employee (applying an earlier established criterion) and building a comparison matrix. Then the so called “indicator of positive choices” is calculated for each employee that serves to ultimately rank the employees.

At first glance, the method seems to be simple and easy. The literature states that the paired comparison method is applied in small groups. If one wants to assess, for example, 20 employees, 190 comparisons have to be made; if there are 40 employees, the number of required comparisons increases to 780; if, however, 100 people are to be assessed in such a way, the number of necessary operations will reach 4950. The number of combinations arises from the following formula:  $N(N-1):2$  [Sidor-Rządkowska 2005, p. 85]. Thus, application of that method makes sense only in small organizations, for single level employees. That method is considered to be insufficiently progressive and appropriate solely for general appraisal. An example of the matrix is shown in Figure 1.

**Figure 1. Example of appraisal using the paired comparison method**

	A	B	C	D	E
A		A	A	A	A
B			C	D	E
C				C	E
D					E
E					

Source: Kostera 2000.

$$\frac{\text{number of positive choices}}{\text{total number of choices}} \times 100\% = \text{indicator of positive choices}$$

A	B	C	D	E
$4/4 \times 100 = 100\%$	$0/4 \times 100 = 0\%$	$2/4 \times 100 = 50\%$	$1/4 \times 100 = 25\%$	$3/4 \times 100 = 75\%$

Employee A, who has four positive indications, ranked first. Employee A's indicator of positive choices is as high as 100%, followed by employee E – 75%, C – 50%, D – 25%, B – 0%.

Other presented techniques is **rating scales**. They are among the most common methods of assessing employee performance. The most popular of them is the point rating scale. It lists, one after another, the most significant appraisal criteria, e.g. creativity, accuracy, skills, quality of work, quantity of work etc.; thereafter, an appraiser evaluates each of the criteria separately [Kostera 2000, p.73]. The dilemma of the rating scale is the number of grades it is to include. Some claim that unpaired scales, e.g. five-point ones, are better because they allow to select the middle grade for average scores. There are, however, more proponents of odd scales that prevent the appraiser from giving the average grade and force him or her to make an unequivocal decision. An advantage of using that technique is the simplicity of its application, easy comparison of received results with results of other employees and clarity of received results. In turn, a disadvantage is that the method is not employee development oriented [Sidor-Rządkowska 2005, p. 91].

The result of point rating is often misleading and thus the so called **weighted scales** are introduced. Those scales are similar to point scales, the only difference being that weights determining the significance of a specific criterion are attached to each of the appraised criteria. The overall result is calculated by multiplying the weight by the criterion, summing the results and dividing the sum by the number of criteria. The received result is the so called weighted mean [Karach 2009, p. 150].

Somewhat different type is so called **behavioural anchored rating scales** – **BARS**. Ratings received based on them are regarded as especially reliable and objective. Preparing such a scale is very laborious and requires specialized knowledge. The first step is to perform the analysis of a position; then major tasks carried out in a given position and being of the crucial importance for meeting the company's goals are chosen. Taking those into account, descriptions of desirable and undesirable behaviours are made. The task of the appraiser is to determine the occurrence of desirable and undesirable behaviours in the appraisee's work. It should be mentioned that advantages of that technique balance difficulties associated with implementing the discussed method.

The last of the presented methods is the **personnel portfolio** technique – a comprehensive appraisal technique. It was created on the basis of the BCG (Boston Consulting Group) marketing matrix. It consists in grouping employees into categories characteristic and typical from the company's strategic point of view which is based on potential for development and effects of employees' work. Work effectiveness concerns the past and is appraised on the basis of present results and behaviours leading to them, i.e. effectiveness and behav-

itorial criteria. In turn, potential for development determines the future usefulness of an employee to the company. Appraisal consists in dividing employees into four main groups (Figure 2) [Pocztowski 2007, p. 243-244]:

As a consequence of placing an employee in one of four fields an appropriate personnel strategy is adopted for him or her. It is recommended that the personnel portfolio be combined with other techniques enabling more precise appraisal of performance and potential.

**Figure 2. Personnel portfolio**

Effectiveness of work			
HIGH	Best employees	Reliable employees	
	Problematic employees	Employees of little use	
LOW			
	HIGH	LOW	Potential for development

Source: Pocztowski 2007, p. 244.

The presented techniques are only just a few in the list comprising techniques and tools used in the process of employee performance appraisal but, due to the length of the article, the list has been limited. They are more comprehensively described in the works of [Sidor-Rządkowska 2003 and 2006; Juchnowicz, Smyk 2000; Karach 2009; Ward 2005; Lapsinger, Lucia 2007 et al.].

### Application of the PageRank Algorithm in Employee Rating

PageRank Google is an algorithm used to rank websites, authored by Larry Page and Sergey Brin. The principle underlying the PageRank algorithm is that it assigns a certain numerical value to every website. The factor determining that value appears to be the number of links on the web leading to a given website. Quality of any such reference depends on the ranking of the websites from which they originate. To be more precise, valuable links turn out to be those that are posted on high-ranking websites.

We will briefly explain how the PageRank algorithm works. It goes without saying that there is a limited number of websites on the web. In the below discussion, we assume that there are precisely  $n$  websites. For the sake of discussion clarity, we will put all websites in a sequence, assigning consecutive numbers of the  $\{1, 2, 3, \dots, n\}$  set to them.

As mentioned above, the PageRank algorithm assigns to each website a value determined by the number of references on the web that lead to a given website. Thus, we begin by creating a matrix compiling information about links on the web. It will be denoted by  $G = (g_{ij})_{n \times n}$ . Coefficients of the matrix are determined by the following relationship:  $g_{ij} = 1$  when there is a reference from website  $j$  to website  $i$ ,  $g_{ij} = 0$  when there is no such reference. Then, we define number  $c_j$  as the number of links originating from website  $j$ .

The next step is to define the  $p_{ij}$  number as the probability that a person browsing website  $j$  will choose a link leading to website  $i$  from among all links posted on website  $j$ . Certainly, if we consider website  $j$  where there are no links posted,  $p_{ij} = 0$  will be assumed for all  $i$ . Such websites are called “dangling”. For websites  $j$  where there are links, the described probability is calculated applying the  $p_{ij} = \frac{g_{ij}}{c_j}$  formula.

The described probabilities for all websites  $j$  are collected in the  $P = (p_{ij})_{n \times n}$  matrix.

Let us remind the reader that by using the algorithm we are to assign a specific value denoted by  $w_i$  to each website  $i$ . The value is to be determined by the number of links leading to website  $i$ . Moreover, the measure of quality of every such link is the value assigned to the website where a given link is found. Intuition also tells us that the smaller the number of links on the website linking to website  $i$ , the higher the quality of each of them.

Hence, let us assign a hypothetical ranking value  $w_j$  to each website  $j$ . Then, in accordance with our above discussion, value  $w_i$  assigned to website  $i$  has to conform to the following relationship:

$$w_i = \sum_{j=1}^n p_{ij} w_j.$$

Let us note that, if we define vector  $w \in R^n$  whose coefficients will be values assigned to specific websites, then, according to the above formula, the following has to occur:  $w = Pw$ . It arises from the received matrix equation that  $w$  is the eigenvector of matrix  $P$  corresponding to the eigenvalue of 1. It is relatively easy to prove that such a vector exists and calculate its value when the matrix is stochastic (sums of elements of each column equal 1) and irreducible (an example of such matrix is a matrix with all positive elements, which is sufficient for our

discussion). Then, we can use the  $w = \frac{1}{n} \lim_{k \rightarrow \infty} P^k e$  formula where  $e$  is

a vector consisting only of ones [Meyer 2001, pp. 533–535, 673–675]. In such a case, we will receive values assigned to each website on our web and be able to rank the websites according to assigned values in a non-ascending order [Bryan, Leise, 2006, pp. 569–581].

The only other issue to be taken care of is to have a stochastic and irreducible  $P$  matrix. To that end, two modifications are applied whose description and motivation will be provided on the example of employee performance appraisal.

The method of employee performance appraisal based on the PageRank algorithm seems to solve many problems that occur in that field. It is based on an assumption that appraisal may not be one-sided, time-consuming or incomprehensible to employees who participate in it. Thanks to that method, appraisal taking into account preferences of the entire staff can be inexpensively made in small firms where all employees know one another. In turn, in larger enterprises the same method can be used within specific departments.

What is needed to apply that method is to ask employees to fill in a short questionnaire in which they should provide their own basic data and say which fellow workers they consider the most valuable.

For example:

Name and Surname:.....Department:.....  
Which employees do you appraise most highly? (You can put any number of surnames.)

At this point, association with the PageRank algorithm is quite noticeable. If we imagine that each employee runs a website, filling in the above-shown questionnaire by employee X can be understood as posting links to the listed colleagues on his or her website. Hence, we can rank employees according to the above-described algorithm.

What is left is to explain why the PageRank algorithm is suitable for such ranking. It goes without saying that excellent employees are able to more accurately appraise who is better at performing one's duties as they themselves are the best experts in it. Moreover, votes coming from individuals indicating many colleagues should be valued lower as the votes may prove their indecisiveness. Thus, it can be seen that such ranking should take into account not only the number of votes obtained but also their origin. Considering those factors, it is easy to conclude that the PageRank algorithm is a very good solution for such employee evaluation rank.

Let us remind the reader, however, that matrices produced by the algorithm are to be stochastic and irreducible. Hence, we will present modifications of created matrices and their interpretations.

First, we will reduce the matrix to the stochastic form. A skilled observer will notice that what we need to do to receive that form is to only modify columns for employees who did not cast vote for any fellow worker (as they comprise only zeros). It is rational to assume that such individuals are unable to decide who is the best (or find all to be not very good employees). Anyway, such individuals claim that all fellow workers and superiors work comparably.

Therefore, their votes can be interpreted as putting all surnames in the questionnaire. Hence, we replace all-zero columns with columns whose all elements equal  $\frac{1}{n}$ . At this point, we receive a stochastic matrix.

What is to be done now is to reduce the matrix to its irreducible form or, in other words, see to it that all its elements are positive. It should be kept in mind that, when filling in the questionnaire, employees put surnames of individuals they consider the best workers, which does not mean that they do not appreciate the rest. Thus, it can be assumed that employees not entered in the questionnaire also get part of the vote. In order to do that, it is enough to assume an appropriate coefficient  $\alpha \in (0,1)$  (any coefficient chosen as preferred) which will reflect the weight of surnames put in the questionnaire ( $\alpha = 0.85$  is assumed for the PageRank). Non-entered surnames are assigned the  $1 - \alpha$  weight. That modification produces a stochastic and irreducible matrix in the following form:

$$R = \alpha P + (1 - \alpha)E,$$

where  $P$  is the stochastic matrix created above and  $E$  is the matrix of the  $n \times n$  dimension whose all elements equal  $\frac{1}{n}$  [Govan, Meyer 2006].

The presented method has several flaws: it does not take into account the diversity of appraisal (if the surname of an appraised employee features in a questionnaire, he or she has been appraised highly, if it does not – the appraisal is low) and the resulting rank contains information only about the general virtues of employees. The first problem can be very easily solved. What is to be done is to modify the questionnaire by adding any kind of appraisal diversification. For example:

Name and Surname:..... Department:.....				
Which fellow workers do you assess...?				
(You can put any number of surnames in each column)				
very well	Well	as average	rather negatively	negatively

Then, by assigning appropriate weights to entered surnames and applying appropriate modifications, diversified appraisal can be produced.

The problem of the excessively general employee appraisal can be solved by creating several parallel ranks by asking more detailed questions: For example:

Name and Surname:.....Department:.....

(You can put any number of surnames to answer each question)

Which fellow workers and superiors do you appraise most highly in respect of discipline?

Which fellow workers and superiors do you appraise most highly in respect of work?

Which fellow workers and superiors do you appraise most highly in respect of interpersonal relations?

In such a case employees should be ranked separately for each question by using the above-presented method. Both the improvements can, of course, be made simultaneously; one should be careful, however, not to make the questionnaire too complicated.

## Summary

Undoubtedly, employee performance appraisals are an important component of personnel policy. Their role increases as the need for modern and effective tools to manage personnel occurs; hence, they should be made in a professional way. Proper appraisal significantly affects communication within the company, remuneration, development or promotion opportunities. Both theoreticians and practitioners are thinking about ways of appraisal that would satisfy both the parties concerned. It is not easy to choose an appropriate method and technique and, as stated in the article, it depends on many factors. It is recommended that several methods be used in the scope of one appraisal, in particular for different groups or types of positions.

The application of the PageRank algorithm seems to be a good solution. It can be used whenever we want to perform rating where an important factor is interactions among classified subjects taking into account values of those subjects. It should be added, however, that it requires appropriate knowledge. Given that the authors of the article did not present their own research (they are in progress) refer to the analysis of world literature.

To conclude, it ought to be said that there is no universal method to be applied in all organizations as each organization is different and requires an individual solution that precisely meets its needs.

## References

- Adamiec M., Kożusznik B. (2000), *Zarządzanie zasobami ludzkimi*, Wyd. AKADE, Katowice.
- Atamańczuk K. (2001), *Ocena pracowników w strategii zarządzania zasobami ludzkimi*, Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego, Olsztyn.

- Bianchini M., Gori M., Scarselli F. (2005), *Inside PageRank*, ACM Trans. Internet Tech.
- Brin S., Page L. (2005), *The anatomy of a large-scale hypertextual web search engine* (<http://www-db.stanford.edu/~backrub/google.html>).
- Bryan K., Leise T. (2006), *The \$25 000 000 000 Eigenvector: The Linear Algebra behind Google*, „SIAM Review”, Volume 48, Issue 3.
- Dzieńdziora J. (2008), *Ocenianie pracowników: ujęcie teoretyczne i praktyczne*. Oficyna Wydawnicza „Humanitas”, Sosnowiec.
- Employee evaluation rank* ([www.existenz.co.jp/Evaluation/Evaluation.htm](http://www.existenz.co.jp/Evaluation/Evaluation.htm)),
- Kamvar S., Haveliwalia T., Golub G. (2004), *Adaptive methods for the computation of PageRank*, „Linear Algebra Appl.”
- Keener J. P. (1993), *The Perron-Frobenius Theorem and the Ranking of Football Teams*, „SIAM Review”, Volume 35 Issue 1.
- Govan A.Y., Meyer C.D. (2006), *Ranking National Football League Teams Using Google's PageRank*, A.A. Markov Anniversary Meeting.
- Jasiński Z. (1999) (red.), *Zarządzanie pracą*. Agencja Wydawnicza „Placet”, Warszawa.
- Juchnowicz M., Smyk E. (2000), *Ocena pracy i pracownika* [w:] A. Sajkiewicz (red.), *Zasoby ludzkie w firmie, organizacja-kierowanie-ekonomika*, Poltext, Warszawa.
- Kostera M. (1997), *Zarządzanie personelem*, PWE, Warszawa.
- Kostera M. (2000), *Zarządzanie personelem*, Wyd. 2 PWE, Warszawa.
- Korach R. (2009), *Nagroda i kara. Profesjonalna ocena pracownika*, Helion, Gliwice.
- Lepsinger R., Lucia A.D. (1998), *360 stopni. System ocen pracowniczych*, Helion, Gliwice.
- Meyer C.D. (2001), *Matrix Analysis and Applied Linear Algebra*, SIAM.
- Oleksyn T. (2011), *Zarządzanie zasobami ludzkimi w organizacji*, Wolters Kluwer Polska, Warszawa.
- Pawlak Z. (2003), *Profesjonalna funkcja firmy: procesy i metody kadrowe*, Poltext, Warszawa.
- Pocztowski A. (2007), *Zarządzanie zasobami ludzkimi: strategie-procesy-metody*, PWE, Warszawa.
- Sánchez F.P. (2007), *Using the Concept of Google's PageRank to Enhance Student Motivation in Mathematics*, ICEE.
- Steward D.M. (1994), *Praktyka kierowania*, PWE, Warszawa.
- Sajkiewicz A. (2000), *Zasoby ludzkie w firmie. Organizacja, kierowanie, ekonomika*. Poltext, Warszawa.

Sidor-Rządkowska M. (2005), *Kształtowanie nowoczesnych systemów ocen pracowników*, ABC, Kraków.

Sidor-Rządkowska M. (2000), *Kształtowanie nowoczesnych systemów ocen pracowników*, Oficyna Ekonomiczna, Kraków.

Sułkowski Ł. (2009), *The problems of epistemology of corporate culture*, „Journal of Intercultural Management”, Vol. 1, No. 1, April, pp. 5–20.

Ward P. (2005), *Ocena pracownicza 360 stopni. Metoda sprzężenia zwrotnego*, Oficyna Ekonomiczna, Kraków.

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## **Psychiatrists and patients suffering from depressive disorders and schizophrenia in one organization basing on the hospitals in Lodz region**

**Abstract:** Collaboration between doctors and patient is a perfect example of a specific kind of collaboration in the organization. Difficulties with establish proper relations between psychiatrists and patients with depressive disorders and schizophrenia is the subject of the paper. The thesis of the work assumes that psychiatrists and patients belong to the totally different “worlds” what is the cause of inability to create proper mutual collaboration between them. In 2009 a questionnaire survey was conducted at public mental hospitals of the Lodz region. Both doctors and patients notice a number of communication barriers and factors hampering the mutual cooperation, at the same time demonstrating the will to agree and cooperate. The proper contact and collaboration affect mental disposition and motivation for the process of recovery from the illness.

### Conclusion

To a large extent not only a course of the treatment, but also a correct social functioning of both groups of the patients depends on the quality of the interrelation between them and psychiatrists. It appears, however, that the hierarchy of obstacles of successful therapy is completely different among the doctors and patients.

**Key words:** doctor-patient collaboration, depression, schizophrenia, “two worlds”.

## **Background**

Many authors emphasize how important collaborative organization and partnership are [Hill, Morgan 2012], also in the medical organizations [World Health Organization, 2004]. The specific character of a doctor-patient relation-

ship is underlined by many authors, physicians, psychologists and therapists, see e.g. [Beach et al. 2006, pp. 347–354; Pulia 2011, pp. 18–19; Roter 1977, pp. 281–315; Roter et al 1987, pp. 437–451; Roter 2006, pp. S28–34; Salmon 2000; Salmon 2006, pp. 137–159; Sofaer, Firminger 2005, pp. 513–559]. One should notice that not always the situation was as clear as it seems to be now when both patients and health professionals are aware of the fundamental conditions of the successful process of recovery. Nowadays, specialists and patients know how profoundly the beliefs, emotions and behavior of individuals influence the processes of understanding, communication and coping in the course of diagnosis and treatment. It has been proved [Salmon et al, 2009, pp. 450–456] that the patients want to communicate their needs that are linked with their desire for emotional support, though it happens infrequently; paradoxically, the clinical practice far too often continues the tradition of assuming that “doctor knows best” [Salmon, Hall 2004, pp. 53–56]. However, for centuries the problem of mental diseases was the dark side of medicine and the treatment of such persons was more than madness for the patients [Foucault 2006; Porter 2002; Shorter 2005; Shorter 1997].

Psychiatrists play a vital role in the patient’s recovery: they help to achieve better therapeutic effects and are able to restore the patient’s sense of security. In this way the treatment becomes more effective and the self-esteem increases. The change concerns not only quality but also the very meaning of life of persons with depressive disorders and with schizophrenia. Thus, patients are less inclined to consider the situation in which they find themselves (the disease and ways of treatment, including hospitalization) as a difficult situation.

## Material and methods

The questionnaires were used to carry out the research. The study involved two groups of people: doctors and patients. 53 psychiatrists and 200 patients – 78 with depressive disorders and 122 patients with schizophrenia were examined. The study was conducted in 2009, in all public mental hospitals in the region of Lodz. Each psychiatrist filled in two questionnaires: the first one – concerning patients with depression disorder, and the second one – relating to the patients suffering from schizophrenia. On the other hand, every patient filled in one questionnaire. Therefore, 106 questionnaires from the psychiatrists and 200 from the patients have become the base for the article. The talks with every examined person were additional sources of information.

The Bioethics Committee of the Medical University of Lodz, all the directors of hospitals and the heads of the appropriate hospital departments agreed to perform the tests in the hospitals. Every individual doctor and patient was also asked each time for consent to participate in the examination. Participation in the study was anonymous and voluntary.

Almost the “mirror questionnaires” for the psychiatrists and for the patients were used in further stages of the research, in the aim to compare the collected material, or, in other words, to describe a problem from two sides. Most of the questions contained in the polls have been closed questions, but a few of them, being the most important for the subject matter, were allowed to be freely answered. Open questions are presented verbatim in order to avoid distortion and misinterpretation. In some cases, both doctors and patients could choose from a set of possible answers more than one answer that is why the results do not always add up to a hundred. The applied research method is standard in this type of research; however, for greater precision the extensive questionnaires were used. On key issues, respondents were asked about additional description (open questions).

Chi-square test was used for statistical analysis, and Pearson’s chi-square test was used to verify the hypothesis significance. The study used a relative measure, that is, structure ratios (fractions). Basic statistical parameters: the median, the arithmetic mean and standard deviation, characterizing the properties of the tested population, and allowing for comparison with the other samples, were used for measurable (quantitative) characteristics.

Statistical analysis of the survey characteristics was performed on the basis of both parametric and non-parametric tests. Analysis of the empirical distribution of parameters was performed on the basis of the Shapiro-Wilk test. The application of parametric test was dependent on the assumption of the normal distribution and homogeneity of variance. The Leven test was applied to check the homogeneity of variance. In the analysis for qualitative characteristics two nonparametric tests were used: the Pearson chi-Square test for qualitative variables and Cramer’s V test.

## **The results of the study**

### **Sociodemographic data**

25% of women (13 doctors) and 75% of men (40 doctors) were reported in the group of the psychiatrists. In the group of patients the percentage of females and males was nearly the same: 51%: 49%. The average age of patients with depression was 50 years and that of the patients with schizophrenia was 45 years. The median is 53 and 45 respectively. These differences are statistically significant ( $p < 0.01$ ). The youngest patient was a sixteen years old person suffering from depression; the youngest patient with schizophrenia was twenty years old. The oldest patients were at approximately the same age (73 and 72 years, respectively).

Most respondents (54%) had a primary education or basic vocational education. 35% of surveyed patients had secondary or post-secondary education

while 12% of respondents completed university studies. There were no significant differences in education levels between the two treatment groups of patients. The percentage of persons being still pupils or students was almost identical (10%) among the two groups of patients. The same is true about the percentage of those who already completed their education. This may indicate either that the patients have not already belonged to the group of adolescents or that the disease could often make impossible the further education. In both groups of patients the majority (total 82%) was not economically active (77% of people with depression and 85% of patients with schizophrenia). These results suggest two aspects of the same phenomenon: inactivity because of illness or immersing in one's own disease because of the lack of activity.

Living of a person with mental disease with his or her own family was by far the most common model which concerned 70% of respondents (67% of people with depressive disorders and 72% of patients with schizophrenia). 32% of people with depressive disorders and 20% of patients with schizophrenia live alone; this is nearly a quarter of the total sample. Only 6% of surveyed patients live in nursing homes. This refers mainly to persons with schizophrenia (8%) and only in one case relates to a patient with depressive disorders.

### **Comparison of the results of doctors and patients' studies**

This section concerns the comparison of the positions represented by the two groups of respondents. Psychiatrists were asked for separate opinions pertaining to the patients with major depressive disorder and those with schizophrenia. As it turned out in most cases, the responses concerning both groups of patients usually do not differ significantly, so that doctors' answers can be considered as a whole relating to all patients. When the differences became statistically significant, it was included in the description. The same is true of the answers given by patients: the fundamental issue – their relationship with doctors – may be regarded as relatively homogeneous. We believe this fact is not entirely intuitive or trivial, more serious differences could perhaps be expected. And even though the answers provided by patients with depressive disorders and patients with schizophrenia usually did not substantially diverge, the differences between patients (considered as a whole) and the position of doctors were sometimes very significant.

In particular, opinions of doctors and patients relating their mutual contacts and information given by psychiatrists to their patients differed significantly from each other. Psychiatrists estimated that in 91% of cases doctors were conducting their patients with major depressive disorder and 79% of patients with schizophrenia continuously (i.e. without interruption), while merely 38% patients with depression and 20% with schizophrenia confirmed that statement. Doctors claimed that during the first visit they had

informed their patients about the specifics of the disease. The statement refers to 91% of people with depression and 83% of patients with schizophrenia. This position was confirmed by less than a half of the patients: 46% of patients with depression and 40% of those with schizophrenia. Psychiatrists also maintained that almost always they had informed the patients about the mode of action of individual drugs (after 92% of responses for each of the groups of patients), while only 64% patients with depression and 65% of patients with schizophrenia confirmed that opinion. Psychiatrists declared that they had informed patients (respectively 98% and 96% of responses) of the undesirable effects of drugs but only a half of patients (respectively 49% and 50% of patients) confirmed that. Convergent responses concerned two other issues. In the first case – “doctors answer all patients’ questions” – 89% and 81% of psychiatrists’ responses to the 83% and 77% of positive answers given by the patients were affirmative. The second case is related to the treatment. Both doctors and patients recognized that sometimes a decision is taken only by the psychiatrists and sometimes together with patients (respectively 58% and 53% of responses on the part of physicians and 55% and 41% of the patients).

Doctors believed that patients presented them doubts and fears related to treatment – 92% of positive responses relating both to one and to the other of the diseases indicated by psychiatrists. This was confirmed by 71% of patients with major depressive disorder and 80% of patients with schizophrenia. Psychiatrists asserted (94% of responses) that they sometimes changed the way of treatment at the request of the patient, which agrees with the answers given by the part of patients: 65% of them with major depressive disorder and 60% with schizophrenia. 87% of psychiatrists expressed the hope that their patients with depressive disorders had trusted them. As for the patients with schizophrenia, doctors showed more caution – at 77% positive responses. The same percentage, 87% of patients with depression and 86% of patients with schizophrenia (i.e. more that the doctors have expected) confirmed confidence in their doctor.

Psychiatrists estimated that at least two (34%) or three (28%) of ten patients with major depressive disorder who had started the treatment would interrupt it. That percentage may be even higher in patients with schizophrenia: three (28%), four (34%), and up to five patients – 24% (or even more) in ten who had begun the treatment could not endure to the end of therapy. Among the patients, 36% of persons with depression and 49% of patients with schizophrenia admitted they had stopped their treatment at least once in the past. Presumably, only a part of the patients responded truthfully, the rest did not have the courage to admit the break. This trend seems to confirm the statement of the doctors and patients relating to compliance. Doctors estimate that

only 64% of patients with major depressive disorder and even less, i.e. 42% of patients with schizophrenia follow medical recommendations - as for the rest – they are not so sure. The patients' evaluation of the level of compliance was bigger than in the doctors' evaluation – respectively 92% and 91% of positive responses which is not astonishing. Doctors believed that their patients with depressive disorders considered their therapy as effective (96%), while the persons with schizophrenia (in the doctors' opinion) determined the level of the effectiveness of the therapy as 72%. Meanwhile, both groups of patients, assessed the treatment effect identically (after 77% positive responses).

Differences were noticeable relating to the subject matter discussed in the psychiatric wards – the talks of psychiatrists and patients. Doctors claimed they had talked with their patients not only about their primary disease, but about all their life problems, what relates to absolutely all patients with major depressive disorder (100% of responses on the part of psychiatrists), and 94% of patients with schizophrenia (as the doctors claim). Meanwhile, the above psychiatrists' opinion was confirmed by 72% of patients with major depressive disorder and merely 61% of patients with schizophrenia. This is one of the most glaring examples of disagreement between the doctors' and patients' evaluation. 75% of psychiatrists believe that the patient had been given enough time and attention, and 25% of doctors were not satisfied at this point with the facts. Meanwhile, 78% of people with major depressive disorder and to 83% with schizophrenia consider that their psychiatrists devoted them enough time and attention. Psychiatrists believe that almost all patients (100% of responses relating to patients with depression and 98% of responses relating to patients with schizophrenia) were in contact with a doctor on time (during outpatient treatment). However, the psychiatrists' thesis is confirmed by just 71% of people with depression and 86% with schizophrenia.

One of the most serious problems in the treatment of both depression and schizophrenia is a stop or break in taking medication by patients without consulting their doctor. Resignation from taking medication usually has very negative impact on the effectiveness of a treatment. Therefore, two examined groups were asked about what is the reason for such decision. In the opinion of the psychiatrists the most common reason is the conviction of patients that they no longer need any medicine. There are 91% of doctors' indications relating to the patients with depression and 83% for the patients with schizophrenia. Also the patients have declared the same reason for discontinuation their pharmacotherapy. However, the difference between percentages is glaring: only half of them pointed out that reason – 52% of patients with major depressive disorder and 42% of patients with schizophrenia. The category "other reasons" (relating to the same problem: discontinuation the treatment) seems to be very interesting, because only a few doctors have pointed it out (respectively 6% and 9%

of responses), but it was important for relatively many patients: 28% with depressive disorders and 25% with schizophrenia. Patients have exchanged quite a few very serious reasons, such as loss of meaning in life and attempted suicide. The big problem among the patients is also the co-existence of alcoholism, which very often becomes the cause of the resignation of medication: patients, knowing that they must not combine drugs with alcohol, choose alcohol. The next major issue is the denial of illness or inability to accept it.

How important are these factors and the perceiving of these and other problems by the psychiatrists, can be proved by the fact that patients often decide to change the doctor just because they had no good contact with the previous one. This is confirmed by psychiatrists themselves, who declare that 91% of their patients with major depressive disorder and 89% of patients with schizophrenia have done it in the past. The patients, have confirmed opinion of the doctors although to a less extent (respectively 29% and 30%), but this can be explained by their fears that the doctor who was given up by them could have find it out.

Both doctors and patients notice a number of nuisances accompanying the process of treatment, although observations of doctors and patients seem to be considerably different. Psychiatrists believe, that the greatest inconvenience for the patients is the need for regular taking medicines, as evidenced by the 40% indications relating to patients with major depressive disorder and 62% relating to patients suffering from schizophrenia, while the patients located this factor in the third place adequately at a level of 9% (patients with depression) and 15% (patients with schizophrenia). Patients, recognized a hospitalization as the greatest nuisance, as indicated by 26% of persons with depression and 40% with schizophrenia. This factor is also cumbersome in the eyes of the doctors and was ranked in the second place, with indications of, respectively, 40% and 51%. Limitations of the private life were recognized by patients as the second most nuisance factor (respectively 14% of people with depression and 26% of patients with schizophrenia). This drawback was also noted by the psychiatrists, who had described it at 38% relating to patients with major depressive disorder and 30% grappling with schizophrenia. In addition, doctors pointed to the need to comply with the rigors of treatment (respectively 32% and 47%), which was reflected in patients only at the level of 3% and 11%. Other factors do not seem to be so important for both physicians and patients.

Patients have presented two statements – “out of obviousness”. First of all – as much as 30% of people with depression and 17% of patients with schizophrenia have found that nothing is burdensome for them in the course of treatment, and secondly – a very large proportion of patients, because 45% of major depressive disorder and 38% suffering from schizophrenia have marked answer “other factors”. Moreover, is not the first time, with a choice of a wide

variety of categories, patients recognize that they do not fit in any of them, so that they had added their own arguments. Here we quote patients' explanations – what they understand by the term “other factors” without changes – in order to avoid distortion and misinterpretation. In their opinion, nuisance are: “Restriction of freedom (internment), the disease and impotence against it, difficult access to a doctor, too much distance between the place of residence and the place of treatment, side effects of medication, concerns about household affairs during the hospitalization, the inability of leisure time activities in the hospital, longing behind the house, the monotony of hospital life, lack of privacy and intimacy in the hospital, the lack of a pass to the house, the inability to contact the psychiatrist due to the permanent lack of time and interest on the part of the doctor, no effect of treatment, inability to accurate drug selection, unrealistic expectations for the effects of treatment, medication side effects – memory loss, reduction in private life, decreased libido, lack of companionship, life problems, inability to work, lack of medical discretion when patient is informed on his / her state of health, uncertainty about the effects of treatment, lack of exit for a walk, the continuing need to talk about themselves and their intimate affairs, co-morbidities, a significant limitation of personal freedom as a result of the treatment, keeping a secret from the family and the environment fact of staying in a mental hospital, the difficulty of getting to a doctor, hospital rhythm of life, necessity of compliance, medication side effects – drowsiness, family relationships, family breakdown as a result of the patient's illness, unemployment, stress, “gray days”, the lack of social life, the stigma of mental illness in the environment – stigma, “excess” of drugs, too many patients the ward daily, no noticeable improvement in health, to mobilize against any effort, change doctors, lack of money for a decent life – so, in addition to the purchase of medicines could be to go to the theater or to buy the book, the inability to implement prescriptions away from home, the failure of the hospital needed research, the disease – problems with memory, concentration, perception, hospitalization against the wishes of the patient, the disease hiding from the environment, large doses of medication, side effects of drugs – to reduce intellectual functioning, slow, fear, anxiety, irritability, lack of privacy and intimacy in hospital, dormitories (social phobia), incorrect diagnosis, incorrect medication”. Patients' answer to the last question may seem surprising. Patients were asked whether, despite the numerous nuisances they accept their treatment. 93% of them (patients with both depression and schizophrenia) answered affirmatively. This may prove strong determination to fight the disease and in the “private” fight for oneself.

Despite of the many differences in the perception of both the recovery and collaboration, doctors and patients are absolutely unanimous on one thing: a necessary condition of their cooperation is mutual trust and respect. Patients

are willing to sacrifice a lot, provided, however, that the doctors saw in them people, not the statistical number of diseases. Also, doctors are willing to make concessions, but on the condition of sincerity on the part of patients. Thus, the mutual co-operation seems to be possible.

Each group is aware of the many barriers of their communication, but both sides are willing to understand each other and cooperate.

## Conclusions

1. Both doctors and patients are in agreement as to the basic element of good cooperation that is mutual trust.
2. However, doctors and patients understand the concept of mutual cooperation quite differently. This difference is due to the other experiences: psychiatrists use their knowledge and years of practice, patients – experiences from the period of the disease and the treatment; additionally their perception of reality could be distorted as the result of the disease.
3. Psychiatrists claim that they provide comprehensive information on both disorders, which their patients suffer from, as well as methods of treatment, and adverse effects of drugs; however, no more than a half of the patients confirm that. Both the persons with depression and schizophrenia maintain that they follow medical recommendations, but in the opinion of doctors this is true only about a part of the patients.
4. The level of compliance in depressive disorders was evaluated by psychiatrists as 64% and among the patients with schizophrenia as 42% (when 92% depressive patients and 91% persons with schizophrenia declare compliance by themselves). Differences between both groups of patients are substantial statistically ( $p < 0.05$ ), indicating that more persons with major depressive disorder follow medical recommendations than patients with schizophrenia, at least in the doctors' opinion.
5. According to the doctors, the most common reason for the desisting from taking medications by patients (both with major depressive disorder and schizophrenia – adequately: 91% and 83%), is their belief that drugs are no longer needed. Patients confirmed the opinion of the psychiatrists (claiming they have no benefits of pharmacotherapy), but only 52% of persons with major depressive disorder and 42% with schizophrenia drew attention to this.
6. Both psychiatrists and patients themselves – notice a number of nuisances accompanying the process of treatment. However – observations of doctors and patients do not fully coincide.

7. Doctors as well as their patients indicate numerous barriers of interpersonal communication meanwhile declaring attempts of understanding and mutual cooperation.
8. Psychiatrists and patients agree that the quality of the relationship, proper contact and cooperation affect mental disposition and patient motivation for the process of recovery from the illness, the treatment and the proper social functioning of both groups of patients.

### **Inference:**

Psychiatrists should explain to the patients what is the overarching goal of therapy. Doctors and patients should jointly discuss medical procedures and psychological problems associated with the treatment. The result of cooperation should be the conclusion of a contract between a psychiatrist and patient. Each party shall abide by its commitments.

### **Bibliography**

Beach M.C., Roter D.L., Wang N.Y. et al. (2006), *Are physicians' attitudes of respect accurately perceived by patients and associated with more positive communication behaviors?*, 'Patient Educ Couns', 62 (3), pp. 347–354.

Foucault M. (2006), *History of Madness*, Routledge, London, New York.

Hill G. (2011), *Seven steps to successful organizational collaboration*, Optima Partners, Edinburgh.

Morgan J. (2012), *The Collaborative Organization: A Strategic Guide to Solving Your Internal Business Challenges Using Emerging Social and Collaborative Tools*, McGraw-Hill, New York.

Porter R. (2002), *Madness. The Brief History*, Oxford University Press, Oxford, New York.

Pulia M. (2011), *Simple Tips to Improve Patient Satisfaction*, 'American Academy of Emergency Medicine', 18 (1), pp. 18–19.

Roter D.L. (1977), *Patient participation in the patient-provider interaction: the effects of patient question asking on the quality of interaction, satisfaction and compliance*, 'Health Educ Monogr', 5 (4), pp. 281–315.

Roter D.L., Frankel R.M., Hall J.A. et al. (2006), *The expression of emotion through nonverbal behavior in medical visits. Mechanisms and outcomes*, 'J Gen Med', 21 Suppl 1, pp. S28–34.

Roter D.L., Hall J.A., Katz N.R. (1987), *Relations between physicians' behaviors and analogue patients' satisfaction. Recall, and impressions*, 'Med Care', 25 (5), pp. 437–451.

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- Salmon P. (2006), *Explaining unexplained symptoms: the role of beliefs in clinical management* [in:] P. Halligan, M.Aylward (ed.), *The power of belief*, Oxford University Press, Oxford, pp. 137–159.
- Salmon P. (2000), *The Psychology of Medicine and Surgery: A Guide for Psychologists, Counsellors, Nurses and Doctors*, Wiley Series in Clinical Psychology, Chichester.
- Salmon P., Hall G.M. (2004), *Patient empowerment or the emperor's new clothes*, JRSM, 97 (2), pp. 53–56.
- Salmon P., Ring A., Humphreys G.M. et al. (2009), *Primary Care Consultations About Medically Unexplained Symptoms: How Do Patients Indicate What They Want?*, JGIM, 4, pp. 450–456.
- Shorter E. (2005), *A Historical Dictionary of Psychiatry*, Oxford University Press, Oxford, New York.
- Shorter E. (1997), *A History of Psychiatry: From the Era of Asylum to the Age of Prozac*, John Wiley & Sons Inc., New York.
- Sofaer S., Firminger K. (2005), *Patient perceptions of the quality of health services*, “Annual Review of Public Health”, 26, pp. 513–559.
- World Health Organization (2004), *Promoting Mental Health*. [http://www.who.int/mental\\_health/evidence/en/promoting\\_mhh.pdf](http://www.who.int/mental_health/evidence/en/promoting_mhh.pdf) [17.09.2013].



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## The use of Social Networking Sites in modern recruitment – empirical study

**Abstract:** Current changes in technology and the role of the Internet open up new opportunities for companies both to communicate and to work. The fact that Social Media entered the business landscape, and in particular the recruitment landscape leads to a demand for knowledge about recruitment trends regarding social media. Contemporary social media and recruitment texts have been reviewed in order to identify what impact social media is having on the recruitment industry. It focuses on how companies and recruitment professionals are taking advantage of the social media landscape to recruit talented people. Relevant existing research has been reviewed and primary research conducted (both qualitative and quantitative). The authors have conducted 8 IDIs with recruiter from various industries. The latter consisted of 147 CAWIs with employees from various Polish organizations from several different industries. The article presents interesting results that can be especially useful for recruitment managers, specialists and company owners. It is recommended that in order to gain a fuller picture of the issues underlying the findings, quantitative research on a bigger scale should be undertaken.

**Key-words:** social media, social networking sites, recruitment industry, research results.

### Introduction

The current economic crisis offers organizations the possibility to rethink their recruitment activities and employer branding strategies. As fewer vacancies are being created and only a limited number of new employees are hired, the quest

for the right candidates who can be efficient integrated in the organization is perhaps becoming more significant. Additionally rapid changes in technology open up new opportunities for companies to communicate and work. As a consequence of this constant changes and due to the growing importance of the Internet, social media create various opportunities for recruiters and their communications. This paper looks at the impact social media is having on the recruitment industry. It focuses on how companies and recruitment professionals are taking advantage of the social media landscape to recruit talented people.

The authors have formulated several research questions:

RQ1: Which tools from social media are used most often by recruiters in Polish organizations?

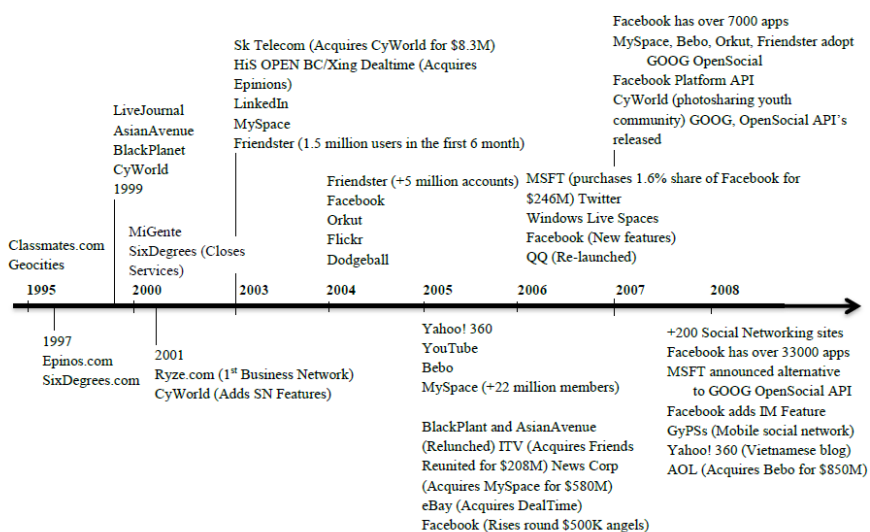
RQ2: Are non-professional SNSs (e.g. Facebook) used as often in the recruitment process as professional SNSs (e.g. Goldenline.pl)

RQ3: Do recruiters think that social media recruitment methods will replace traditional recruitment methods?

### Social media and Social Networking Sites

Social media is a relatively new concept, therefore social media experts have not finished to debate a proper definition of the term, and deciding on a universally accepted definition may prove impossible. Nevertheless, taking into account definitions from several social media experts assists in determining a reasonable definition – one that accurately describes the core purpose of social media.

**Figure 1. Social media development from 1995 to 2008**



Source: Trebnick 2008.

Safko and Brake [2009, p.6] observe that social media “refers to activities, practices, and behaviors among communities of people who gather online to share information, knowledge, and opinions using conversational media”. Weinberg [2009, p. 1]. notes that social media “relates to the sharing of information, experiences, and perspectives throughout community-oriented web-sites”. Comm [2009] believes that social media is content that has been created by its audience. The Universal McCann report refers to social media as “online applications, platforms and media which aim to facilitate interaction, collaboration, and the sharing of content”[Universal Mccann 2009, p. 10]. The preceding definitions describe various aspects of social media but do not grasp its essence.

Palmer and Koenig-Lewis [2009, p.162] divide social media into following categories:

- blogs,
- social networks,
- content communities,
- forums / bulletin boards,
- content aggregators.

Zarella offers a basic definition that brings clarity to the term: According to him social media consists of on-line technologies that facilitate the creation and distribution of content [Zarella 2010]. Concise and simple, this definition lays the foundation for a proper understanding of additional facets of social media.

According to Zarella [2010], social media uses many forms:

- blogs,
- micro blogs,
- social networks,
- media sharing sites,
- social bookmarking and voting sites,
- review sites,
- forums,
- virtual worlds.

SNS – a *social networking site* is the phrase used to describe any Web site that enables users to create public profiles within that Web site and form relationships with other users of the same Web site who access their profile. SNSs have different rules for establishing connections, but they often allow users to view the connections of a confirmed connection and even suggest further connections based on a person’s established network. Some social networking

websites like LinkedIn are used for establishing professional connections, while sites like Facebook straddle the line between private and professional.

### **Recruitment, social media and social networking sites**

Human resource management in a professional business context entails the effective and efficient management of an organization's employees toward the achievement of desirable objectives and goals. Human resources management has replaced its predecessors such as personnel administration and personnel management by integrating traditional management elements such as:

- human resource development,
  - job design,
  - recruitment and selection,
  - rewards systems, career management,
- with the strategic objectives of the organisation.

Human resources management perceives employees in a similar way to other resources such as finance or technology and in that sense they must be effectively managed to ensure the best performance for the whole organisation. Human resources management functions to outline the processes for employee acquisition, development and termination [Compton et al. 2009, p. 2].

Organizations are realizing the importance of human resources. Nevertheless its role in a strategic context is still quite limited when compared to other functions. As more firms are embracing human resources functions and aligning them with the central business strategy, human resources managers are starting to adopt more influence and become responsible for strategic business decisions. Management often has an old-fashioned view towards human resources management especially when it concerns the retention of key staff. Functions that are evaluated through cost and profit often fall under this dilemma. It is much easier to calculate the direct costs of human resources management activities than the actual benefit these activities may bring to the organization in the short and long term. However, it is more than likely that investing in human resources can deliver valuable and unique contributions to performance enhancement, cost reduction and finally productivity [Emerald Group Publishing Limited 2009].

Recruitment can be described as the “practices and activities carried out by the organization with the primary purpose of identifying and attracting potential employees” [Parry & Wilson 2009]. Recruitment aims to attract applicants and fill vacancies to maintain proper staff levels to correspond with an organisation's strategy.

Talented people are a prime source for a company's competitive advantage. The search for the best people is a constant battle between companies and

they have to develop strategies in order to find the best employees. Due to the competitive nature of the employment market, the potential employer must also sell itself and the vacant position to prospective applicants by presenting its employment advantages. Because of that that, the strategic question of finding, attracting and recruiting the best people has become a relevant issue for companies. Small and large companies, career centers, recruiters and staffing firms develop strategic social recruiting plans to create and maintain relationships with prospective candidates through social media and branding tactics. Recruiters can use tools from four main groups (table 1).

**Table 1. Recruitment tools – social media**

<b>Contact SNS</b>	- <b>Generalist SNS : Facebook, Twitter</b> - <b>Professional SNS : LinkedIn, Viadeo, Xing</b>
<b>Content SNS</b>	- Video, photo and document sharing sites: YouTube, Daily Motion, Flickr, Slideshare
<b>Publication tools</b>	- Applicants blogs: personal or professional. - Employers blogs: corporate, HR, or specialized in a field.
<b>Discussion tools</b>	- Forums: generalist or specialized in a specific field.

Source: own study.

The variety of Social Networking Sites is growing fast and what is worth mentioning there are clear national differences in their usage. According to Kim et al. (2009) there is a diversity of popular Social Networking Sites by continent, region and country. In Europe, for example, Germans use StudiVz, while Hyves is popular in the Netherlands, Portuguese focus on Hi5 and Poles use GoldenLine. Facebook is used on nearly every continent and is the Social Networking Site with the most registered users with more than 1 billion active users [Facebook 2013]. The number of Social Networking Sites has risen enormously during the last years and still keeps on rising.

Although some of both practitioners and researchers claim that social networking will increasingly replace the traditional CV, both candidates and employees are constantly being advised to be selective in what they put online. Online profiles do not necessarily present an accurate picture of the candidate. Some candidates in the marketplace are concerned about the security issues (identity theft etc.) associated with having personal information online. Others are wary of being victims of discrimination by providing employers with demographic information (such as age, race) that could potentially exclude them from the recruitment process. It happens because employers can essentially filter out candidates based on numerous 'subjective' factors such as e.g. 'university attended'. Assessing someone's potential employability based solely on an online profile leaves many possibilities for unethical practices.

## Research methods and findings

Critical review of literature and statistics has been undertaken to develop a full understanding and insight into the current trends of online recruitment and the factors surrounding it.

This research was a multistep process which used a combination of research methods (see table 1).

**Table 2. Research methods**

Research tool	Type of research	Sample size
Desk research	Qualitative	-
IDI	Qualitative	8
CAWI	Quantitative	147

Source: own study.

Both IDIs and CAWIs were conducted among Human Resources (HR) departments of Polish companies. To determine the perceptions and experiences of the HR departments, the author developed a questionnaire based on the constructs derived both from IDs and from the literature review.

147 respondents participated in CAWI. The majority of respondents come from training and consulting sector (19%), as well as IT (14%), finance (12%) and industry (12%) (see table 3).

**Table 3. Researched companies' sectors**

Training and consulting	19%
C2C services	8%
IT	14%
Media	7%
Industry	12%
Finance	12%
Insurance	8%
Science, education, research	6%
FMCG	5%
Retail	9%

Source: own study.

The majority of respondents (37%) work for companies employing more than 250 employees. The smallest group of respondents came from companies employing from 1 to 10 employees.

**Table 4. The size of the company you work for (employees)**

1–10	13%
11–49	14%
50–99	19%
100–249	17%
>250	37%

Source: own study.

The majority of respondents were either HR Specialists (46%) or HR Managers (42%) (see table 5).

**Table 5. Respondents positions.**

Assistant	3%
Specialist	46%
Manager	42%
Owner	9%

Source: own study

In the past, to recruit employees, companies would simply advertise in the local press, post jobs online via the company website or on popular job boards. This ‘passive approach’, many claim, is on the way out. The global phenomenon of social media is having a significant impact on the world of work and on job markets. Social media is no longer a trend which might be included into a company recruitment strategy. For example in 2009 Monster.com reported a 31% drop in revenue. Regarding on-line tools, Polish recruitment specialists and managers tend to use mostly job search internet portals and social media sites for professionals (see table 6).

**Table 6. Online tools used for recruitment (number of total indications)**

Job search internet portals	129
Social media (professionals)	121
Social media (general)	32
Wirtual job fair	24
Blogs	11
Microblogs	9
Discussion groups	14
Intranet	32

Source: own study.

Today hiring managers and recruiters find that they need to be more proactive in their approach. This can be accomplished by engaging with talent across

various social networking platforms. Essentially, companies and recruiters need to be where their candidates are in order to engage them in the recruitment process. Usually the best candidates, who advertise themselves online using social media sites, tend to want to be found rather than having to actually apply for jobs. Nowadays recruiters have to become experts in using social networking technology to find the right candidates.

Study called Candidates 2.0 conducted by the Employer Branding Institute (ebinstitute.pl) showed that 74% of students and graduates use the Internet to look for work or practical training. However, research indicates that only 21% of respondents are looking for work, practice or training on such sites as Facebook or Twitter. The majority uses professional sites such as: GoldenLine or Profeo or LinkedIn.

This research shows that the sites which are mostly used by recruiters are: GoldenLine and Profeo (tab. 7).

**Table 7. Social media sites used for recruitment (number of total indications)**

GoldenLine.pl		114
Profeo.pl		87
LinkedIn.com		32
Facebook.com		23
Twitter.com		6
NK.pl		4
Other		19

Source: own study.

According to the previously mentioned study 51% of surveyed companies have already decided on the activity on social networking sites, promoting their business, informing about the inner life of the company, posting announcements, or looking for workers. The power of the Internet is also stressed by the fact that 78% of respondents would not accept a job offer from a company which has a bad reputation in the Internet.

**Table 8. Do you think social media recruitment will replace other recruitment methods?**

Yes	3%
No	93%
Difficult to say	4%

Source: own study.

However, as table 7 illustrates 93% of the respondents do not believe that recruitment through social media will replace other recruitment methods. D. Lewicka notes that Polish recruitment specialists believe that it is the best to start the job search from the Internet. Internet provides both the employee and the employer almost unlimited access to information about the advertisement [Lewicka 2010]. What is more, social media isn't for everyone. 94% of the respondents believe there is number of limitations associated with its use for recruitment.

Of course there are some quick gains; nevertheless using this method particularly at the executive level can lead to missing out the relationship building and the selection and assessment of individuals, which, if overlooked, can undermine the recruitment process overall.

Social media imposes few rules for recruitment agencies, which may include:

1. Transparency of activities. Any activity in the field of recruitment in social media should not leave behind any doubts.
2. HR principles in social media are not related only to this area of the business. These "social" approach in the recruitment should result of business thinking version 2.0.
3. HR builds the image of the company. Employer branding in Web 2.0. is inextricably linked with the previous point, which relates to the same philosophy. It is impossible to conduct recruitment via social media if the company does not have a strong social media presence and understanding.
4. Viral sharing. Ads shall be designed in such a way they it is easy to share them with other users via social media like Facebooka, Google+ or Twitter.

### **Limitations**

This study covers a broad range of topics including human resource management, recruitment as well as social media. It was therefore necessary to give just a general insight into each of these areas. This article does not cover the whole range of activities performed by the recruitment managers and specialists from human resources departments in organizations nor does it analyze the outsourcing of these activities. Social media was introduced although its broader uses and implications were not further examined.

### **Summary**

Recruiting the best candidates is critical to any company's success and it's organizational culture [see Sułkowski 2012] today and many exciting tools have been created to help them find and source the key talent.

In the past, there was always a question of the value of social media in recruitment processes, but based on this research, it is clear that recruiter be-

lieve social recruiting is a very helpful method. Social media allows recruiters to find more job candidates than ever before. As a result, recruiters say that social media recruiting improved both the quantity and quality of candidates. It's also much easier to share jobs through social networks because employees can refer jobs to their own networks. It is worth stressing that recruiters review more and more often candidates' social profiles in non-professional SNSs in the hiring process, the content on these profiles could make or break a candidate's chances.

On the one hand social media made the recruitment process more open and democratic on the other leaves open door for unethical practices. The research shows using this method alone takes the 'personal touch' out of relationship building and candidate identification and that it is unlikely to completely replace the traditional recruitment methods in the near future.

Social media is being taken more and more seriously by the recruiters. Increasing number of employers are taking advantage of this growing trend by adapting and supplementing traditional recruitment processes with social media-based methods, therefore it's important for job candidates to pay more attention to how they use it. As more employers begin to use these outlets, recruiting methods will continue to transform.

## Bibliography

Comm J. (2009), *Twitter power: How to dominate your market one tweet at a time*, Hoboken, NJ: John Wiley & Sons.

Compton R.-L., Morrissey W., Nankervis A. (2009), *Effective Recruitment and Selection Practices*, 5th edition. Australia: CCH Australia Limited.

Emerald Group Publishing Limited (2009), *HR's time machine trip to top jobs – Evolving role makes department central to success*, *Strategic Direction*, Vol. 25, No. 8, pp. 6–9.

*Emploer Branding Institute*, [www.ebinstitute.pl](http://www.ebinstitute.pl) 23.03.2013.

Lewicka D. (2010), *Zarządzanie kapitałem ludzkimi w polskich przedsiębiorstwach. Metody, narzędzia, mierniki*, PWN, Warszawa, p. 101.

Safko L., Brake D K. (2009), *The social media bible: Tactics, tools & strategies for business success*, Hoboken, NJ: John Wiley & Sons., p.6.

Palmer A., Koenig-Lewis N. (2009), *An experiential, social network-based approach to direct marketing*, 'International Journal Of Direct Marketing', Vol. 3. No. 3, p. 162.

Parry E., Wilson H. (2009), *Factors influencing the adoption of onlinerecruitment*, 'Personnel Review', Vol. 38, No. 6, pp. 655–673.

Sułkowski Ł. (2012), *Kulturowe procesy zarządzania*, Diffin, Warszawa.

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Trebnick C. (2008), *Social media market dynamics and impact on communications infrastructure*, Americas Growth Capital.

Universal McCann (2009), *Power to the people: Social media tracker wave 4*. Retrieved from <http://universalmccann.bitecp.com/wave4/Wave4.pdf> p. 10., 11.02.2013.

Weinberg T. (2009), *The new community rules: Marketing on the social web*. Sebastopol, CA: O'Reilly Media, Inc. p.1.

Zarrella D. (2010), *The social media marketing book*, Sebastopol, CA: O'Reilly Media, Inc.



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## New system of employment forecasting in Poland

**Abstract:** The goal of the paper was to describe the system of employment forecasting in Poland and to present forecasts results. The paper described the main assumptions and elements of the system of employment forecasting (the structure of econometric models and on-line forecasting tool). It also elaborated on employment forecasts at national, regional and occupational levels. The analysis of forecasts enabled drawing some conclusions, important from the point of view of the perspectives of the Polish labour market and the labour market policy.

**Key words:** employment forecasting, occupations, econometric modelling, Polish labour market, regional disparities.

### Introduction

Demographic forecasts for Poland clearly indicate that two negative trends, from the point of view of labour market, will take place – first, the decline in the total number of population (by 2035 it will decrease, as compared to 2007, by 5.6%), and second, the processes of rapid aging of population. According to the forecasts by the Polish Central Statistical Office, there is no doubt that by 2035 we will witness a significant loss of working-age population (projected at 3.8 million people), with simultaneous increase of share of people in no-mobile age in the working age population (from 37.8% in 2007 to 47.2% in 2035) [CSO 2009]<sup>6</sup>.

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<sup>6</sup> Similar conclusions stem from predictions based on the SYSDM 2.0 model, described in detail in [Bukowski (ed.) 2010]. The population of people in non-mobile age is defined as those aged 45-59 years for women and 45-64 for men (age range in this definition will probably change as a result of retirement age raise in Poland, that is to be 67 years for men in 2020, and the same for women in 2040). This group is characterised by a low propensity for occupational, education and spatial mobility, which results in lower employability on the rapidly changing labour market.

Demographic forecasts point out that in the long run labour force in Poland will decrease. So, important issue connected with this fact is how it influences labour market equilibrium – if unemployment rate will decrease, increase, or stabilize at some level; in which occupations it will be easy to find a job, and in which occupations finding a job will be extremely hard? To address this issue, it is necessary to have forecasts of developments of the demand side of the labour market. Although the system of forecasting labour demand is, in many EU countries, an important element of the institutional framework and is used as instrument to promote socio-economic policies (in particular, labour market policies), in Poland, such a system have not yet existed, although attempts to create it had already been taken.

Setting up a system for forecasting labour demand in Poland is a challenge but, at the same time, a necessity. The concept of introducing such a system was initiated in 2011 by launching a Task *Establishing the integrated forecasting and information system providing employment forecasts* within an EU funded project *Analysis of the processes on the Polish labour market and in the area of social integration in the context of conducted economic policy*. The project conducted by the Human Resource Development Centre (Leader) and the Institute of Labour and Social Studies (Partner) has aimed to implement an integrated system of employment forecasting in Poland by 2014. Although it is not yet a system that forecasts labour demand, it should be seen as a milestone in setting up this kind of measure in the coming years.

Comparison of demographic projections (labour supply) with forecasts of labour demand (in different cross-sections) enables to determine the scale and nature of the imbalance on the labour market in the future, identifying those areas (such as groups of occupations, the types of skills and knowledge) in which there will be excess supply of labour (resulting in unemployment) or labour supply shortages<sup>7</sup>. On this basis, policy makers will be able to take reasonable steps in order to reduce the scale of these imbalances. The labour market and education policy (in Poland, active labour market policies and system of lifelong learning are the two most important pillars of flexicurity) with the use of specific tools can help to „transfer” labour surplus to areas of labour shortages. Labour demand forecasts should also allow to take informed decisions on migration policy, in a situation where balancing the labour market through the national labour force may be impossible. It is clearly seen, that creation of the system of forecasting labour demand is essential to cope with the challenges faced by Poland in the near future. This argument has been strengthened by research studies results showing that the lack of medium and long-term labour

<sup>7</sup> The problem of skills mismatch at European Union level has been raised in particular in the framework of the initiative New skills for new jobs [see *New Skills for New Jobs*, 2008]. It should also be noted that to achieve the employment goals defined in the strategy Europe 2020, it is necessary to keep people in non-mobile age economically active as long as possible. It requires, in many cases, adaptation of the competences (and sometimes full re-training) of these people to the employers' needs - here the role of the system of forecasting labour demand is undeniable.

demand forecasts by regions and professions cannot be compensated for even the best system of on-going monitoring of deficit and surplus professions carried out by labour offices [Kryńska (ed.) 2007, p. 230].

The goal of the paper is to describe the system of employment forecasting in Poland and to present forecasts results for Poland, Polish regions and selected minor occupational groups. These forecasts results enable to verify the research hypothesis saying that Polish labour market will follow the trend of structural change favouring highly-skilled labour force and growing labour market polarisation [see Acemoglu and Autor 2011, pp. 1070–1096].

### **New system of employment forecasting in Poland**

It has been assumed that a new Polish system of employment forecasting should be based on foreign expertise and learn as much as possible from the experience of other EU Member States that have been developing their forecasting system for many years. Basically, we would like to take advantage of a leapfrog opportunity by implementing up-to-date developments in econometric modelling and management of the forecasting process, including methods of making the results available to the public<sup>8</sup>.

The general recommendations stemming from analysed best EU practices are following [Arendt, Ulrichs (eds.) 2010, p. 8]:

- Setting up a well-organised forecasting system is a process that takes time and requires substantial investment;
- The issues common to all forecasting systems are data availability and inconsistency of time series caused by changes in statistical classifications;
- Although it is impossible to predict future (all forecasts are imperfect), the quality of forecasts should be evaluated in terms of their usefulness to different stakeholders;
- The most successful forecast is the one that addresses and influences specific target groups (especially policy makers) to undertake specific measures in order to avoid projected negative changes. In this sense, we should wish that forecasts will ‘destroy themselves’;
- To forecast demand for labour it is necessary to include in the model different types of demand, such as expansion demand and replacement demand in order to make projection on the number of job openings;
- As some international experiences show, the major impact on the labour market up to 2020 is expected to be related to changes in replacement demand, while expansion demand is projected to be rather moderate;

<sup>8</sup> Description of systems of forecasting labour demand in EU and non-EU countries are available in: [Heijke (ed), 1994], [Neugart, Schomann (eds) 2002], [CEDEFOP 2009], [Helmrich, Zika (eds) 2010], [ROA 2011], [CEDEFOP 2012], [Arendt, Ulrichs (eds) 2010], [Capellen, Gjeffen, Gjelsvik, Holm, Stolen 2013].

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- Well-established systems of forecasting demand for labour should be based on an integrated approach in which demand and supply-side of the labour market are modelled within one framework.

Those recommendations, as well as specific measures, were taken into account while creating a new Polish system of employment forecasting, that is based on the following characteristics:

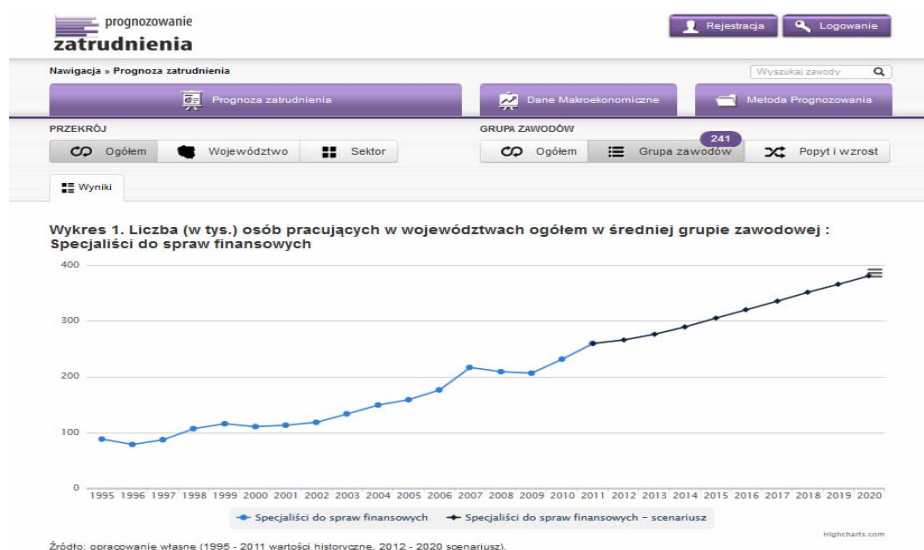
- the core of the system are the econometric models - the results generated by these models are subject to revision by experts, and only the adjusted forecasts are entered into the forecasting system,
- the forecast horizon is 2020,
- forecasts are generated in three cross-sections:
  - the occupational groups, according to the Polish Classification of Occupations and Specializations for the labour market needs 2010<sup>9</sup> at the level of minor groups (three-digit codes),
  - economic sectors (according PKD2007<sup>10</sup> broken down into: agriculture, industry, market services and non-market services),
  - the NUTS II statistical areas,
- the main recipient of the forecasts are public employment services. Forecasts are intended to provide a reference point for labour market policy at the national, regional and even local level<sup>11</sup>.

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<sup>9</sup> This Polish classification is coherent and comparable with ISCO-08 classification.

<sup>10</sup> The Polish Classification of Activities (PKD2007) is coherent and comparable with the clarification NACE Revision 2.

<sup>11</sup> However, the on-line forecasting tool is supposed to be used by the young people who are about to decide what career path to choose, and other groups of stakeholders who should also benefit from it (i.e. labour market institutions, educational institutions, employers, employees, etc.).

**Figure 1. Screenshot of the on-line forecasting tool\***

Source: [www.prognozowaniezatrudnienia.pl](http://www.prognozowaniezatrudnienia.pl).

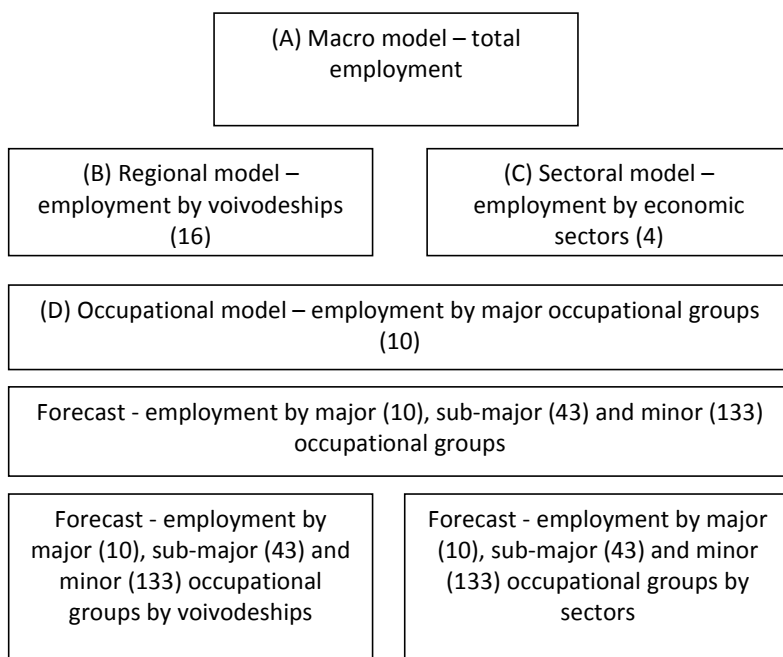
\* The screenshot shows the forecast for the minor occupational group 241 (Finance professionals) for Poland.

The system of employment forecasting consists of two main elements:

- infrastructure of the econometric models which generate employment forecast, and
- on-line forecasting tool that provides a graphical interface through which the user of the system will be able to download the results of the forecasts. Forecasting tool (in Polish) is available on the website [www.prognozowaniezatrudnienia.pl](http://www.prognozowaniezatrudnienia.pl) (Figure 1).

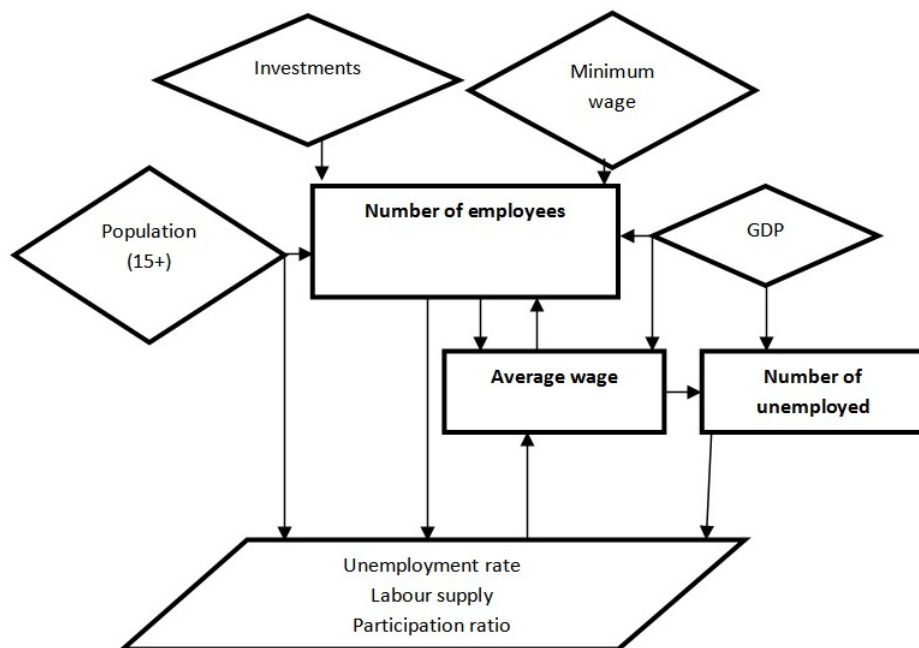
The forecasting methodology is built on models of the demand side of the labour market, with the control from the supply side (population, labour force participation). The flexibility of econometric models is provided by their hierarchical structure and the possibility of expert adjustments at each stage of modelling and forecasting.

Employment forecasts at the national level are developed through the use of a hierarchical approach to econometric modelling, with ensuring consistency of the forecasts at every level of disaggregation (for each cross-section) (see Figure 2).

**Figure 2. Structure of the econometric forecasting model**

Source: Kwiatkowski et. al. 2001, p. 76.

Global (POLMOD 2013) model (A), which is a multi-equation econometric model, generates an overall employment forecast. The model consists of two sub-models: macroeconomic model and model of the labour market. The macro-model takes into account interactions among incomes, consumption, capital accumulation, investments, export, import, added value and yields GDP and final domestic demand values. The sub-model of labour market is based on 5 stochastic equations (number of employees, number of workers, average wage, number of unemployed, number of job offers) and 4 identity equations. Interactions in the sub-model of labour market are presented on the Figure 3.

**Figure 3. Interactions in the sub-model of labour market**

Source: Ł. Arendt, A. Gajdos, *Labour demand forecasting in Poland – a new approach, presentation on the Conference Long-term labour market forecasting in Europe*, Nuremberg 24-25 October 2013.

Global model by regions (B) (that includes spatial interactions) and a global model by sectors (C) (multi-equation panel data model) allow to forecast independently the number of employees at, respectively, spatial and sectoral level, taking into account the forecasts from the global model (A). Regional model (B) is a multi-equation recurrence model that estimates (using SUR methodology) GDP in each region and then, with the use of Seemingly Unrelated Regression Equations system with spatial interactions, yields employment number in a given region. The sectoral model (C) is based on modified Cobb-Douglas production function – it consists of long-run employment functions for a given economic sector. The total number of employees in a given region or economic sector is then split by the occupational (cause and effect model) model (D) into major, sub-major and minor occupational groups<sup>12</sup>.

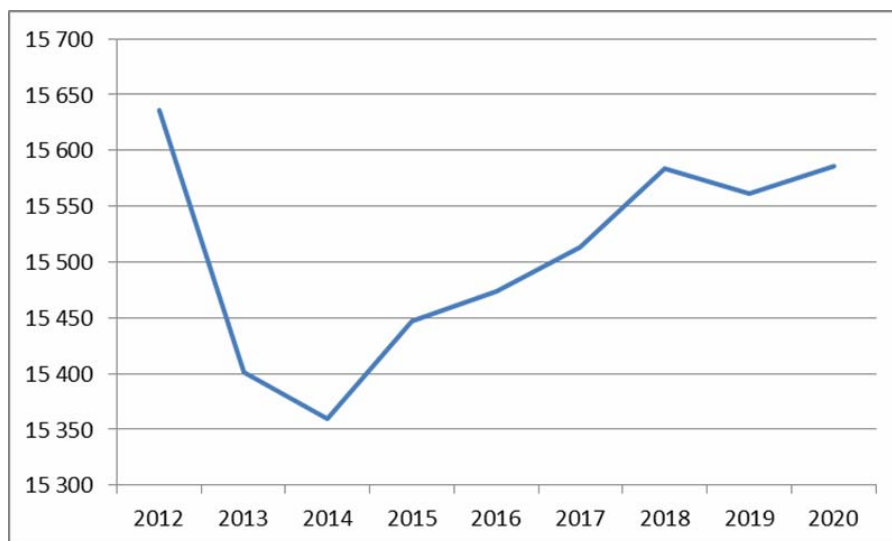
<sup>12</sup> The new approach to forecasting employment in Poland is consistent with the modern labour market forecasting systems existing in developed economies (see e.g.). All of those systems are based on macro-modelling framework combined with labour market sub-models which generate employment

### Employment perspectives in Poland to 2020

The analysis of employment forecasts generated by the system shows that at the aggregated level, changes in the employment numbers will be moderate. However, significant differences in the development paths are noticeable by regions, and, especially, by occupational groups.

By 2020 Poland should witness a slight decrease in employment – employment will fall between 2012 and 2020 by 0.32%, from 15636 ths to 15587.7 ths people.

**Figure 3. Employment in Poland – forecast 2012-2020**



**Source: forecast results database.**

However, as presented in Figure 3, Polish economy will suffer from a sharp decline of employment between 2012 and 2014, which may be attributed to the long-lasting effects of the world economic crisis that began in 2008 in the U.S. It is predicted that from 2015 to 2018 employment will recover, followed then by slight changes and stabilisation till 2020.

This fall in employment will be distributed unevenly between regions. In eight Polish regions the number of employees should rise:

- in Dolnoslaskie region by 4.2% (from 1092.9 ths in 2012 to 1138.7 ths people in 2020);

forecasts at occupational, regional and sectoral level. However, it should be stated that Polish system of labour market forecasting should be continuously developed in order to introduce such features, that already exist in other countries, as forecasting expansion demand (see e.g. [Cörvers, Dupuy 2010], replacement demand (see e.g. [Fox, Cornerford 2008]), analysis of future labour demand by educational level (see e.g. [Wilson 2013]), by age groups (see e.g. [Hyndman, Booth 2008]), and integration of demand and supply-side of the labour market within one modelling framework.

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- in Pomorskie region also by 4.2% (from 929.9 ths in 2012 to 968.7 ths people in 2020);
  - in Slaskie region by 3.9 % (from 1912.9 ths in 2012 to 1986.6 ths people in 2020);
  - in Mazowieckie region by 3.3% (from 2426.8 ths in 2012 to 2505.7 ths people in 2020);
  - in Lubelskie region by 3.1% (from 923.9 ths in 2012 to 952.2 ths persons in 2020);
  - in Świętokrzyskie region by 2.2% (from 569 ths in 2012 to 581.7 ths people in 2020);
  - in Warmia and Mazury region by 2.1% (from 515 in 2012 to 525.8 ths persons in 2020);
  - in Wielkopolskie region by 0.5% (from 1361.9 ths in 2012 to 1369.4 persons in 2020).

At the same time, the number of employees should decline in other eight Polish regions:

- in Lubuskie region by 13.5% (from 410 ths in 2012 to 354.6 ths persons in 2020);
- in Podlaskie region by 13.1% (from 458 ths in 2012 to 397.9 ths persons in 2020);
- in Opolskie region by 7.9% (from 355 ths in 2012 to 326.8 ths persons in 2020);
- in Zachodniopomorskie region also by 7.9% (from 574 ths in 2012 to 528.5 ths people in 2020);
- in Podkarpackie region by 4.9% (from 809.9 ths in 2012 to 769.9 ths persons in 2020);
- in Kujawsko-pomorskie region by 4.8% (from 778 ths in 2012 to 740.6 ths people in 2020);
- in Malopolskie region by 4.7% (from 1310.9 ths in 2012 to 1249.3 ths persons in 2020);
- in Lodzkie region by 1.5% (from 1207.9 ths in 2012 to 1189.3 ths people in 2020).

The data shows that the huge gap will arise between best performing regions (eg Dolnoslaskie and Pomorskie) which will strengthen their competitive advantages, and worst performing regions (eg. Lubuskie and Podlaskie), in which situation on the labour market is going to deteriorate.

From the point of view of labour market, as well as lifelong learning policies, it is important to foresee the directions and scale of changes in the em-

ployment levels by occupational groups. Having this knowledge, policy makers and institutions responsible for conducting these policies, may programme and undertake steps aiming at balancing the labour market in the future. This information is also important for young people, because it helps in taking educational choices that would maximise the youth employability at the end of their educational path.

Hence, in this section of the paper we will analyse the forecast results in order to point occupational groups with highest dynamics (as for increase and decline) between 2012 and 2020, and groups with highest and lowest employment level in 2020.

The biggest increase in labour demand should take place in the 2<sup>nd</sup> major group “Professionals” (see Table 1). Analysis of data confirms the international trends related to development of information society and growing importance of Information and Communication Technologies for economy’s performance – the biggest rise in number of employees (by almost 60%!!!) is forecasted in the minor group of professionals employed in IT branch – exactly the software and applications developers and analysts as well as database and network professionals (Table 1).

**Table 1. 10 minor occupational groups with highest increase in employment (in ths)**

Minor group	Year									Increase (in %)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Software and applications developers and analysts; Database and network professionals	181.8	191.7	203.7	217.7	231.1	244.9	259.3	272.4	286.3	57.5
Administration professionals; Sales, marketing and public relations professionals	389.4	405.1	425.2	449.3	472.0	495.3	519.8	541.5	564.8	45.1
Finance professionals	265.9	276.0	289.2	305.0	319.9	335.2	351.3	365.5	380.7	43.2
Physical and earth science professionals; Mathematicians, actuaries and statisticians	23.5	24.4	25.5	26.8	28.1	29.4	30.7	31.9	33.2	41.2
Vocational education teachers	21.1	21.8	22.7	23.8	24.9	25.9	27.1	28.0	29.1	37.5
Electrotechnology engineers	54.2	55.8	58.0	60.7	63.2	65.8	68.5	70.8	73.4	35.4
Social and religious professionals	80.4	82.6	85.7	89.6	93.1	96.8	100.6	103.9	107.5	33.6
Life science professionals	46.4	47.6	49.3	51.5	53.5	55.5	57.7	59.5	61.6	32.7
Engineering professionals (excluding electrotechnology)	197.3	202.3	209.5	218.6	226.9	235.4	244.4	252.1	260.4	32.0
Architects, planners, surveyors and designers	91.5	93.7	97.0	101.0	104.8	108.6	112.6	116.1	119.8	30.9

Source: forecast results.

High increases are also reported in occupations that require technical knowledge and education (e.g. physical and earth science professionals, mathematicians, actuaries and statisticians, engineering professionals, electro-technology engineers, architects, planners, surveyors and designers). Growing importance of specific vocational skills, instead of universal skills, is confirmed by relatively high raise in number of vocational education teachers on the labour market in 2020. Financial knowledge and managerial skills also seem to be in a high demand.

The biggest decrease of labour demand is concentrated within two major occupational groups: skilled agricultural, forestry and fishery workers, and craft and related trades workers (see Table 2). These results reaffirm two phenomena. The first phenomenon is connected with the fact that changes in the sectoral structure of the Polish economy have led to decline of the role of agriculture and growing importance of services and manufacturing sectors. This, in turn, affects the employment structure, which is going to be more and more modern – that means higher employment in service sector and shrinking number of employees in agriculture. The other phenomenon is related to skill-biased technological change that favours highly skilled professionals – technology is replacing human resources in simple operations that may be automated. Thus, demand for low-skilled employees performing simple tasks is going to fall by 2020, which is clearly seen in Table 2.

**Table 2. 10 minor occupational groups with highest decrease in employment (in ths)**

Minor group	Year									Decrease (in %)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Other elementary workers	97.1	93.0	90.1	87.8	85.2	82.7	80.4	77.7	75.2	<b>22.6</b>
Wood treaters, cabinet-makers and related trades workers	152.2	141.4	134.8	130.8	124.8	123.0	121.8	118.8	116.7	<b>23.3</b>
Machinery mechanics and repairers	216.4	203.8	196.9	193.8	187.7	181.8	176.7	169.2	163.2	<b>24.6</b>
Food processing and related trades workers	160.5	150.4	144.6	141.7	136.5	131.4	127.1	121.0	115.9	<b>27.8</b>
Subsistence farmers, fishers, hunters and gatherers	234.0	221.9	212.6	205.1	197.6	190.4	183.4	175.6	168.2	<b>28.1</b>
Garment and related trades workers; Other craft and related workers	202.8	181.8	166.6	154.7	152.5	150.3	148.8	145.1	142.6	<b>29.7</b>
Printing trades workers	41.6	37.1	33.8	31.2	30.7	30.3	30.0	29.2	28.7	<b>31.0</b>
Mixed crop and animal producers	1051.1	991.4	944.8	906.2	868.0	830.9	795.7	756.7	720.3	<b>31.5</b>
Handicraft workers	44.3	41.2	39.4	38.3	36.6	34.9	33.5	31.6	29.9	<b>32.4</b>
Painters, building structure cleaners and related trades workers	104.8	97.4	92.8	90.0	85.9	81.8	78.2	73.6	69.6	<b>33.6</b>

Source: forecast results.

Changes in employment, described in Table 1 and 2, show the tendencies on the Polish labour market till 2020. However, it is important to take into account not only dynamics but also the levels of employment, as they constitute those occupational groups in which demand for labour, in absolute terms, will be biggest (Table 3) or lowest (Table 4) in 2020.

The forecast shows that Polish economy will need almost 1.4 million salespersons in 2020 to fulfil the market demand (Table 3). This is the only minor group in which number of employees exceeds 1 million. The other groups on the “top 10” list will generate perceptible smaller employment levels, with only three groups above 0.5 million: mixed crop and animal producers, administration professionals and heavy truck and bus drivers. Some of the minor groups that are listed in Table 3 are also present in the Table 1 (administration professionals, sales, marketing and public relations professionals; finance professionals), which reaffirms the conclusion that these occupational groups are of growing importance for the Polish economy. In some cases (mixed crop and animal producers; building finishers and related trades workers; domestic, hotel and office cleaners and helpers, food preparation assistants; and building frame and related trades workers) in spite of falling number of employees between 2012 and 2020, these groups should still maintain their high position as for labour demand.

**Table 3. 10 minor occupational groups with highest employment in 2020 (in ths)**

Minor group	Year								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
Shop salespersons; Street and market salespersons; Other sales workers	1302.8	1301.6	1309.2	1322.3	1332.5	1343.1	1356.1	1365.2	<b>1376.1</b>
Mixed crop and animal producers	1051.1	991.4	944.8	906.2	868.0	830.9	795.7	756.7	<b>720.3</b>
Administration professionals; Sales, marketing and public relations professionals	389.4	405.1	425.2	449.3	472.0	495.3	519.8	541.5	<b>564.8</b>
Heavy truck and bus drivers	471.7	470.5	474.7	482.5	488.7	496.7	505.7	511.9	<b>519.5</b>
Finance professionals	265.9	276.0	289.2	305.0	319.9	335.2	351.3	365.5	<b>380.7</b>
Building finishers and related trades workers	397.6	382.2	377.3	379.5	375.6	371.7	369.6	362.0	<b>357.2</b>
Financial and mathematical associate professionals	344.4	343.6	344.8	347.2	348.9	350.5	352.4	353.2	<b>354.5</b>
Domestic, hotel and office cleaners and helpers; Food preparation assistants	382.8	373.3	368.0	365.3	361.4	357.8	354.9	350.2	<b>346.5</b>
Protective services workers	316.6	317.5	320.5	324.9	328.6	332.4	336.8	340.2	<b>344.2</b>
Building frame and related trades workers	347.9	336.3	333.7	337.4	335.8	334.0	333.8	328.6	<b>325.8</b>

Source: forecast results.

Finally, there are minor occupational groups which share in the total employment is small – the 10 minor groups with the lowest employment level

(Table 4), according to the forecasts, will account only for 137.7 ths of employees in 2020 (that is only 10% of the number of shop salespersons, which is the group of the highest demand). However, it does not mean that these minor groups are insignificant for the Polish labour market. Within these 10 groups there are, for example, legislators and senior officials, who play important role in policy making and its implementation, or ship and aircraft controllers and technicians, who are responsible for security measures. Moreover, in case of veterinarians, their number is forecasted to increase by 20.3% between 2012 and 2020, while the number of telecommunications and broadcasting technicians; and nursing and midwifery associate professionals should raise by, respectively, 9.3% and 8.8%.

**Table 4. 10 minor occupational groups with lowest employment in 2020 (in ths)**

Minor group	Year								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
Telecommunications and broadcasting technicians	17.0	17.1	17.3	17.6	17.8	18.0	18.3	18.4	<b>18.6</b>
Commissioned armed forces officers	21.0	20.4	19.9	19.6	19.2	18.8	18.5	18.1	<b>17.8</b>
Sports and fitness workers	18.7	18.4	18.2	18.0	17.9	17.7	17.5	17.3	<b>17.2</b>
Legislators and senior officials	16.9	16.7	16.6	16.7	16.7	16.8	16.9	16.8	<b>16.9</b>
Veterinarians	13.0	13.1	13.4	13.9	14.2	14.6	15.0	15.3	<b>15.6</b>
Nursing and midwifery associate professionals; Traditional and complementary medicine associate professionals; Veterinary technicians and assistants	11.9	11.9	12.1	12.2	12.4	12.5	12.7	12.8	<b>12.9</b>
Travel attendants, conductors and guides	14.3	14.0	13.8	13.6	13.5	13.3	13.2	13.0	<b>12.8</b>
Librarians, archivists and curators	12.2	12.1	12.1	12.2	12.2	12.2	12.2	12.2	<b>12.2</b>
Ship and aircraft controllers and technicians	8.9	8.9	8.9	9.0	9.0	9.0	9.1	9.1	<b>9.1</b>
Street vendors (excluding food); Street and related service workers	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.6	<b>4.6</b>

Source: forecast results.

## Conclusions

An important element of the institutional framework of the labour market in the modern economies is a system of anticipating skills needs. Usually, such a system is focused on projecting and forecasting demand for labour by occupation and with regard to some other dimensions (i.e. industries, qualifica-

tions, etc.). Information provided by this system is of a great importance for policy makers, and also for other labour market actors, as it helps to counteract future mismatches between qualification requirements and formal and informal qualifications acquired by individuals. In other words, the system of forecasting skills needs helps to balance the labour market in a short and medium term. The importance of such a system is confirmed by the fact that at the European Union level, CEDEFOP has been conducting for years many projects on forecasting labour demand and skills demand in the EU. At the same time, it is assumed that every EU Member State has set up its own system for forecasting labour demand.

The paper described the system of the employment forecasting that has been implemented in Poland within the framework of an EU funded project *Analysis of the processes on the Polish labour market and in the area of social integration in the context of conducted economic policy*, Task 2 *Establishing the integrated forecasting and information system providing employment forecasts*. It presented the main assumptions and elements of the system (the structure of econometric models and on-line forecasting tool) that should be fully operable till October 2014. The paper also elaborated on employment forecasts at national, regional and occupational levels. The analysis of forecasts enabled to draw some conclusions, important from the point of view of the perspectives of the Polish labour market and the labour market policy.

Firstly, employment in Poland will slightly decrease between 2012 and 2020, with rapid decline to 2014, and then continuous recovery to 2018.

Secondly, there will be large differences between regions in employment dynamics - in Dolnoslaskie and Pomorskie regions employment will raise by 4.2%, while in Lubuskie and Podlaskie region will fall by, respectively, 13.5% and 13.1%.

Thirdly, forecasts reaffirm changes in the employment structure (sectoral as well as occupational). This confirms the research hypothesis defined in this paper - decreasing demand for workers in the agriculture sector will be complemented by increasing demand for workers in the service sector. The fastest growing occupational groups will be these in which high skills are required. At the same time, demand for low-skilled workers will continuously decline. It means, that changes on the Polish labour market should follow development paths similar to these in highly developed economies.

## References

Acemoglu D., Autor D. (2011), *Skills, Tasks and Technologies: Implications for Employment and Earning* [in] O. Ashenfelter, D. Card (eds), *Handbook of Labour Economics*, Vol. 4B, Elsevier, Amsterdam, pp. 1043–1171.

- Arendt Ł., Ulrichs M. (eds) (2012), *Best practices in forecasting labour demand in Europe*, Instytut Pracy i Spraw Socjalnych, Warsaw.
- Bukowski M. (ed.) (2010), *Employment in Poland 2008. Work over the life course*, Human Resources Development Centre, Warsaw.
- Capellen A., Gjefsen H., Gjelsvik M., Holm I., Stolen N.M. (2013), *Forecasting demand and supply of labour by education*, Statistics Norway, Oslo.
- Cörvers F., Dupuy A. (2010), *Estimating Employment Dynamics across Occupations and Sectors of Industries*, „Journal of Macroeconomics”, vol. 32, issue 1, pp. 17–27.
- De arbeidsmarkt naar opleiding en beroep tot 2016* (2011), Researchcentrum voor Onderwijs en Arbeidsmarkt, Maastricht University, School of Business and Economics, Maastricht.
- Future skills needs in Europe: medium-term forecast. Background technical report* (2009), CEDEFOP, Luxembourg: Publications Office of the European Union.
- Future skills supply and demand in Europe. Forecast 2012* (2012), CEDEFOP, Luxembourg: Publications Office of the European Union.
- Heijke H. (ed.) (1994), *Forecasting the Labour Market by Occupation and Education*, Springer Science+Business Media, New York.
- Helmrich R., Zika G. (eds) (2010), *Beruf und Arbeit in der Zukunft – BIBB-IAB-Modellrechnungen zu den Entwicklungen in den Berufsfeldern und Qualifikationen bis 2025*, W. Bertelsmann Verlag, Bielefeld.
- Hyndman R. J., Booth H. (2008), *Stochastic population forecasts using functional data models for mortality, fertility and migration*, „International Journal of Forecasting”, vol. 24, Issue 3, pp. 323–342.
- Kryńska E. (2007), *Podstawy konstrukcji modelu systemu zmniejszania niedostosowań strukturalnych podaży pracy i popytu na pracę w województwie mazowieckim* [in] E. Kryńska (ed.), *Regionalny system koordynacji rynku pracy województwa mazowieckiego PRACA-ZATRUDNIENIE-SZKOLENIE. Syntezy wyników badań i rekomendacje*, Tom II, Instytut Organizacji i Zarządzania w Przemśle i Instytut Pracy i Spraw Socjalnych, Warszawa.
- Kwiatkowski E., Kwiatkowska W., Gajdos A. (2011), *Stworzenie koncepcji modeli prognoz zatrudnienia według zawodów dla wybranego województwa*, mimeo, Instytut Pracy i Spraw Socjalnych, Warszawa.
- Neugart M., Schomann K. (eds) (2002), *Forecasting labour markets in OECD countries. Measuring and tackling mismatches*, Edward Elgar, Cheltenham, Northampton.
- New Skills for New Jobs. Anticipating and matching labour market and skills needs, Communication from the Commission*, COM(2008) 868, 16 December 2008.

---

*Prognoza ludności na lata 2008-2035* (2009), Główny Urząd Statystyczny, Warszawa.

Fox R., Cornerford B. (2008), *Estimating replacement demand: lessons from Ireland*, „International Journal of Manpower”, vol. 29, Issue 4, pp. 348–361.

Wilson R. (2013), *Skills anticipation – The future of work and education*, „International Journal of Educational Research”, vol. 61, pp. 101–110.

# **Methods and tools used in contemporary management organizations**



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## **Competitive factors for microenterprises in the process of marketing and logistic management based on the Kuyavian-Pomeranian Voivodeship**

“Small business is not a little big business” [Welsh, White 1981, p. 25]

**Abstract:** Upon accession to the European Union, the SME sector in Poland found itself in a much more difficult situation than that of similar enterprises which had operated in the EU for years. New phenomena have occurred in this environment, including globalization, with not only its economic dimension, but also structural and functional ones, which comprehensively affects all fields of enterprises' operations. Growth of competitiveness of SMEs, in particular of microenterprises, is a very interesting aspect and questions arise as to possible new methods of management which could help achieve this goal. This article presents the author's own research on SMEs in the Kuyavian-Pomeranian Voivodeship from the perspective of competitive factors in the management process. The factors of chief significance to growth and development are presented as exemplified by marketing and logistic management process in a microenterprise.

**Key-words:** SMEs, competitive factors, growth.

### **Introduction**

Management of a microenterprise differs from that of a large one, and frequently it proves impossible to employ the same management methods in both. One of the contemporary methods of management in large enterprises is the integrated marketing and logistic method [Matwiejczuk 2006, p. 29]. In the context of the resources available to microenterprises, this method is applied

in all areas of operations, and marketing and logistic instruments are used. Marketing measures – the 4 P's and the logistic-mix are employed to create customer satisfaction. The questionnaire survey was conducted in 69 micro, small and medium enterprises in the Kuyavian-Pomeranian region. The aim of the research was to identify the competitive factors in marketing and logistic management. The results of this research can serve as an example of measures seeking to create a marketing strategy for a microenterprise.

### **Previous research on the SME sector**

The purpose of research on the SME sector is to follow phenomena and processes occurring in the sector in order to expand our knowledge of the enterprises and to recognize long-term trends [Dominiak 2005, p. 9]. The growing role of SMEs in the economy requires that we comprehend the importance of particular properties and manifestations of activity. Expert knowledge of SMEs is multidisciplinary and covers a wide range of issues regarding the operation and development of enterprises. Dominiak observed that a new SME science discipline is arising, one based on research, comparative analysis, and closely connected with research on entrepreneurship. Research on SMEs, both in Europe and in the US, dates back to 1980s. The beginning of this research in Poland coincides with the transformation phase, and at present focuses on the following aspects:

- Inter-systemic aspect;
- international comparison;
- intercultural comparison;
- comparison between different regions of the same country or different groups of countries;
- inter-sectoral aspect;
- intra-sectoral aspect with regards to micro, small and medium enterprises;
- dynamics of development.

Typology presented by Dominiak is derived from the European research and points to significant differences in and problems with comparing enterprises within the sector, defining of the same and selecting appropriate measures and research criteria [Dominiak 2005, p. 27].

On the basis of the EU systematic, which classifies SMEs based on the number of employees, we can distinguish three groups:

- Microenterprises – with up to 9 employees;
- Small enterprises – with 10 to 49 employees;
- Medium enterprises – with 50 to 249 employees.

With such vast differences between actual employment numbers, the ques-

tions arises whether it is possible to apply the same model of management? The other problem is that of what elements of the management system could be of particular significance to those three types of enterprises making up the SME sector. Bieniok presented the characteristic methods of SMEs management [Bieniok 2003], which are based on their limited resources and correspond to the size of the given enterprise.

The limited resources of a microenterprise do not allow it to copy the strategies applied by large enterprises, such as price strategy or technical innovation strategy. The strengths of SMEs are their flexibility, quick adaptation to the changing environment and ability to establish individual relations with customers, but due to their limited resources SMEs would not be able to follow a strategy of low prices or aggressive promotion. Kamińska researched the SMEs' effectiveness vis a vis the economy of the region, focusing on effectiveness analysis [Kamińska 2013, p. 214], and demonstrated that the cluster strategy is one of the methods with which an enterprise can succeed on the market with certain assistance by local administration. Research by the Private Employers Association "Lewiatan" indicated that the strategies most frequently employed by SMEs are based on experience, tradition, specialization or the niche strategy [Starczewska-Krzysztosek 2008]. Strużycki expressed the opinion that achievement of a specific position on the market requires long-term targeted actions, including improved management processes [Strużycki 2004]. He listed the elements of the management system which are characteristic for the sector and which can be defined as competitive factors. These include:

- shaping of the organizational structure;
- improvements of the human resources system;
- performance of managerial functions;
- setting of strategic goals;
- creation of knowledge resources;
- work organization;
- decision making;
- control systems;
- logistic and marketing systems;
- innovation.

As regards SMEs, these elements must be interpreted in a specific manner, different from how the same are understood in large enterprise (see the epigraph). Research on SMEs, and microenterprises in particular, requires both examination of the elements of competitiveness and identification of the measures and properties of competitiveness which lead to success.

### **The notion of success in a microenterprise**

Research on activities of microenterprises in Poland was conducted by the Kronenberg's Foundation [Pentor 2010]. The surveyed SMEs identified success with survival on the market and with increase in their resources. They listed the following as elements conducive to success:

- constant development of the enterprise –activities thanks to which the enterprise does not remain stagnant and takes advantage of the chances offered by its environment, builds a long-term market superiority and has an active attitude to barriers;
- resources – with particular emphasis on non-material resources affecting the method of management;
- processes – including logistic and marketing processes, information flow;
- environment –an external factor significantly affecting the other factors of success, which at the same time can be a dynamizing factor or, in certain circumstances, can hinder the development and growth of resources.

The decisive role of the intellectual capital in increasing competitiveness of SMEs is emphasized by Herman [Herman 2006, p. 30], who points to the following three areas of knowledge in an enterprise, treated as a new source of growth of its value:

- area where knowledge is generated;
- area where knowledge is delivered;
- area where knowledge is managed.

Neither knowledge management nor implementation of modern management methods seems very important to SMEs [Krzysztozek 2007, p. 25]. Krzysztozek claims that due to this approach, the potential of modern management is still not used by microenterprises. In her research conclusions, Krzysztozek noted that the perception of price as the most important factor of competitiveness was gradually changing. This means that managing an enterprise based on intellectual capital is going to become important to those enterprises which now focus on material resources. According to the Lewiatan research by Krzysztozek, innovative measures aimed at cost reduction coupled with simultaneous improvement of the quality of products and services are crucial to an enterprise's success.

Bossak analyzed the country's international competitiveness in the light of integration with the EU and the competitiveness factors of microenterprises at the same time. Based on his research of the competitive factors [Bossak 2004, pp. 45–46], he emphasized that from the perspective of ensuring growth of production and sale, the main problems are:

- to adapt the properties of the product to the customer's expectations;
- to implement innovation in the product, in technology;
- to implement innovative methods of organization and management.

Research on the characteristics of elements of advantage in microenterprises was conducted the author from the intra-sectoral perspective of SMEs in the confectionery industry [Janczewska 2011]. The specific characteristics demonstrated by the research are presented in table 1. The main properties of activities of microenterprises in the confectionery business included:

- creation of own markets;
- ability to detect new impetuses and opportunities in the environment;
- filling in market gaps;
- ability to use the existing technology in a unique way;
- strong niche specialization;
- narrow segments of customers – in line with the available resources;
- dynamics and expansion;
- timeliness and price;
- individual customer service;
- flexibility;
- quick reaction.

**Table 1. Characteristics of the activities of microenterprises, as exemplified by the confectionery industry**

Area of activity	Characteristic features of the given area of activity	Example of the given feature in the confectionery industry
creation of own markets	Searching for customers, creation of a market offer	Looking for regular customers for confectionery products, such as shops, wholesalers, chains
ability to detect new impetuses and opportunities in the environment	Monitoring of the market trends and offers of competitors	Introducing health-promoting and eco products, imitative innovations
filling in market gaps	Providing unique products which the large companies do not offer	All hand-made products, such as pralines, marzipan, cakes in the micro-enterprise Hildebrand

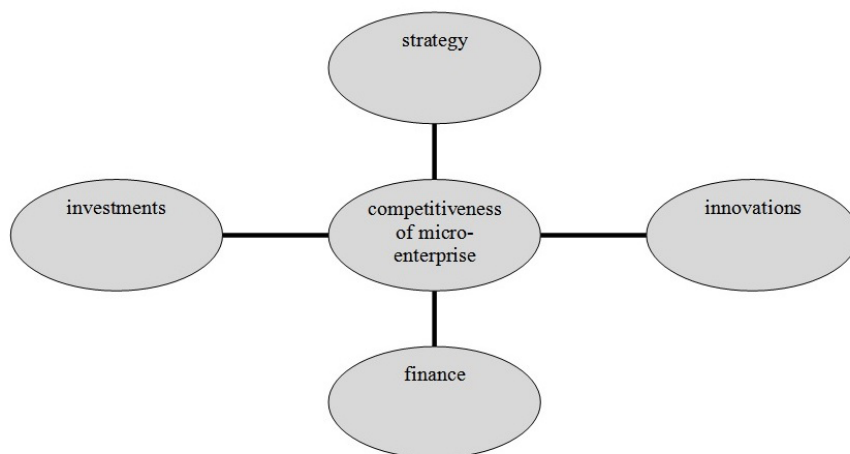
ability to use the existing technology in a unique way	Using the production technology on a smaller scale or based on simpler machines	Using smaller production machines for candies during small-scale production of cream fudge in the Majami company
strong niche specialization	Production of special, unique products difficult to manufacture on automated lines	Hand-made cakes and other confectionery products – for example produced by the Sowa company
narrow segments of customers – in line with the available resources	Offer addressed to local customers with specific, identified expectations	Local producers of cakes, ice-creams and candies
dynamics and expansion	Dynamic search for customers in neighbouring markets	Development of a micro-enterprise through expansion to other markets – for example the Sowa company
timeliness and price	Compliance with undertaken commitments	Developing production – for example for chain customers
individual customer service	Accepting individual orders from customers, with customized conditions and terms of delivery	Possibility of small batch production, customized packaging of confectionery products
flexibility	Adjustment to individual expectations, making changes and modifications	Possibility of introducing recipe modifications at a short notice
quick reaction	Quick reaction to every signal from the market	Individual reaction to complaints and new orders

Source: own research.

The notion of success is strongly connected with the theory of competitiveness. There are numerous models of competitiveness and competitive advantages. From the perspective of this article, the appropriate one was formulated by M.E. Porter, whose theory of competitiveness presents the concept in the form of competitive advantages or benefits. These should be presented as an effect of the microenterprise's own strategy or its market behaviour. The competitiveness model developed by M.E. Porter [Porter 1999, p. 24] is based on the summary result of numerous factors, such as: the main competitive strat-

egy, creation of innovations, completed investments and financial resources (fig. 1). Connections and interactions between those elements are bidirectional.

**Figure 1. Model of the competitiveness system by M.E. Porter**



Source: M.E. Porter (1999), *Porter o konkurencji*, PWE, Warsaw, p. 24.

Competitiveness can be defined as the processes and the system through which an enterprises may become the leader in its key competitiveness as a results of possessing skills superior to those of its competitors. Porter's model was used in planning the research on microenterprises in the Kuyavian-Pomeranian region. One part of the research is focused on the issues of competitiveness, in particular on defining the competitiveness factors in an enterprise.

### **Research on competitiveness factors in the area of marketing and logistic management in SMEs in the Kuyavian-Pomeranian Voivodeship**

The author's own research was conducted in 2012-2013 on 69 enterprises. The goal of the research was to examine the categories and the structure of marketing and logistic activities and to identify the competitiveness factors. The special goal was to examine whether those enterprises employed modern management based on marketing and logistic process. Selection of the sample group was intentional and based on the criterion of confirmation of the marketing and logistic processes' application in the enterprise<sup>13</sup>. The sample group's structure was as follows:

- microenterprises: 24 firms – which amounts to 35% of the sample group;
- small enterprises: 19 firms – which amounts to 28% of the sample group;

<sup>13</sup> Students of SAN in Brodnica participated in the research.

- medium enterprises: 12 firms – 17% of the sample group;
- large enterprises: 14 firms – 20% of the sample group.

In the sample group, the majority of enterprises were based in towns with a population of 10 to 50 thousand, which amounted to about 56% of the sample group. The location of the surveyed enterprises is presented in table 2.

**Table 2. Location of the sample group enterprises (in nominal values)**

Type of enterprise	Number of enterprises	Country	Town		
			> 10 thousand population	10–50 thousand population	< 50 thousand population
Micro	24	3	4	14	3
Small	19	1	7	11	0
Medium	12	0	6	5	1
Big	14	0	4	9	1
Total	69	4	21	39	5
Share in %	100%	6%	30%	56%	8%

Source: own research

In the majority of the enterprises, the object of their activity was:

- production;
- services;
- trade;
- others.

Table 3 presents the types of activity in the surveyed enterprises, as broken down into four groups. The largest group (43%) is made up of companies providing services, such as repairs, transport, IT services. This kind of activity was carried out by 30 enterprises, most of them belonging to the microenterprise group. The second largest group was that of production activity (32%) with 22 enterprises, predominantly large ones. Trade activity was conducted by 13 enterprises, which amounts to 19% of the sample group.

**Table 3. Types of activity in the surveyed enterprises**

Type of enterprise	Number of enterprises	Type of activity			
		production	services	trade	other
Micro	24	2	16	5	1
Small	19	3	8	6	2
Medium	12	8	2	1	1
large	14	9	4	1	0
Total	69	<b>22</b>	<b>30</b>	13	4
Share in %	100%	32%	43%	19%	6%

Source: own research

Analysis of the largest activity groups – services and production – confirms that the marketing and logistic processes are identified in these two types of enterprises. Examination of the main and the secondary marketing and logistic process has shown that marketing in an enterprise is connected with the logistic process on the grounds of market oriented management.

### **Results of research on marketing and logistic processes in microenterprises as competitive factors**

In microenterprises, the following marketing and logistic processes were described as most important for competitiveness:

- management of customer relations;
- management of customer service;
- management of information flow;
- management of materials flow.

The following marketing and logistic process ranked lower:

- management of demand;
- management of product development;
- management of knowledge;
- management of innovation measures.

The main marketing and logistic processes in a microenterprise were rated from 1 (minimum score) to 5 (maximum score). Results of the rating are presented in table 4.

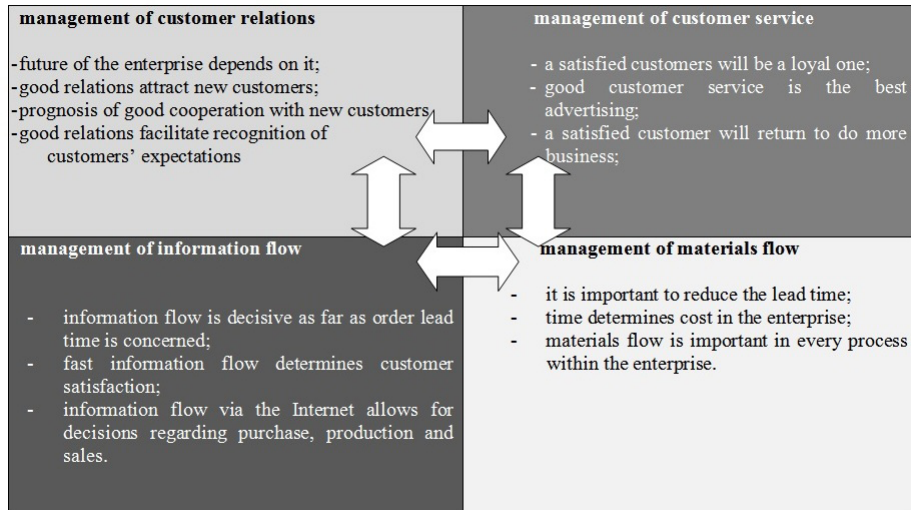
**Table 4. Results of rating of main marketing and logistic processes in microenterprise**

Type of enterprise	Number of microenterprises	Evaluation of significant of marketing- logistic process (from 1 to 5 )			
		management of customer relations	management of customer service	management of information flow	management of material flow
Microenterprises	24	4.38	4.22	4.20	4.00

Sources: own research.

On the basis of evaluation of the most important marketing and logistic processes in a microenterprise, the following description has been developed – see fig. 2. Discussion on the results of the research indicates that all these processes are interconnected. Customer relations are connected with information flow and with management of materials flow. All processes affect the level of customer service management.

**Figure 2. Opinions regarding the most important marketing and logistic processes in a microenterprise**



Source: own research.

Micro-enterprises revealed the following to be the main barriers as regards marketing and logistic processes:

- it is necessary to build a strategy of customer service, based on marketing analysis;
- lack of a customer service department or a dedicated person;
- modern technology is necessary to expedite contact with customers and within the enterprise;
- a simple and cheap model of customer relations monitoring is necessary.

Analysis of the research's results indicates that marketing and logistic management in the surveyed microenterprises can be perceived as a significant competitive factor. Mail marketing and logistic instruments can be the competitive factors, but at present modern IT technologies are the best instrument supporting competitiveness in a microenterprise. The important marketing and logistic processes are interconnected, and supporting them with quality management can become the way to eliminate developmental barriers. The much lower frequency with which the other marketing and logistic processes were identified in this research shows that most microenterprises are unable to apply them on a satisfactory level.

## Summary

Improvement of enterprises' competitiveness is currently the most important problem and goal of the SME sector. The predominant participation of microenterprises in the sector's composition is not only of statistical importance, but also translates to employment levels in the sector, and to economic and social issues. Research on management of microenterprises can help identify the factors affecting improvement of competitiveness. Analysis of competitive factors, in turn, explains the strengths and weaknesses of microenterprises. This article presented research on a group of companies from the Kuyavian-Pomeranian region, as a result which the system of management of microenterprises was defined. Based on management of marketing and logistic instruments, factors stimulating development and competitiveness were presented. Demonstrated in the result of the research were the barriers to marketing and logistic management in microenterprises.

## References

- Bossak J. (2004) *Międzynarodowa konkurencyjność gospodarki kraju i przedsiębiorstwa. Zagadnienia teoretyczne i metodologiczne* [in:] J. Bossak, W. Bieńkowski (red.), *Konkurencyjność gospodarki Polski w dobie integracji z Unią Europejską i globalizacji*, t. I, Wydawnictwo SGH, Warszawa.
- Dominiak P. (2005), *Sektor MSP we współczesnej gospodarce*, PWN, Warszawa.
- Fundacja Kronenberga (2010), *Raport z badania czynników sukcesu mikroprzedsiębiorstw*, Pentor, Warszawa.
- Herman A. (2006), *Nowe uwarunkowania funkcjonowania przedsiębiorstw* [in:] B. Dobiegała-Korona, A. Herman (red.), *Współczesne źródła wartości przedsiębiorstwa*, Difin, Warszawa.
- Janczewska D. (2010), *Zarządzanie marketingowo-logistyczne jako element konkurencyjności przedsiębiorstwa z grupy MŚP*, „Zarządzanie Innowacyjne w Gospodarce i Biznesie”, Nr 1 (10), Wyd. AHE w Łodzi, pp. 49–62.
- Janczewska D. (2012), *Rozwój potencjału innowacyjnego przedsiębiorstwa w sektorze MŚP na przykładzie branży konstrukcji stalowych*, Uniwersytet Szczeciński, Zeszyty Naukowe Nr 716, EKONOMICZNE PROBLEMY USŁUG NR 92, Strategiczne uwarunkowania kształtowania potencjału innowacyjnego przedsiębiorstw SOOIPP Annual 2012, SZCZECIN, pp. 167–184.
- Kamińska B. (2013), *Koncepcja klastra jako sposób na poprawę konkurencyjności małych i średnich firm*, „Przedsiębiorczość i Zarządzanie”, Tom XIV, zeszyt 8, cz. I.
- Koźmiński A.K. (2004), *Zarządzanie* [in:] A.K. Koźmiński, W. Piotrowski (red.), *Zarządzanie. Teoria i praktyka*, Wyd. Naukowe PWN Warszawa.
- Matwiejczuk R. (2006), *Zarządzanie marketingowo-logistyczne. Wartość i efektywność*, Wyd. C.H. Beck, Warszawa.

- 
- Porter M.E. (1999), *Porter o konkurencji*, PWE, Warszawa.
- Starczewska-Krzysztozek M. (2008), *Konkurencyjność sektora MSP – Monitoring kondycji sektora MSP*, Badania Lewiatan, Warszawa.
- Strużycki M. (2004), *Uwarunkowaniarozwojowe przedsiębiorstw* [in:] M. Strużycki (red.), *Zarządzanie przedsiębiorstwem*, Wyd. Difin, Warszawa.
- Welsh J.A., White J.F. (1981), *A Small Business Is Not a Little Big Business*, Harvard Business Review 1988, vol. 59, nr 4 – cited by P. Dominiak (2005), *Sektor MSP we współczesnej gospodarce*, PWN, Warsaw, p. 25.



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## Innovation in view of entrepreneurs

**Abstract:** The paper presents the entrepreneurs' view on innovation in Lublin Voivodship. It is analysed on the basis of taken research. As a result the paper shows discrepancies of opinions between entrepreneurs implementing and non implementing innovations. It points out that a more innovative entrepreneur is less afraid of negative results of innovation although he is more aware of they can occur.

**Key-words:** innovation, entrepreneur's view on innovations, lubelskie voivodship.

### Introduction

Over the last few years innovations have become one of the most frequently analyzed issue in the area of enterprise development and building up competitive advantages. One should note, however, that understanding of this concept varies, ranging from a purely technological approach, process to organizational. [Ayyagari, Demirgüç-Kunt, Maksimovic 2011]. On the one hand, it results from a different interpretation of this phenomenon in the theory of economics, a various approach to, on the other, from various attitude of institutions responsible for creating innovation both at global, domestic and regional level, as well as entrepreneurs themselves. The latter understanding is particularly essential, as in practice business units are key chains that are responsible for the improvement of innovation in a given economy. Although the theory of economics should create proper norms, yet it is important these norms be adequate to the

business environment. In this context it is justified to verify how the concept of innovation is perceived, as well as to what behaviors or features demonstrated by entrepreneurs it is related. The aim of this paper is to determine the view on innovation of entrepreneurs who operate in the lubelskie voivodship. The authors assumed that entrepreneurs who don't implement innovations take problems connected with the implementing process more seriously than those who implement innovations. The grounds to these considerations were given by the research done within the research grant financed by MNiSW (Ministry of Science and Higher Education) No NN 113 303038 "Financial Instruments Supporting Development of Innovation in Lublin Voivodship".

### Definitions of Innovation

The subject literature introduces a number of various definitions of the "innovation". J.A. Schumpeter was the first to interpret this concept as:

- introducing into production new products or improving already existing,
- implementing a new or improved production;
- opening a new market;
- applying a new way of selling or buying;
- using new materials or semi-finished products, introducing a new organization of production [Schumpeter 1934, p. 66].

It appears that Schumpeter's approach is relatively narrow and of technological nature.

In turn, P.F. Drucker emphasizes the need to identify actively the changes in the environment and the continuous analysis of the possibilities of their use to create new solutions. In this way this approach shows innovation as a specific tool for entrepreneurs which is activity giving to resources new possibilities of generating wealth [Wang 2009, p. 62].

Yet another approach is presented by A. Hargadon and R.I. Sutton. They claim innovations come from the exchange of knowledge from different functional areas of the company and from its business environment. The integration of this knowledge in a new novel way brings about new services, products and processes [Hargadon, Sutton 2000, pp. 157–166].

At present, the most prevailing is the definition of OECD, included in the handbook Oslo Manual. According to this interpretation, innovation should be understood as implementing new or a considerably improved product or a process, a marketing method or an organizational method in economic practice, organization of the workplace or relations with the surrounding [OECD, 2005]. Such an approach to innovation is consistent with the definition Polish entrepreneurs may encounter while implementing investment projects financed with the European Union resources. These projects are to be characterized by

innovation, they have to implement new solutions into one of the four areas: product, process, organization, marketing [MRR, 2011].

### **The characteristics of innovative companies**

The diversity of the approach to innovation makes one look for a more integrated definition. In this respect it is essential to verify what qualities should characterize an innovative enterprise.

By A. Jasiński an innovative enterprise is the one which [Jasiński 1992, p. 25]:

- carries out research and development works (or purchases new products or technologies),
- allocates relatively high expenditure to this activity,
- regularly implements new scientific and technological solutions,
- represents a big share of innovation (products and technologies) in the volume of production and services,
- continuously introduces innovation onto the market.

Therefore, one may conclude that in the author's opinion one of the key areas distinguishing innovative and non-innovative entities is the commitment to research and development which allows generating competitive advantages in a particular sector. Additionally, the author claims that the essence of an innovative company is the ability to implement effectively these advantages into operational activity.

A far broader interpretation of the characteristics of innovative companies is given by A. Sosnowska, S. Łobejko, A. Kłopotek, who classify them as [Sosnowska, Łobejko, Kłopotek, 2000, p. 11]:

- abilities to permanently generate innovation, and creativity,
- ability to make use of innovative potential of the company to maintain a high competitive position based on key competencies,
- ability to anticipate the future, prospective thinking,
- regular contact with the company's clients to recognize effectively their current and future needs,
- maintaining a team of creators, innovators who ensure a high level of the company's innovation,
- proper range of information allowing accurate assessment,
- flexibility in adapting to changing circumstances of activity.

Thus, enterprises seek innovation not only in the area of research and development, but first of all, in respect of using resources and managing them. A special attention is drawn to in-company resources both among the employees who possess potential to create external innovation as well as among the

management as a unit which is expected, by planning and analyzing business environment (including the competition), to use the company's potential for generating competitive advantages. On analyzing these qualities one may conclude that all business entities hold some potential to become innovative, providing they are well managed and able to take advantage of the opportunities which arise in their surroundings.

The above described characteristics may be confirmed by the findings of the research conducted in Italy by B. Bigliardi, P. Colacino, and A. I. Dormio [2011, p. 83] on the sample of 128 enterprises. The authors analyzed the frequency of proper characteristics in a group of innovative and non-innovative companies and through comparison concluded on those characteristics which, to a larger extent, were related to this first group. As the data from Tab.1.show, one may notice that among innovative enterprises definitely higher commitment to the company's development is on the part of the management and the owners. It is evident, in particular, in the case of looking for new products and services, where the difference to the other group was 38 percentage points, as well as the development of products and services where the disproportion is even bigger as it was 65 percentage points.

**Table 1. The percentage of innovative and non-innovative companies with appropriate characteristics**

Characteristic	Innovative enterprises	Non-innovative enterprises
The management's and the owners' involvement in the development of new products and services	100%	62%
The management's and the owners' involvement in the development of new production methods	100%	90%
The management's and the owners' involvement in the change of in-company processes	95%	80%
Developing existing products and services	95%	30%
Regular analysis of the market	95%	45%
Regular analysis of the competition	77%	33%
Examining their clients' needs	95%	63%
Making use of IT systems supporting production processes in the company	89%	39%
Employees' trainings	45%	20

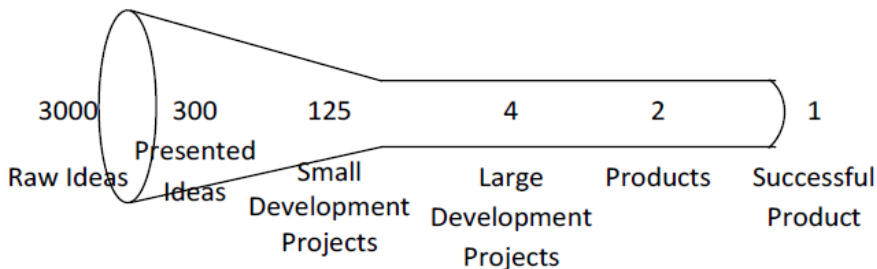
Source: Bigliardi, Colacino, Dormio 2011, p. 83.

According to the research one of a characteristic of an innovative company is also strong commitment to analyze the market environment, with particu-

lar reference to the competition and the clients' expectations. As evidenced by research, innovative companies analyze more external factors and draw on inspiration to implement development projects fast. Since time is essential for innovation, companies which better analyze customers' expectations, changes on the market and competitors' activities are able to decide on implementing innovation more easily and faster. In this way they become forerunners of change and outperform the competition. The last area which was investigated in the research is connected with investments in in-company resources. More than twice as many innovative companies compared to non-innovative companies invested in IT solutions which supported them in the production process and the organization of other functional areas. A similar difference appeared in the case of investment in their own human resources, which are treated in innovative companies as a resource to generate internal innovations, not merely as a productive resource.

Finally, it is also worth noting the aspect of risk in implementing innovative projects. From the perspective of the company, introducing new solutions rises some dilemma. The company has to be innovative to survive and to develop. Thanks to innovations it can introduce new products and services, win new markets or minimize costs which has direct impact on the price position on the market. On the other hand, one should also take into account the fact that implementing innovations is accompanied with the threat to fail and lose the incurred costs. The risk of innovative projects is, in fact, bigger than the one of modernization or replacement projects. As the graph of core innovation shows only few ideas at various stages of development may be successfully implemented. Consequently, entrepreneurs who decided to implement them must have a greater willingness to take risk.

**Figure 1. Innovation core**



Source: Khorshidi, Rajab-Baigy 2012, p. 142 qtd. Stevens & Burley 1997, pp.16–27.

### The research conducted in Lublin Voivodship

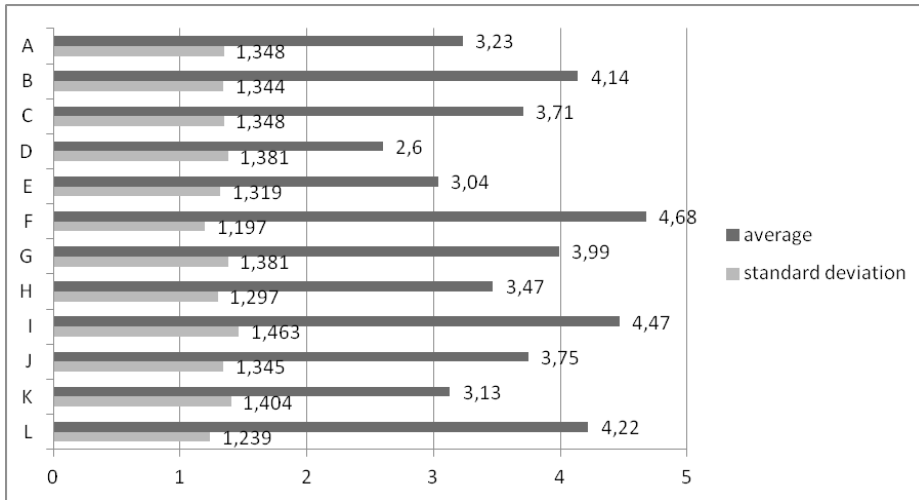
In order to compare the findings of the world research with the situation in Lublin Voivodship the described above aspects were examined in the research carried out in 2012 within the independent research project No NN 113 303038. It covered 395 entities from Lublin Voivodship representing different sectors of business activity. They were to answer the questions posed in the questionnaire presented to them. Among other things, the entrepreneurs were asked to refer to the statements describing the way they perceive innovation. The list of these statements is shown in Tab. 2.

**Table 2. Assessed statements**

Statement	Mark
Senior managers governing our company are characterized by strong willing to take risk in business activity	A
To implement innovation one should be prone to take risk	B
Implementing innovation is very risky	C
Every entrepreneur is competitive	D
Companies do not implement changes as they distort operational activity	E
Innovation raises competitiveness of companies	F
Innovation of competitors of my company inspires us to implement innovation	G
Senior management of our company is characterized by great openness to innovations in business activity	H
Companies do not implement innovations because they lack resources to finance them	I
Innovation of the suppliers and customers of my company inspire us to implement innovation	J
Small companies are more innovative than large ones	K
Innovations increases profitability of enterprises	L

Source: own study.

The respondents were asked to make their assessment on a six-level scale, where 1 meant "I strongly disagree", and 6 "I definitely agree". Their responses indicate that a significant majority (59,8% of responses with the rating 5 and 6 ) think that implemented innovation increases the company's competitiveness. The average rating for these response was 4,68 with the lowest standard deviation (Fig. 2).

**Figure 2. Average mark of assessments by the respondents (scale 1 to 5)**

Source: the authors' own calculations.

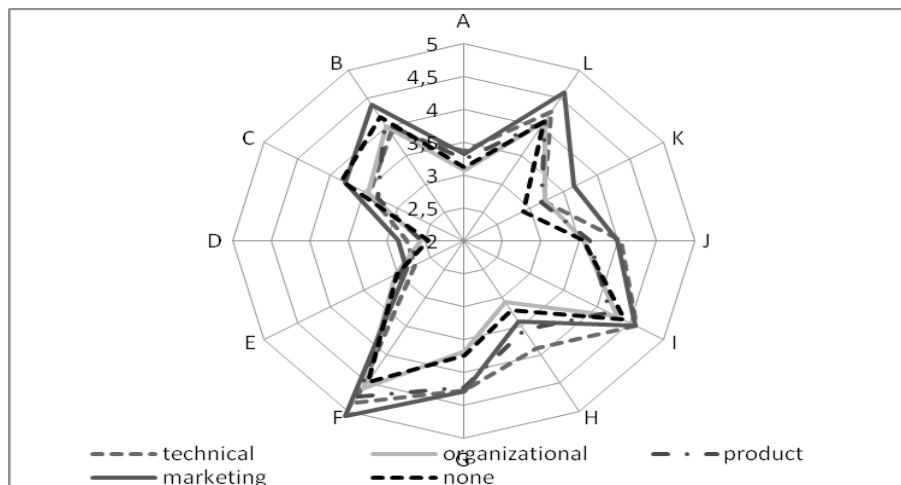
The surveyed entrepreneurs pointed out that the problem of financing innovation is important. The statement that the lack of financial resources is the reason for not implementing innovative solutions received an average rating of 4,47, where the respondents showed little unanimity on the importance of this issue and it is proved by the highest standard deviation.

Average ratings of over 4,0 were also given to the statements referring to the necessity of being willing to take risk and positive impact on profitability of enterprises implementing it.

The surveyed did not confirm the statement that every entrepreneur is innovative (average rating 2,6). Nor do they agree that implementing innovations distorts operational activity (average rating 3,04).

While classifying the respondents into the persons implementing various innovations and those who did not implement innovations in their companies, the investigators found out that, among 365 entities examined, 191 persons implemented and 174 did not implement any innovations at the period examined. At the same time some of the respondents implemented different types of innovations. Hence, 74 entities implemented technological innovations, 63 – organizational, 80 – product, 39 – marketing. To find out about the attitude of those implementing particular types of innovations towards those persons who did not run such actions, a comparison of the average was made. On the basis of this, it was discovered there are a few essential differences in the approach of those persons who implement innovations and those who did not implement a given type of innovation in their enterprises.

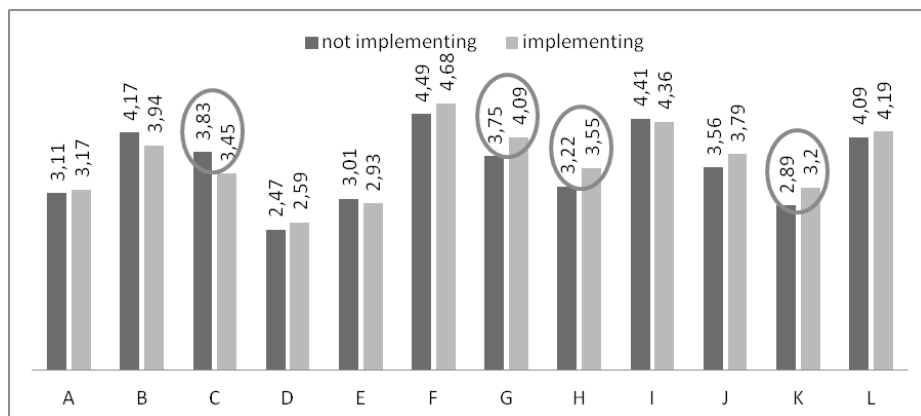
**Figure 3. Differences in views on innovation of those who implement various types of them**



Source: the authors' own calculations.

The respondents who made the effort to implement innovation slightly lower assess the risk connected with such activities, much better they assess the positive effects of implementation such as the increase in profitability or the improvement of competitiveness. The comparison of average ratings attributed to particular statements by the respondents not implementing any innovations with the responses given by those who implemented at least one type, is illustrated in Fig. 4.

**Figure 4. Discrepancy between those implementing and not implementing innovations**



\* Statistically significant differences were marked

Source: the authors' own calculations.

As evidenced, the respondents who do not implement innovative solutions show more concerns than those who have already met with innovations in practice. They see in this type of activity a threat to the stability in functioning of their enterprises. In turn, they rate lower potential positive impact of the implementation they might carry out.

Statistically significant differences between average ratings attributed by those implementing and not implementing innovation are evident in four cases. The respondents who do not implement innovation more definitely show that implementing innovation is much more risky (answer C). In the other three cases those not implementing attributed lower ratings which means they did not agree with the statements that smaller companies are more innovative (K), The competitors' innovation influences the decisions on implementation (G)<sup>14</sup>, and they rank lower readiness to innovations which was demonstrated by senior management of the entities presented (H).

With the assumed 95% level of probability no statistically significant differences were noticed in the case of the respondents who implement organizational innovations and those who do not implement them or implement other kinds.

Statistically significant differences between entrepreneurs who implement technological innovations and those who did not carry out such implementations referred to the requirements posed by the market. These respondents, contrary to the rest of the group, rated higher the impact of innovation of competitors, suppliers and customers. They also assigned more significance to the openness to innovations demonstrated by the senior management.

The role of Competitors' innovation was also, to a larger extent, indicated by the respondents who implement product innovations. This group also gave lower average, than the others, to the statement that implementing innovation is risky.

The assessment of entities which implement marketing innovations is statistically higher in three cases. These respondents ranked higher the impact of innovation on competitiveness and profitability of enterprises. They agree more with the statement that smaller companies are less innovative than the large ones.

The described above observations are confirmed by the results of the research on the correlation between the assessment attributed to particular statements by the respondents and the fact of implementing or not a given type of innovation. Statistically significant correlation (in minus in the case of those implementing product innovations and in plus for those who do not implement) appeared while assessing the statement that innovations are risky. Positive correlation in stating that innovations raise competitiveness of enterprises is shown in the responses implementing technological and marketing innovations.

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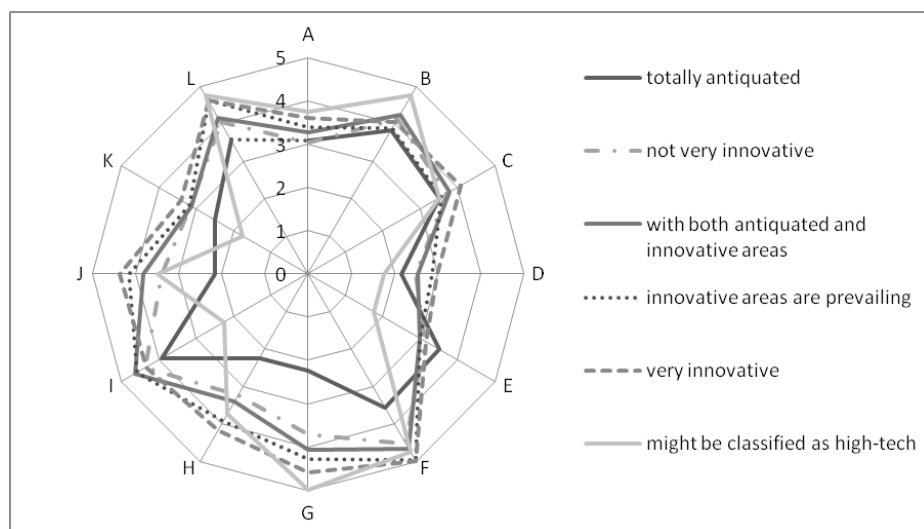
<sup>14</sup> Compare with research provided by T. Aghion and others [Nicholas 2003].

The highest rates – in plus for those who implement innovations and in minus for those who do not implement them – are with the assessments of competitors' impact on innovation (positive correlation here is also in the case of those implementing product innovations) and the readiness of managers to innovate. The similar outcome appears in the case of assessing the impact of innovation of suppliers on the decisions on implementing innovation.

Positive correlation was also observed in two other cases: implementing marketing innovations while agreeing at the same time that smaller companies are more innovative than larger ones, and positive impact of innovation on profitability of the entities implementing them.

Another stage of the research was to verify views on innovations in relation to technological advances presented by the surveyed entities. According to the declarations, among entities which took part in the research, 13 entities were totally antiquated, 112 were not very innovative, 166 were with both innovative and antiquated areas, in 71 innovative areas were prevailing, 24 were very innovative and 5 regarded by the respondents as high-tech. Four respondents did not point at any innovation rating of their entities and so their responses were not included in the calculations.

**Figure 5. Discrepancy between those representing different technological advances**



Source: the authors' own calculations.

In the case of the statements A, F, G, H and L one may note the increase in the average of ratings attributed to them along with the increase in the degree of technological advancement of the investigated entities. Therefore, the more

innovative product the more its managers are open to innovations and willing to take risk. The increase in innovation encourages higher assessments of the impact of innovation on profitability and competitiveness, as well as putting more weight to competitors' actions in the area of implementing innovative solutions.

## Summary

To sum up the research described above, one may conclude that an entrepreneur who decides on implementing innovations is characterized as being fairly willing to take risk and open to changes. He is not afraid of the negative impact of carrying out the implementation on the operational activity in the company he manages. He pays attention to the market position of his enterprise and the one of his the competitors', and he is fairly positive about innovation as the way to improve this position, inter alia, through increasing profitability. He is sceptical about the reliance between the size of the enterprise and the degree of its innovation, yet, he agrees that implementation of innovations requires financial backup, which is scarce on the market.

These results are consistent with those presented in the earlier part of the research, according to which innovative enterprises are characterized by significantly stronger commitment of managers to the development of new products, methods of manufacturing and in-company processes. In their activities managers take into account observations of both supplier and customer market.

Unfortunately, the research confirmed a relatively low level of innovation of enterprises in Lublin Voivodship and exaggerating the problems which may be triggered off by the process of innovation, when a group of entrepreneurs do not take such activities.

## Bibliography

Ayyagari M., Demirgüç-Kunt A., Maksimovic V. (2011), *Firm Innovation in Emerging Markets: The Role of Finance, Governance, and Competition*, "Journal of Financial and Quantitative Analysis", Vol. 46, No. 6, Dec. pp. 1545–1580, doi:10.1017/S0022109011000378

Bigliardi B., Colacino P., Dormio A.I. (2011), *Innovative Characteristics of Small and Medium Enterprises*, "Journal of Technology Management & Innovation", Volume 6, Issue 2.

Hargadon A., Sutton R.I. (2000), *Buling Innovation Factory*, „Harvard Business Review", Vol. 78, No 3, May-June.

Jasiński A.H. (1992), *Przedsiębiorstwo innowacyjne na rynku*, KiW, Warszawa.

Khorshidi M. F., Rajab-Baigy H. (2012), *Determinates of Innovation Adoption, A Case Report of Sadaf Plastic Sima Company*, "European Journal of Economics, Finance and Administrative Sciences", Issue 48 (2012), p. 142 qtd Stevens G. & Burley J. (1997), *3000 Raw ideas Equals 1 Commercial Success!*, "Research Technology Management" 40, no.3, pp. 6–27.

MRR (2011), Program Operacyjny Innowacyjna Gospodarka, 2007–2013, Narodowe Strategiczne Ramy Odniesienia 2007– 013, [http://www.poig.gov.pl/Dokumenty/Lists/Dokumenty%20programowe/Attachments/116/Program\\_Innowacyjna\\_Gospodarka\\_zatwierdzony\\_przez\\_KE\\_22122011.pdf](http://www.poig.gov.pl/Dokumenty/Lists/Dokumenty%20programowe/Attachments/116/Program_Innowacyjna_Gospodarka_zatwierdzony_przez_KE_22122011.pdf) Accessed on: 11.09.2013.

Nicholas T. (2003), *Why Schumpeter was Right: Innovation, Market Power, and Creative Destruction in 1920s America*, "The Journal of Economic History", Vol. 63, Issue 04, Dec, pp 1023–1058, doi: 10.1017.S0022050703002523.

OECD (2005), *Oslo Manual, Guidelines for Collecting and Interpreting Innovation Data*, Organization for Economic Co-Operation and Development and Statistical Office of the European Communities.

*Sima Company*, "European Journal of Economics, Finance and Administrative Sciences" Issue 48.

Schumpeter J. (1934), *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, Cambridge: Harvard University Press.

Sosnowska A., Łobejko S., Kłopotek A. (2000), *Zarządzanie firmą innowacyjną*, Difin, Warszawa.

Stevens G., Burley J. (1997), *3000 Raw ideas Equals 1 Commercial Success!*, "Research Technology Management", 40, No.3.

Wang Y. (2009), *Research on Foreign Innovative Countries and Their Revelations*, "Canadian Social Science", Vol. 5, No. 1, February.

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## The effectiveness of capital management strategies used by the investment funds in Poland

**Abstract:** Collective investors play an extremely important role in the financial system of the state and in the economy. They operate in the financial market as institutions that enable households and businesses to convert savings into investments. Investment funds are the most conventional institutions which are dealing with financial intermediation.

The main purpose of the submitted paper is to characterise the essence of investment funds operation in the role as financial intermediaries, to present the investment strategies and to characterise the methodology for measuring the effectiveness of capital management entrusted by the clients.

The author has formulated a research hypothesis, according to which, the strategies of capital location policy used by the investment funds have an impact on the level of their performance, while funds holding higher risk portfolios perform better compared to the funds using passive investment strategies.

**Key-words:** collective investor, investment fund, investment strategies, capital management, rate of return on investment.

### Introduction

Financial intermediaries play an extremely important role in the financial system of the state. They operate in the financial market as institutions that enable households and businesses to convert savings into investments. Investment funds are the most conventional institutions which are dealing with financial intermediation.

The goals of the paper are to characterise the essence of investment funds operation in the role of financial intermediaries, to describe the investment

strategies and to characterise the methodology for measuring the effectiveness of management of the capital entrusted by the clients.

The paper formulates a research hypothesis, according to which, the strategies of capital investment used by the investment funds have an impact on the level of their performance, while funds holding higher risk portfolios perform better compared to the funds using safer investment strategies.

The analysis will be covered by the most popular investment funds in Poland: Polish Equity Funds, Polish Bond Funds, Polish Mixed Balanced Funds, Money Market Funds and Polish Mixed Growth Stable Funds. The analysis will be carried out for the period 2009–2012.

### **1. The nature and importance of financial intermediaries in the financial system**

A special role in the transformation of savings into investment plays the financial market, in which the matching of supply and demand for financial resources takes place. Supply side of the financial market is represented by actors with financial surpluses that are named as capital donors or investors. The financial market enables them to multiply the money they have. These entities are mainly households and businesses [Nacewski, Zabielski 2000, pp. 15–16].

Demand side of the financial markets is represented by entities seeking capital in order to meet their lending or investment needs. Own financial resources of these entities are not sufficient, and therefore they demand additional financial resources. These entities are referred to as capital takers or issuers, and these are mostly companies and state treasury [Wypych 2000, p. 114].

The functions of financial intermediaries, that use mainly external capital, can be described as [Dobosiewicz 2009, pp. 44–45]:

- intermediation between the owners of surplus funds and those demonstrating a need for cash,
- moving the time of consumption,
- concentrating capital and the transformation of money over time,
- reducing the financial risk,

Financial intermediaries, in exchange for their services, are given the right to dispose of the financial resources for a period of time, which allows them to lend money to other parties at a specified interest rate, or to invest these funds in securities.

Non-banking financial intermediaries make a simple transformation of savings into capital in the sense that they have no right to make money on the basis of acquired savings.

They make changes to the structure of financial resources created by the banking system. The idea of the action boils down to collect financial resources

from individual investors (mainly from households, to a lesser extent from the companies) and then, their professional placement on the financial market.

Compared to banks, non-banking financial intermediaries offer entities willing to save, more diverse financial instruments in terms of the risk, resulting in the further differentiation of yields. It is very important that a wider range of financial deposits supports greater flexibility of the financial market, which has a major impact on facilitating and streamlining the process of transformation of savings into capital, followed by a physical investment in the economy as a whole [Owsiak 2002, pp. 227–228].

Non-banking financial intermediaries create conditions for investing for those who prefer a higher income, and are willing to take more risk. This does not mean that their investment offer does not include financial instruments with the risk of a similar or even lower level than the risk as for bank deposits [Proniewski, Niedźwiedzki 2002, p. 17].

## **2. The nature and tasks of investment funds as institutional investors**

The first institution that possessed the characteristics of the investment fund was established by King William I in Brussels in 1822. The members were selected (not all who wish were able to become members of it), and the purpose of its activities was to create small and medium-sized enterprises a possibility to invest capital in foreign debt securities [Chróścicki 1998, p. 13]. Common development of this type of financial institutions began in England and Scotland. The stimulus was a fast-growing economy of the Great Britain, with a simultaneous rapid enrichment of the population and an increase in the propensity to save.

In the early years of operation, the majority of the funds were the closed funds – they emit a fixed number of shares adjusting it to market demand. A turning point in the history of the U.S. investment funds market was when the British funds noticed the potential of the U.S. financial market. The rates of return achieved on the U.S. market were usually higher than the rates in Europe. From that moment, fast and rapid growth of investment funds in the United States has been recorded.

The first two decades of the twentieth century were the period of the real development of investment funds in the United States and England. Hundreds of such institutions were established then, including The Massachusetts Trust Fund, created in 1924 [Sas-Kulczycka (ed.) 1999, p. 4]. The Massachusetts Trust Fund placed the collected assets in shares of 45 companies (diversification of the investment portfolio), and consistently offered the opportunity to purchase and resale of the shares by investors at a price based on the present value of the fund's assets. It was, so the first open investments fund [Chróścicki 1998, pp. 13– 14].

The first piece of legislation in Poland, governing the operation of investment funds, was the Act of 28 August 1997 on investment funds.

In accordance with the contents of the Act, a fund is “a legal person, who’s the only purpose is solely to invest funds collected in a public offer in securities and other property rights defined in the Act”<sup>15</sup>. The fund operates according to the rules of reducing the investment risk.

From the point of view of funds’ customers, the important regulation is the amendment introduced in the Act of 23 November 2012 amending the Act on Investment Funds and the Act on the Supervision of Financial Market. The most important feature of the Act is the introduction of an obligation to publish information in the form of KIID (Key Investor Information Document) which will replace the information prospects.

The most important issue is to determine the profit and risk profile of the fund. This indicator is presented on a numerical scale from 1 to 7, and the methodology of its calculation is based on the average fluctuations in pricing in annual perspective, that occurred in the past five years.

Most individual investors do not meet the above requirements and, therefore, they entrust their financial resources to specialized financial institutions, including investment funds. These institutions have advantages not available to individual investors. The most important are [Dawidowicz 2008, p. 10]:

- Professional management,
- Diversification of the portfolio,
- The liquidity of the investment,
- Security of the deposit,
- Control of the investment,
- The cost of investing,
- The choice of strategy corresponding to the propensity to take risk.

Investment funds can be classified from different points of view. According to the criteria describing the way the fund investment operates, funds can be divided into [Dawidowicz 2008, p. 18]:

- open-ended funds,
- closed-ended funds,
- mixed funds.

When asset allocation criteria, is taken into account, investment funds can be divided into the following types [Dawidowicz 2008, p. 24]:

- equity funds,
- balanced funds,

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<sup>15</sup> The Act of 28 August 1997 on investment funds, Journal of Laws of 1997 no. 139, item 933.

- 
- stable growth funds
  - bond funds,
  - money market funds,
  - mortgage funds,
  - foreign funds,
  - universal funds.

### **3. Methods for measuring the effectiveness of the funds' investment policy**

While reviewing the literature on methodology of assessing the effectiveness of the investment funds, three American economists, who are among the first called “financial economists” are usually pointed out as pioneers in this field. Those are W.F. Sharpe, J.L. Treynor and M.C. Jensen.

Their contribution to the study on the funds was to develop measures that take into account an investment risk in assessing the effectiveness of investment funds.

Despite, they use of different measurement, obtained results were similar.

An innovative approach to how to assess the effectiveness of the capital management by the investment funds is described in the following research papers:

- M.C. Jensen, *The performance of mutual funds in the period 1945–1964*,
- W.F. Sharpe, *Mutual fund performance*,
- J.L. Treynor, *How to rate management of investment funds*.

Evaluation of the effectiveness of the investment policy of pension funds and investment funds should be considered in the context of the functions they perform on the financial market. Investment funds companies are the entities that manage the funds.

The rate of return is a criterion for assessing the effectiveness of the funds. The rate of return is measured by changes in the value of participation units, the level of risk involved and the additional compensation gains.

Assessment of the effectiveness of capital management by investment funds and pension funds should be carried out in two areas:

- the rate of return on investment,
- compensation of the risk by the additional rate of return.

The analysis is based on the rate of return defined as the percentage ratio of capital growth over the analysis period to the amount of capital at the beginning of the period (initial capital). In order to compare this calculated rate of return to interest yields for the various instruments of financial market, the

rate of return should be calculated for the period covering a year (annual interest rate) or for long-term periods (eg. three-year rate of return). The formula to calculate the rate of return on investment in the funds is as follows [Dybał 2008, p. 66]:

$$R = \frac{W_{j_2} - W_{j_1}}{W_{j_1}} \times 100$$

where:

R – rate of return,

$W_{j_1}$  – The value of the participation or clearing unit at the beginning of the period,

$W_{j_2}$  – The value of the participation or clearing unit at the end of the period.

In order to make a more complete and objective analysis of the effectiveness of management of capital by collective investors, the use of a simple rate of return is considered to be insufficient. Therefore, it is advisable to use an additional measure that takes into account of the level of investment risk and the extent of its compensation by additional profits.

One such measure is the Information Ratio. It is a measure that identifies the size of the additional rate of return in comparison with unit risk taken by the fund investment. It is presented in the following form [Dawidowicz 2008, p. 92]:

$$IR = \frac{R_p - R_m}{TE}$$

where:

IR – information ratio,

$R_p$  – rate of return of the fund,

$R_m$  – benchmark rate return of the (reference portfolio),

TE – tracking error of the portfolio of the fund in relation to the benchmark (standard deviation of the difference in the rates of return of the fund and its benchmark).

Information ratio is based on the Sharpe ratio, but is related to the selected benchmark portfolio – the rate of return on the fund wants to cross, rather than the risk-free rate of return. It reflects the investor's ability to create a portfolio with a more favourable rate of return than the return on the model portfolio.

The higher the level of IR, the higher efficiency of management of the fund. The satisfactory level of IR is value above 50%, and if IR exceeds the value of 75%, this is a very good result [Kothari, Warner 2001, p. 2003].

Tracking Error and Information ratio are widely and commonly used in the process of assessing the effectiveness of the funds' investment policy because they enable comparing funds using different investment strategies, with different levels of risk [Kothari, Warner 2001, p. 2009].

#### 4. Assessment of the effectiveness of funds' investment policy in 2009–2012

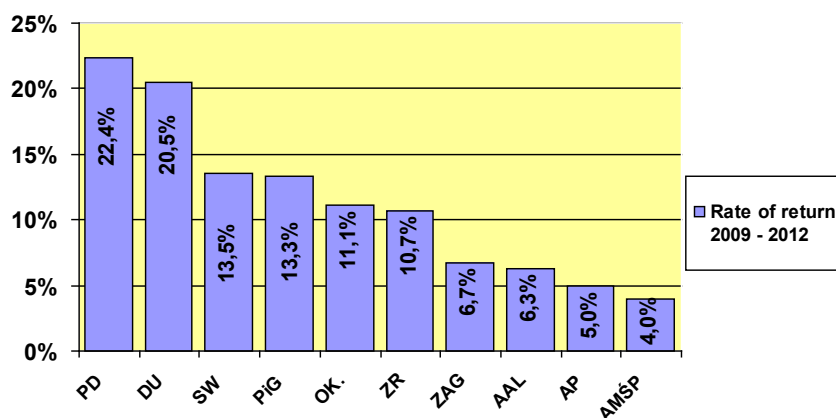
The first part of the analysis concerns the comparison of rates of return for the period 2009–2012 for the selected types of investment funds. The calculations were carried out for investment funds that have been classified, due to the investment strategies used in accordance with the methodology of the Polish Financial Supervision Authority. It is possible to distinguish three main groups of funds. The first group consists of funds that have shares in their portfolios, apply strategies to secure funds; and funds that invest in financial markets abroad, where there is an additional factor in the form of foreign exchange risk. Performance results are presented in the following figure and table.

**Table 1. Rates of return on the TFI market in 2009–2012**

Type of investment fund	Rate of return (in %)
Polish equity funds – AP	5.00
Polish mixed balanced funds – ZR	10.70
Polish SMEs equity funds – AMŚP	4.00
Polish mixed stable growth funds – SW	13.50
Polish bond funds – PD	22.40
Money market funds (PLN) – PiG	13.30
Polish mixed active allocation funds – AAL	6.30
Polish universal debt funds – DU	20.50
Polish capital protection funds – OK	11.10
Foreign markets funds – ZAG	6.70

Source: own calculations based on [www.analizy.pl](http://www.analizy.pl).

**Figure 1. Rates of return on the TFI market in 2009–2012**



Source: own calculations based on [www.analizy.pl](http://www.analizy.pl).

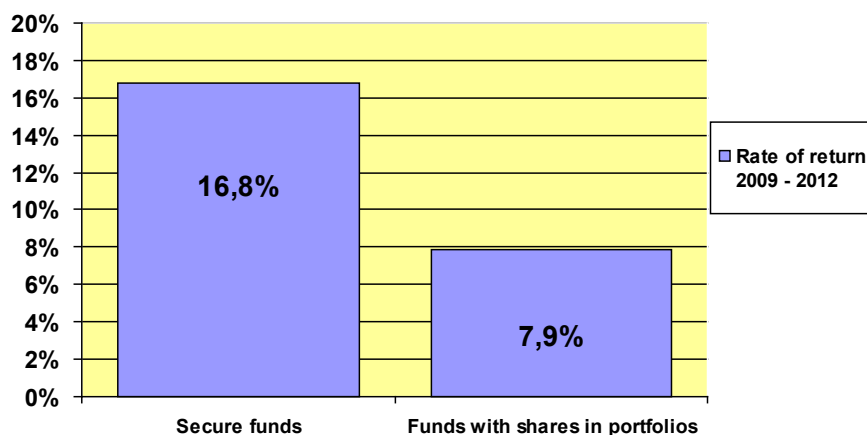
Analysing these data, it should be noted that during the reporting period, the highest rate of return reached the funds, using safe investment strategies. Bond funds and universal debt funds were the only that achieved during the three years the rates of return above 20%, which is significantly higher than the results of other types of funds.

Stable growth funds achieved lower profit by nearly 9 percentage points than the best of the funds. Another funds, that hold shares in their investment portfolios, resulted even worse in comparison with debt funds, respectively: the profit of balanced funds was lower by nearly 12 percentage points, active allocation funds by almost 16 percentage points, Polish equity funds generated a rate of return lower by more than 17 percentage points, while investing in companies in the sector of small and medium-sized enterprises by more than 18 percentage points.

Investing on foreign financial markets also did not brought comparable results with Polish funds based on secure investment strategies. The results of foreign funds were more than 15 points worse for the analysed period.

The figure below presents a comparison of rates of return of the Polish secure funds (bond, universal debt securities, money market funds and capital protection) with returns of funds using strategies with a higher risk (stable growth, balanced, active allocation, Polish equities and Polish SMEs equities).

**Figure 2. Rates of return – secure vs. aggressive funds in 2009–2012**



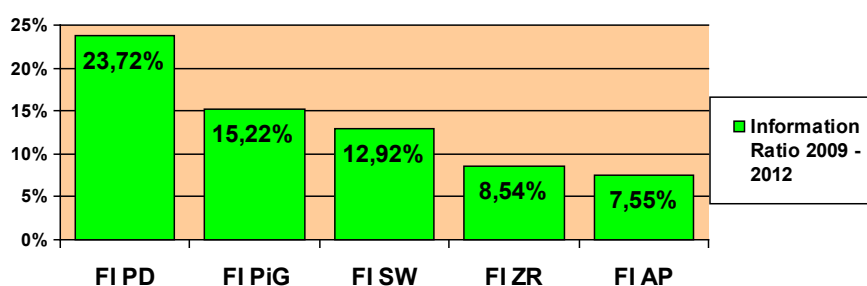
Source: own calculations based on [www.analizy.pl](http://www.analizy.pl).

Secure funds recorded, in the analysed period, rate of return higher more than twice as many funds holding high-risk securities in their portfolios. This is a signal that during the period of uncertainty on financial markets, funds

using strategies involving the protection of the capital achieve higher rates of return.

The second part of the analysis concerns the evaluation of the effectiveness of the funds' investment policy in the relationship between the achieved rates of return and the level of risk. The methodology of calculation was presented in the previous section of the paper. According to the literature, satisfactory level of Information Ratio is at least 50%. The results below this level mean the lack of adequate compensation for the additional investment risk in the form of superior returns. Performance results are presented in the following figure.

**Figure 3. Information Ratio for selected investment funds**



Source: own calculations based on [www.notoria.pl](http://www.notoria.pl) and [www.analizy.pl](http://www.analizy.pl).

Presented data clearly indicates that the efficiency of the investment funds market in the period 2009 - 2012 was unsatisfactory. Incurring additional risk is found to be justified, as the IR indicator exceeds 50%. In this case the efficiency of the investment fund is significantly higher than the market benchmark.

None of the different types of funds reached the level of 50% for IR, even without approaching the number. The secure funds had better results – they achieved IR level above, respectively, 15 and 23 per cent. However, any group of funds with shares in their investment portfolios did not exceed 13%, which should be assessed negatively.

## Summary

Investment funds are important players on financial markets. They act as intermediaries in the process of conversion of savings into investments. Investment funds are institutions of public trust. They play an important role on financial markets, especially on the capital market and as part of a voluntary pension pillar in Poland.

The goal of the paper defined in the introduction has been achieved. The paper presented the essence and role of the funds as financial intermediaries;

it described principles of their operation and legal regulations. The methodology for assessing the effectiveness of investment funds' management of capital entrusted by their clients was also elaborated.

The research hypothesis formulated in the introduction has been rejected. Use of the normal rate of return on investment, as well a joint measure of the risk – return relationship (Information Ratio) could not confirm the higher efficiency of the investment funds, using aggressive asset management strategies compared to secure types of investment funds.

No group of funds generated profits for their clients, significantly exceeding market benchmarks. It's possible to formulate following conclusion, according to which there is a need of significantly improvement in the efficiency of investment policy applied by investment funds.

## References

### Literature

- Chróścicki A. (1998), *Fundusze inwestycyjne i emerytalne*, ABC, Warszawa.
- Dawidowicz D. (2008), *Fundusze inwestycyjne, rodzaje, typy, metody pomiaru i ocena efektywności*, CeDeWu, Warszawa.
- Dobosiewicz Z. (2009), *Wprowadzenie do finansów i bankowości*, PWN, Warszawa.
- Jensen M.C. (1968), *The performance of mutual funds in the period 1945–1964*, "Journal of Finance", May, vol. 23.
- Kothari S.P., Warner J.B. (2001), *The Journal of Finance*, Vol. LVI, No 5.
- Nacewski J., Zabielski K. (2000), *Funkcjonowanie rynków finansowych*, Wydawnictwo Naukowe Wyższej Szkoły Kupieckiej, Łódź.
- Owsiak S. (2002), *Podstawy nauki finansów*, PWE, Warszawa.
- Proniewski M., Niedźwiedzki A. (2002), *Rynek pieniężny i kapitałowy. Podstawy teorii i praktyki*, Wyższa Szkoła Finansów i Zarządzania w Białymstoku, Białystok.
- Sas-Kulczycka K. (red) (1999), *Instytucje wspólnego inwestowania w Polsce*, WIG PRESS, Warszawa.
- Sharpe W.F. (1966), *Mutual fund performance*, "Journal of Business", No. 1.
- Szturo M. (2010), *Rynek usług zarządzania aktywami finansowymi*, CeDeWu, Warszawa.
- Treynor J.L. (1965), *How to rate management of investment funds*, "Harvard Business Review", No. 1.
- Wypych M. (2000), *Finanse i instrumenty finansowe*, Społeczna Wyższa Szkoła Przedsiębiorczości i Zarządzania w Łodzi – Absolwent, Łódź.

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**Legal acts**

The Act of 27 August 2003 on the organization and operation of pension funds, Journal of Laws of 2003 no. 170, item 1651 as amended.

The Act of 25 March 2011 on the amendment of certain laws relating to the operation of the social security system, Journal of Laws of 2011 no. 75, item 398.

The Act of 28 August 1997 on investment funds, Journal of Laws of 1997, no. 139, item 933.

The Act of 23 November 2012 amending the Act on Investment Funds and the Act on the Supervision of Financial Market, Journal of Laws of 2013 no. 0, item 70.

**Electronic bibliography**

[www.analizy.pl](http://www.analizy.pl).

[www.notoria.pl](http://www.notoria.pl).



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## The importance of older people's participation in the financial services market

**Abstract:** The article presents definitions on population aging, characterises the analysed group of population, and discusses selected aspects of its activity in the financial services market. Its purpose has been to determine the importance of the elderly as the users of financial services. As demonstrated, the activity of customers aged 60+ in the financial services market is of significance for various players in this market, as well as from the micro and macro perspective. The hypothesis that this subject area is neither sufficiently known nor recognized has been proved to be true. To improve the situation, financial institutions should analyse in detail the needs of elderly customers to develop targeted products and services, while older people should be more active and use them more often.

**Key-words:** financial services market, elderly people.

### Introduction

One of macroeconomic goals is financial stability that depends, *inter alia*, on the efficiency of the financial system, which is determined by relations between financial intermediaries and their customers. With demographic forecasts predicting an increase in the proportion of the elderly population, people aged 60+ are becoming an important and desired<sup>16</sup> group of customers. Dynamic demographic changes following from the aging of populations [Prognoza 2009, p. 308] are addressed in various fields of science. One of them is gerontology, an interdisciplinary and holistic science combining the elements of biology, psychology, cultural anthropology, sociology, pedagogy, demography,

<sup>16</sup> Most respondents (87%) surveyed by CBOS are of the opinion that society needs older people: *Polacy wobec ludzi starszych i własnej starości. Raport CBOS*, BS/157/2009, Warszawa, p. 1.

medicine (geriatrics) and economics [more: Jurek 2012, Bombol, Słaby 2011, Kleer 2008].

Population aging viewed in terms of public money spend to maintain elderly people and to cater for their needs is called „apocalyptic demography” [Ed. Gee, Gutman 2000, as quoted Golinowska 2012, p. 134]. A more optimistic approach that has been developed in response is called “silver economy”, where supply is adjusted to the needs of older citizens with a view to stimulating the economy and thereby ensuring economic development and growth. In the silver economy, the needs of the aging population are analysed with respect to the assumption that meeting them is beneficial for the public at large, because the process brings new jobs and increases employment [Golinowska 2012, pp. 134–136].

The above facts have caused the author to conclude that the elderly population is as significant and interesting from the theoretical perspective as important for the economy. The public also seems to need more specific information on this subject. The decision to investigate this area followed from a critical review of the literature, which revealed a limited number of studies and publications on the users of financial services aged 60+.

The innovative dimension of the research on the economic aspects of old age is proven by the fact that there are few reports on older customers in the market for lending and investment products offered by banks and unregulated providers, despite the subject becoming increasingly popular (J.K. Solarz indicated that the issue of population aging was raised in 1956 in the publication: *The Aging of Populations and its Economic and Social Implications*, *Population Studies*, United Nations, New York, 26/1956 [Solarz 2012, p. 85]) and attracting more and more researchers. This noticeable gap makes it worthwhile to study the activity of people aged 60+ in the financial services market.

The main purpose of this investigation is therefore to determine the importance of older people’s participation in the financial services market. In accomplishing it, notions related to aging are presented, the analysed group of population is characterised, and problems surrounding its activity in the financial services market are investigated. The presentation starts with a hypothesis that older people’s participation in the financial services market is inadequately recognised and appreciated.

### **Theoretical approaches to old age and the characteristics of the elderly population**

Researchers exploring the population aging issues has been interested so far in developing a definition of aging, finding its characteristics, and determining the chronological age from the perspective of the labour market and healthcare needs. The psychological and social aspects of aging have been studied along-

side biological processes bringing about perceptual, motor, and psychological changes, as well as affecting social roles. To develop aging theories [Modrzejewski 2007, pp. 201–212] accounting for the human psycho-physical condition, life situation and participation in public life the following criteria have been used [Leszczyńska-Rejchert 2005, p. 18]: biological (changes in physiological functions), psychological (changes affecting psychological processes, personality and personal experiences) and socio-economic. The typology of elderly people has been discussed by: B. Barak, L.G. Schiffman, M. Salomon, G. Bamossy, and S. Askegard, G.P. Moschis [Bombol, Słaby 2011, pp. 111–114, Byłok 2013, pp. 124–129].

The disadvantages and advantages of old age have also been studied. The first category includes increased incidence of chronic diseases, reduced physical fitness, the loss of family members and friends, problems with filling free time, a feeling of being useless, and financial problems. The assets of old age are free time to pursue one's interests, life experience and financial resources. The literature on aging offers many theories that explain attitudes held by senior citizens, as well as how they are perceived by the society. These are [Osiecka-Chojnacka 2012, p. 103]:

- the theory of exclusion which holds that aging causes a gradual withdrawal from previous roles and the weakening of emotional ties with the milieu and of vital forces.
- the continuity theory stating that human personality develops over the lifetime, and stressing human adaptability.
- the exchange theory pointing out that health and financial resources decrease while people are growing old, so they withdraw from interactions, e.g. from the labour market, once they discover their productivity to be lower than it used to be.
- the theory of selection, optimisation and compensation according to which good aging can be achieved by selecting the activities one wants to pursue, by acquiring new skills to become more efficient, by optimising performance, and by utilising various devices and equipment.
- the activity theory assuming that involvement in various activities ensures good old age and relatively good health in this period of life.

The theories underpin the active aging concept that recommends redefining one's priorities, giving up some life roles, and seeking new occupational, family and social activities.

The issue of population aging has been addressed by the Community and Member States that have taken measures to create the necessary state structures and to encourage research [The national plan... 2012]. The European Union designated the year 2012 as the European Year for Active

Aging and Solidarity Between Generations to give prominence to the fact that Europe needs to promote a culture of activity of the older population and to foster the development of societies embracing all age groups [Active Ageing... 2012]. The challenges of population aging have also been addressed in the strategic part of the Polish presidency's programme in the EU Council. Major UN documents on the elderly people include the Vienna International Plan of Action on Aging (Vienna 1982) and the Madrid International Plan of Action on Ageing (Madrid 2002). In Poland, following the decision of the President of the Council of Ministers of 16 August 2012 the Department of Senior Policy was established as part of the Ministry of Labour and Social Policy. Its responsibilities range from setting the objectives and developing measures for senior citizens to the coordination of the Government Programme for Senior Citizens' Social Activity 2012-2013<sup>17</sup>. The third activity in this field, enhancing the preparation of documents on aging and the creation of institutions to actively respond to its aspects, has been studies conducted by institutions such as the Eurobarometer, the Public Opinion Research Centre [CBOS report 2012] (CBOS), Pol-Senior [Błędowski, Mossakowska, Więcek 2011] and National Bank of Poland.

Old age, particularly active aging, is studied from many scientific perspectives which leads to the creation of various theoretical approaches explaining its nature. A more practical interest in aging can also be observed to increase. Even so, the literature offers few studies on the activity of consumers aged 60+ in the financial services market, despite their growing significance for this market. This new role of older consumers makes financial institutions face the challenge of winning them for their business and of answering the question about what satisfying and fulfilling services can be offered to them so that their relatively unrecognised potential can be exploited.

Different resources, life experiences, social and occupational roles, as well as outlooks on life make seniors a heterogeneous group. They also differ in respect of demographic and socio-economic attributes and market activity. The Polish GUS' *Household Budgets* reports investigating households' levels of incomes, expenditures and poverty show those run by old age pensioners to have a relatively good situation compared with their other types, which makes them an interesting target group for financial intermediaries. The main source of livelihood of seniors is old age pension, while savings and gains from investments and deposits are rather infrequent. This means that the financial market should consider taking measures to develop lending and investment products addressed to seniors and consistent with their profile (table 1).

<sup>17</sup> The regulation no 68 by the President of the Council of Ministers of 16 August 2012 granting a statute to the Ministry of Labour and Social Policy (Monitor Polski of 17 Aug. 2012, item. 590). Ombudsman's regulation no. 8 of 2011 establishing Ombudsman's Commission of Experts for Older People.

**Table 1. The sources of livelihood of respondents drawing old age pensions (N=297), whether primary or secondary (%)**

What is your present source of livelihood, whether primary or secondary:	Yes	No
Old age pension	89	10
Assistance from family members (children and relatives)	12	88
Savings	9	90
Disability pension	6	94
Farm	5	95
Family pension	4	96
Odd jobs	4	96
Maintained by a spouse	4	96
Steady employment	3	97
Own-account employment	2	98
Additional life insurance (III pillar)	2	98
Revenue from investments and deposits	1	99
Social welfare benefit	1	99
Revenue from rented space (a flat or a house)	1	99
Others	1	99

Source: *Sytuacja ludzi starszych w społeczeństwie-plany a rzeczywistość. Raport CBOS*, BS/160/2009, p. 7.

The functioning of customers aged 60+ in the financial market depends on the availability of anti-usury laws and macro-stability tools (e.g. caps on the loan-to-value ratio (LtV) or the debt-to-loan ratio (DtL)), responsible lending rules, the protection of consumers' economic interests and the prevention of financial exclusion. In analysing the activity of this group of customers in the financial services market lending products offered by banks and unregulated financial intermediaries and their take up must also be considered, because this approach allows the potential of older consumers and their activity in that market to be determined vis-à-vis the identified barriers. It also enables the effectiveness of the existing instruments to be assessed and the optimal policy in this area to be defined. Moreover, in investigating consumer lending activity the perspective of both banks and unregulated financial intermediaries must be taken into account. These issues are relatively new and important for financial stability, but at the same time outside the scope of banking supervision, so the results of their analysis will have major practical implications [Kotliński, Waliszewski (eds) 2012, pp. 175-191].

## **2. The reasons why customers aged 60+ should be active in the financial services market**

Making financial intermediaries enable people aged 60+ to have appropriate and safe access to finance seems vital not only from the microeconomic per-

spective, i.e. the ability of these customers to afford the purchase of various goods, but also for the progress of civilisation, because instead of being viewed only through the public finances' costs of their maintenance, the elderly and their needs will be recognised as a factor in economic development.

The above means that older people's activity in financial markets is a socially important and topical issue. At the same time, it is relatively new and little unrecognised by theory and practice. What makes it worth exploring is its demographic, as well as economic and social impacts. If a positive view on old age is to be taken, then it should not be perceived as a period of stagnation, but as another part of the lifetime when people are aware, have the basic knowledge of consumer technology, and are active, also in the banking services market.

With the aging of population it becomes necessary to develop products addressing the special needs of older consumers. Another reason why these products should be delivered is that the activity is in line with the sustainable development and corporate social responsibility (CSR) concepts implemented by financial institutions (including banks). The concepts take account of environmental and social demands without compromising the business side. Their elements are, respectively, economic growth based on stronger social cohesion, reduction in social stratification, elimination of discriminatory practices and marginalisation, and initiatives serving the public good and enhancing the image of institutions attentive to human needs.

The public dimension of the banking intermediation business means that the providers of financial services should contribute to solving social problems in a manner respecting economic security, for instance by providing customers aged 60+ with access to finance. This implies that the concept of financial sustainability stemming from the concept of sustainable development extends also to relations between financial institutions, particularly between banks and customers aged 60+ that deserve special treatment because of their attributes (attachment to solutions they already know, insufficient knowledge, problems with understanding legal procedures and specialist financial terminology, expectation of direct interaction with the provider's staff, etc.) that expose them to greater risks. These unique attributes and the awareness that these consumers may be uninformed, careless, imprudent and susceptible to unfair business practices result in the tightening up of regulations serving the protection of their interests and preventing unfair competition. The legal system offers extended protection to consumers meeting special criteria, such as age, that make them a vulnerable group, exposed or prone to harm [Brocklenhurst, Laurenson 2008, p. 1354, as quoted Mikołajczyk 2012, p. 37].

There are many tools that businessmen can use to influence the behaviour of their customers, i.e. marketing and selling techniques, or mislead-

ing, aggressive market practices or advertisements. In addition to unfair business practices, the financial services market is also troubled by ageism [Mikołajczyk 2012, pp. 37–54] that usually takes the form of refusal to lend to those deemed too old. Financial exclusion of population can be measured with access to saving instruments or the possession of a bank account that are the least frequent among old age pensioners and people aged 65+ [Solarz 2012, pp. 30–34] (see table 2). The reasons why people in this age group do not have bank accounts may be related to various forms of financial exclusion [Solarz 2012, p. 33], such as spatial exclusion caused by the remote location of a banking establishment; business exclusion arising from some segment of customers being rejected upfront because of the implemented business model; cost exclusion appearing when the cost of a service is not affordable; quality exclusion in cases when products and services fall short of customers' expectations; and self-exclusion determined by people's belief that products and services for individuals with low social status are not available.

**Table 2. The socio-demographic characteristics of the holders of checking accounts (CA) (%)**

Socio-demographic characteristic	CA holders	Non-holders of CA
<24	70	30
25-34	93	7
35-44	96	4
45-54	88	12
55-64	68	32
65>	43	57
Old age pensioner	50	50
Disability pensioner	54	46
Pupil, student	59	41
Unemployed	69	31
Farmer	83	17
Manual worker	90	10
Entrepreneur	93	7
Specialist	98	2
Office employee	99	1

Source: J.K. Solarz, *Nowi wykluczeni. Ryzyko finansowe codzienności*, *Studia i Monografie*, Łódź-Warszawa 2012, SAN, pp. 28–29.

Not only do older people frequently feel that the banking system does not appreciate them, but also that it mistreats and discriminates them. The complaints that consumers lodge with the Polish Ombudsman's office every year confirm that it is really so. While admitting that banks are free to make busi-

ness decisions, the Ombudsman has stressed that ageism violates the constitutional principle of human equality and dignity, so it is unacceptable<sup>18</sup>. Complaints are filed by consumers who were denied access to banking products on the grounds of age, which caused their financial exclusion and prevented them from fully participating in economic activity, ultimately leading to social exclusion. To counteract these practices, preventive measures addressed to banks and consumers aged 60+ are proposed, such as codes of ethics, good market practices, certificates for banks friendly to older customers, educational programmes, the appointment of banks' representatives for older customers, changes in regulations restricting lending.

Better relations between customers aged 60+ and financial intermediaries would be advantageous for both sides. Being reliable and predictable, with regular incomes and paying their debts on time, older customers have the potential to become a factor driving the growth of the banking sector. Granted access to banking services they can not only purchase various goods and live better lives, but also take active part in the life of their communities, develop personally, live active lives, and use new technologies.

However, if both parties are to be satisfied, the banking institutions must bear in mind that these customers are a unique group that has special needs and concerns that must be well understood before banking products and services targeted to their needs can be developed. On the other hand, older people should be active, trust in the banking system, and be ready to handle new challenges, such as the use of new technologies.

Investigating older persons' participation in the financial services market is important for further development of the field of finance, because the findings can show how to make the financial system more effective by ensuring a better match between financial services and the needs of the expanding segment of customers aged 60+. Financial intermediaries will also benefit from this research, because they will be shown why this group of customers should be provided with access to finance and the benefits of doing so. As far as customers aged 60+ are concerned, they will be able to understand how to seek funds from financial intermediaries according to the rules of ethics and consumer protection.

Last but not least, the findings of the research will be also important for the supervisory authorities and the law-making bodies, because the knowledge of older people's activity in the lending market and of the barriers they face will allow selecting mechanisms capable of eliminating the exclusion or discrimina-

<sup>18</sup> Sytuacja osób starszych, jako konsumentów na rynku usług bankowych, Zespół Prawa Administracyjnego i Gospodarczego Ombudsman's Office. Art. 32 of the Constitution of the Republic of Poland All persons shall be equal before the law. All persons shall have the right to equal treatment by public authorities. 2. No one shall be discriminated against in political, social or economic life for any reason whatsoever. As quoted in Ombudsman's report, *Osoby starsze, jako konsumenci na rynku usług bankowych*, 23 Jan. 2012, Ombudsman's Office.

tion of older people and thereby of increasing their trust in the financial sector, which is particularly important in times when financial stability is at risk.

The undertaking of research with a view to creating a commercial financial system that will allow an increasing group of aging customers to stay active is also important for the advancement of civilisation, as it is said that people do not grow old but become old when they stop to develop and be active. This means that the research should aim to gain new knowledge for creating a society embracing all age groups, where older people will be neither discriminated nor excluded, and where their activity and the resulting demand will be important factors in economic development.

## Conclusions

The above analysis of older people's participation in the financial services market has been undertaken to demonstrate that this subject is insufficiently known and recognised. The conclusion arising from the discussion is that this hypothesis is true. A more general conclusion offered by the review of issues in population aging, which presents a major challenge for governments, financial intermediaries, and communities, performed with regard to the seniors' use of financial services is that neither their providers nor their users are active enough given the scale of available opportunities. This finding is strong enough to try to modify the present attitudes of financial service providers and customers aged 60+. A banking sector evolving in this direction will be more effective financially and socially, and so its development will be more dynamic.

## Bibliography

- Błędowski P., Mossakowska M., Więcek A. (2011), *Projekt badawczy PolSenior, Aspekty medyczne, psychologiczne, socjologiczne i ekonomiczne starzenia się ludzi w Polsce 2011 r.*, Międzynarodowy Instytut Biologii i Molekularnej i Komórkowej.
- Bombol M., Słaby T. (2011), *Konsument 55+ wyzwaniem dla rynku*, Oficyna wydawnicza SGH w Warszawie, Warszawa.
- Brocklenhurst H., Laurenson M., (2008), *A Concept Analysis Examining the Vulnerability of older people*, "British Journal of Nursing", vol.17, nr 21.
- Byłok F. (2013), *Strategia zachowań konsumpcyjnych seniorów na rynku dóbr i usług konsumpcyjnych*, Problemy Zarządzania Wydział Zarządzania UW, Warszawa, vol. 11 nr. 1 (40), t. 1.
- Golinowska S. (2012), *Srebrna gospodarka-ekonomiczny wymiar procesu starzenia się populacji* [w:] *Strategie działania w starzejącym się społeczeństwie, Tezy i rekomendacje*, Rzecznik PO, Warszawa.
- Jurek Ł. (2012), *Ekonomia starzejącego się społeczeństwa*, Difin, Warszawa.

- Kleer J. (red.) (2008), *Konsekwencje ekonomiczne i społeczne starzenia się społeczeństwa*, Polska Akademia Nauk Komitet Prognoz, „Polska 2000 PLUS”, Warszawa.
- Kotliński G., Waliszewski K. (red.) (2012), *Instytucje para bankowe na rynku usług bankowych w Polsce*, CeDeWu.pl. Warszawa.
- Leszczyńska-Rejchert A. (2005), *Człowiek stary i jego wspomaganie w stronę pedagogiki starości*, Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego, Olsztyn.
- Mikołajczyk B. (2012), *Międzynarodowa ochrona praw osób starszych*, LEX a Wolters Kluwer business, Warszawa.
- Modrzejewski J. (2007), *Socjalizacja i uczestnictwo społeczne. Studium socjopedagogiczne*, Wyd. Uniwersytetu im. A. Mickiewicza, Poznań.
- Osiecka-Chojnacka J. (2012), *Społeczne opinie o starości a wdrażanie idei aktywnego starzenia się*, Studia BAS, nr 2 (30), ([www.bas.sejm.gov](http://www.bas.sejm.gov)).
- Solarz J.K. (2012), *Nowi wykluczeni. Ryzyko finansowe codzienności*, „Studia i Monografie” nr 37, Łódź-Warszawa, SAN.
- The Overselling of Population Aging: Apocalyptic Demography, Intergenerational Challenges and Social Policy*(2000), Ed. E.M. Gee, G.Gutman, Toronto, Oxford University Press.
- Active Ageing* (2012), Report, Special Eurobarometer 378, European Commission, nr 1.
- The national plan of activities in support of the European Year for Active Aging and Solidarity Between Generations of 2012* (2012), Ministerstwo Pracy i Polityki Społecznej.
- Opinie o podniesieniu wieku i zmianach w systemie emerytalnym* (2012), Raport CBOS BS/40, Warszawa.
- Polacy wobec ludzi starszych i własnej starości* (2009), Raport CBOS, BS/157/, Warszawa.
- Prognoza ludności na lata 2008–2035* (2009), GUS, Warszawa.
- Sytuacja ludzi starszych w społeczeństwie-plany a rzeczywistość* (2009), *Komunikat z badań. Raport CBOS*, BS/160, Warszawa.
- Sytuacja osób starszych, jako konsumentów na rynku usług bankowych*, Zespół Prawa Administracyjnego i Gospodarczego BRPO, [https://www.rpo.gov.pl/sites/default/files/13279229450\\_0.pdf](https://www.rpo.gov.pl/sites/default/files/13279229450_0.pdf) (10.10.2013)
- The Aging of Populations and its Economic and Social Implications, Population Studies* (1956), United Nations, New York, nr 26.
- Konstytucja Rzeczypospolitej Polskiej z 2 kwietnia 1997.
- The regulation no 68 by the President of the Council of Ministers of 16 August 2012 *granting a statute to the Ministry of Labour and Social Policy* (“Monitor Polski” of 17 Aug. 2012, item. 590).

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Ombudsman's regulation no. 8 of 2011 *establishing Ombudsman's Commission of Experts for Older People*, [http://www.rpo.gov.pl/sites/default/files/Zarzadzenie\\_nr\\_8\\_2011.pdf](http://www.rpo.gov.pl/sites/default/files/Zarzadzenie_nr_8_2011.pdf) (30.10.2013).



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## Optimization of investment management in Warsaw stock market

**Abstract:** Application of simple prescriptions of technical analysis on the Warsaw Exchange Market (GPW) has been analyzed using several stocks belonging to WIG20 group as examples. Only long positions have been considered. Three well-known technical-analysis indicators of the market have been investigated: the Donchian channels, the Relative Strength Index, and Moving Average Convergence-Divergence indicator. Optimal values of parameters of those indicators have been found by „brute force” evaluation of (linear) returns. It has been found that trading based on both Donchian channels and Relative Strength Index easily outperform the „buy and hold” strategy if supplied with optimal values of parameters. However, those optimal values are by now means universal in the sense that they depend on particular stocks, and are functions of time. The optimal management of capital in the stock market strongly depends on the time perspective of trading. Finally, it has been argued that the criticism of technical analysis which is often delivered by academic quantitative financial science is unjustified as based of false premises.

**Key-words:** Warsaw Exchange Markets, technical analysis, indicators of the market.

## Introduction

The problem of optimization of management of investments in financial markets belongs, needless to say, to those of paramount importance for quantitative financial sciences. Among the methods which have long been applied to increase profitability of investments, one can mention, among the most popular, those associated with the terms „fundamental analysis” and „technical analysis”. Both are popular among the traders, and both have attracted interest of researchers. In particular, the role of technical analysis in trading in the stock market has been highly controversial. On one hand, it has very often been declared as a kind „pseudoscience”, which, because of the incorrectness of its most important principles, cannot and does not lead to any sustainable increase of returns above the market level [Malkiel 1981, Fama and Blume 1966]. On the other hand, there is also a tendency among many practicing traders to appear technical analysis blindly, without any serious knowledge about the market dynamics. The second tendency is a matter which is beyond the scope of this work. Below we shall, however, address the first one.

One may first of all observe that any long-standing successful trading with the help of technical analysis could, in principle, be considered a strong argument against its adversaries. But that assertion would be too hasty and simplistic. Indeed, the statements of great efficiency of technical analysis usually come from the people whose claims cannot be verified because their behavior at the stock market cannot be traced in full detail, and it is not clear whether their declarations about their usage of technical analysis tools are reliable even though they may be sincere. More importantly, technical analysis has been criticized for its failure to recognize that the markets, or at least the mature markets, are close to being efficient, and their dynamics closely resembles fully random walks without any significant correlations. In short, one cannot make any predictions.

Against such statement we would like to provide two arguments. Firstly, the statement about the random-walk character of the dynamics of stock market prices have long been falsified [please see, e.g. Lo and McKinley 1988]. Secondly, the technical analysis has inherently *local* character in both time and „space”. Indeed, the time horizon of many traders does not exceeds several years, or in the best case, several decades. What is more, there is almost not a single trader who would „test” *all* the assets on the stock market. No more than several tens of them are involved. Therefore, investigations of the value of technical analysis which attempt to take into account as huge amount of data as possible using heave apparatus of statistics completely miss the point even though in several case they seem, perhaps somewhat surprisingly, vindicate the technical analysis [please see, e.g. Brock, Lakonishok and LeBaron 1992; Allen and Karjalainen 1999; Lo, Mamayski and Wang 2000]. As all other fields of

human activity, the technical analysis should be considered and its value tested as it is really applied, and not as academic researchers imagine it should.

In addition, it is of critical importance that, according to surveys, technical analysis is used by the fund managers, both small and large ones. This means that the technical analysis actually *does* influence the very dynamics of the market that is a subject of the science of financial market, and as such, must be considered seriously. We would like to mention here that we have read many times complaints of small-scale traders who say that the price of such or that stock behaves as if some big players just wanted the technical-analysis indicators to work or to remain valid. And should science take into account hearsay? Yes, when hearsay does drive the events which are under investigations. Such a process does indeed happen in financial markets.

In this contribution we provide results of our investigations regarding the applicability of three simple indicators of technical analysis: the Donchian channels (DC), Relative Strength Index (RSI) and Moving Average Convergence-Divergence (MACD), the latter in two variants which differ in how the buy and sell signals are defined.

They have been chosen for two reasons: firstly, they are reasonably popular among traders. Secondly, the trading rules are unambiguous and straightforward. We hasten to state that our approach is also an idealization. It happens very rarely that a trader uses just one of the indicators in his or her investments. However, we feel that some degree of idealization has been necessary at this stage.

Twenty stocks of the Warsaw Exchange Market have been chosen to illustrate the results of optimization. Their advantage is that while not all of them belong to the most popular trading stocks, they all form the group of Polish „blue chips”, i.e. the WIG20 group.

The main body of our work is organized as follows. In Section 2 we provide a short description of the three indicators considered here. Section 3 consists of our qualitative results regarding the optimized parameters and their dependence of time and stock. Section 4 contains the discussion and some concluding remarks.

### **Donchian Channels, Relative Strength Index and Moving Average Convergence-Divergence**

The Donchian channels have been introduced by Richard Donchian in the sixties. According to Farlex Financial Dictionary [Farlex, 2012], Donchian Channels „consist of two moving averages stating the highest high [i.e. maximum, JOW] and the lowest low [i.e. Minimum, JOW] for a security over the desired time period. The highest high and the lowest low are each replaced as the previous ones move out of the current time period. According to this device, a buy

signal occurs if the price of a security closes above the current highest high and a sell signal occurs if it closes below the lowest low.” The space between the moving averages is called the „channel”. Let us notice here that both the indicator itself and the trading signals are both extremely simple. Also, let us stress the signals appear to be counterintuitive: one has to buy when the prices are „high” and sell when they are „low”. The rationale behind is that the Donchian channels are meant to be a trend-following devices: when the price crosses the highest maximum in a certain time period from below, this may be a beginning of an upward trend; when the price crosses the lowest minimum (in a time period) from above, this may signal the downward trend. In addition, the lowest low of  $n$  periods can serve as a stop loss for the trader.

The Donchian channel indicator has three parameters: the period  $I$  of which the highest maximum is calculated, the period  $J$  of which the lowest minimum is calculated, and  $M$  – the time (in market sessions) after which the position is unconditionally exited – that is, the securities are all sold.

Donchian himself recommended to take  $I = 20$ ,  $J = 10$ ,  $M = 80$ , and those values are usually considered standard (they will be called thus in the following).

The Relative Strength Index [Murphy 1999, Kaufman 2013] attempts to give quantitative meaning to the intuitive notion of the „strength” of a stock. The security is „strong” if its price tends to grow in period of time, and it is „weak” if its price tends to decrease in the same period of time. Quantification of that idea is performed via the following procedure:

1. For each trading day  $n$  in a given period of  $M$  days, one defines  $U_n$  as  $C_n - C_{n-1}$  if  $C_n > C_{n-1}$  and zero otherwise. Similarly, one defines  $V_n$  as  $C_{n-1} - C_n$  if  $C_n < C_{n-1}$  and zero otherwise.  $C_n$  means here the closing price on the day  $n$ .
2. One calculates exponential moving averages  $E_{U,M}$  and  $E_{V,M}$  in considered period for both  $U_n$  and  $V_n$ .
3. The relative strength factor  $RS$  is then calculated as the ratio:  $E_{U,N} / E_{V,N}$ .
4. Finally, the strength factor is converted so that it takes values from 0 to 100.  $RSI = 100 ( 1 - 1/(1 + RS) )$ .

The latter quantity is called the relative strength index. Taking the value 30 or less by RSI is usually considered to be buy signal, while taking the value 70 or above is considered to be a sell signal. Other pair of values, like (20, 80) can also be found in the trading literature. In our simulations, we optimized three parameters of RSI: the value which gives the buy signal  $I$ , the values which provides the sell signal  $J$ , and the period  $M$  over which the exponential moving averages are computed. Thus,  $RSI = RSI(I, J, M)$ . The case of  $I = 30$ ,  $J = 70$  and  $M = 14$  will be called *standard*.

Finally, the MACD indicator is usually defined as follows [Murphy 1999, Kaufman 2013]: Let  $EMA(n)$  denotes the exponential moving average of last  $n$  closing prices with the weighting factor  $\alpha = 1 - 2 / (n + 1)$ . Then the MACD

indicator is defined as  $EMA(EMA(I) - EMA(J), M)$ . Two elementary ways of using MACD can be found in practice of trading: (1) Crossing of MACD the value 0 from below is a buy signal (entering long position) while crossing that value from above is a sell signal – in the following, we shall call the trading based on the above rule simply as “MACD trading”; (2) Passing of MACD indicator through a lower-than-zero (local) minimum is a buy signal, while its passing through a larger-than-zero (local) maximum is a sell signal – we shall call the trading method based on the second rule as “modified MACD trading”.

Needless to say, the triples  $(I, J, M)$  have completely different meaning in the above three indicators.

### Results of simulations

We have performed simulations for the securities traded in the Warsaw Exchange Market (GWP) belonging to the groups which has been used to calculate WIG20 index. These are: ASSECOPOL, BOGDANKA, BZWBK, EUROCASH, GTC, HANDLOWY, JSW, KERNEL, KGHM, LOTOS, MBANK, PEKAO, PGE, PGNIG, PKNORLEN, PKOBP, PZU, SYNTHOS, TAURONPE, and TPSA. Optimal values of  $(I, J, M)$  in the case of the Donchian channel, RSI indicator as well as two variants of MACD-based trading have been found by straightforward evaluation of returns. The values  $I$  and  $J$  in the case of RSI are actually real (i.e. continuous, not discrete). However, for simplicity of the optimization procedure they have been considered as integers, as is the common practice in the technical analysis. Time periods of the optimization have been equal to the total times of trading of a given security in GPW. It has been assumed that the cash in hands of the simulated trader has initially been equal to 10,000 PLN. The costs of every cell or buy would be set equal to 0.38% of the transaction value (this is a recent standard in Polish broker houses).

The results are contained in the following tables:

#### 1. ASSECOPOL (3908 trading sessions)

**Table 1. Optimal values of parameters as well as final values of assets for Assecopol stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	35	8	39	6
	J	5	92	74	7
	M	62	8	36	5
	Final value of assets	114749.01	62565.64	39138.68	34451.11

Source: own calculations.

## 2. BOGDANKA (1136 trading sessions)

**Table 2. The same as in Table 1 but for the Bogdanka stocks**

Trading method					
Optimal value		Donchian channels	RSI	MACD	MACD modified
	I	5	29	11	22
	J	26	77	56	74
	M	77	10	5	20
	Final value of assets	27831.50	27227.62	24781.31	18293.17

Source: own calculations.

## 3. BZWBK (5017 trading session)

**Table 3. Optimal values of parameters as well as final values of assets for BZWBK stocks**

Trading method					
Optimal value		Donchian channels	RSI	MACD	MACD modified
	I	3	39	10	14
	J	22	97	18	44
	M	50	6	7	2
	Final value of assets	762820.03	852610.89	136253.21	1002823.20

Source: own calculations.

## 4. EUROCASH (2230 trading sessions)

**Table 4. Optimal values of parameters as well as final values of assets for EUROCASH stocks**

Trading method					
Optimal value		Donchian channels	RSI	MACD	MACD modified
	I	7	22	19	3
	J	31	24	21	35
	M	65	75	18	62
	Final value of assets	104984.15	364294.33	36832.79	52327.94

Source: own calculations.

## 5. GTC (2425 trading sessions)

**Table 5. Optimal values of parameters as well as final values of assets for GTC stocks**

Optimal value		Trading method			
		Donchian channels	RSI	MACD	MACD modified
	I	12	14	34	30
	J	15	64	96	94
	M	79	6	32	2
	Final value of assets	26751.93	25554.88	20970.78	10645.59

Source: own calculations.

## 6. HANDLOWY (4136 trading sessions)

**Table 6. Optimal values of parameters as well as final values of assets for HANDLOWY stocks**

Optimal value		Trading method			
		Donchian channels	RSI	MACD	MACD modified
	I	20	25	34	3
	J	23	81	65	35
	M	53	19	9	62
	Final value of assets	92239.70	89981.12	38446.39	55503.22

Source: own calculations.

## 7. JSW (623 trading sessions)

**Table 7. Optimal values of parameters as well as final values of assets for JSW stocks**

Optimal value		Trading method			
		Donchian channels	RSI	MACD	MACD modified
	I	23	22	3	3
	J	25	24	35	35
	M	79	75	62	62
	Final value of assets	11910.00	15216.70	9915.87	9172.28

Source: own calculations.

## 8. KERNEL (1528 trading sessions)

**Table 8. Optimal values of parameters as well as final values of assets for KERNEL stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	3	4	9	3
	J	38	99	74	4
	M	73	5	6	2
	Final value of assets	27544.51	22839.28	35856.60	23703.34

Source: own calculations.

## 9. KGHM (4130 trading sessions)

**Table 9. Optimal values of parameters as well as final values of assets for KGHM stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	18	10	39	20
	J	20	95	62	35
	M	63	7	11	8
	Final value of assets	186221.43	397272.15	194471.18	15829.92

Source: own calculations.

## 10. LOTOS (2149 trading sessions)

**Table 10. Optimal values of parameters as well as final values of assets for LOTOS stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	18	22	3	3
	J	15	24	35	35
	M	59	75	62	62
	Final value of assets	49481.33	81626.27	22047.01	29191.29

Source: own calculations.

## 11. MBANK (5120 trading sessions)

**Table 11. Optimal values of parameters as well as final values of assets for MBANK stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	5	22	3	3
	J	28	24	35	35
	M	41	75	62	62
	Final value of assets	2565292.43	1998540.30	2325744.08	150331.19

Source: own calculations.

## 12. PEKAO (3891 trading sessions)

**Table 12. Optimal values of parameters as well as final values of assets for PEKAO stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	6	20	39	28
	J	40	80	78	98
	M	50	12	32	25
	Final value of assets	35905.75	296552.12	19569.77	23496.80

Source: own calculations.

## 13. PGE (1040 trading sessions)

**Table 13. Optimal values of parameters as well as final values of assets for PGE stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	5	19	30	39
	J	35	81	40	73
	M	57	2	28	38
	Final value of assets	11187.84	16559.23	11682.71	10869.26

Source: own calculations.

## 14. PGNIG (2074 trading sessions)

**Table 14. Optimal values of parameters as well as final values of assets for PGNIG stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	7	14	12	32
	J	38	90	23	34
	M	76	3	10	12
	Final value of assets	11328.94	42090.02	11690.10	15378.79

Source: own calculations.

## 15. PKNORLEN (3535 trading sessions)

**Table 15. Optimal values of parameters as well as final values of assets for PKNORLEN stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	26	37	29	27
	J	16	71	30	99
	M	53	14	26	2
	Final value of assets	17285.73	51896.76	7527.94	18989.61

Source: own calculations.

## 16. PKOBP (2294 trading sessions)

**Table 16. Optimal values of parameters as well as final values of assets for PKOBP stocks**

Optimal value		Trading method			
		Donchian channels	RSI	MACD	MACD modified
	I	16	33	37	38
	J	32	75	93	92
	M	73	21	21	36
	Final value of assets	30307.10	41116.70	19303.52	21680.69

Source: own calculations.

## 17. PZU (914 trading sessions)

**Table 17. Optimal values of parameters as well as final values of assets for PZU stocks**

Optimal value		Trading method			
		Donchian channels	RSI	MACD	MACD modified
	I	11	28	32	3
	J	26	77	72	4
	M	51	7	21	2
	Final value of assets	14580.80	20089.05	13295.70	11613.98

Source: own calculations.

## 18. SYNTHOS (2267 trading sessions)

**Table 18. Optimal values of parameters as well as final values of assets for SYNTHOS stocks**

Optimal value		Trading method			
		Donchian channels	RSI	MACD	MACD modified
	I	39	22	3	3
	J	32	24	35	35
	M	80	75	62	62
	Final value of assets	197823.08	216143.30	120661.35	97890.31

Source: own calculations.

## 19. TAURONPE (880 sessions)

**Table 19. Optimal values of parameters as well as final values of assets for TAURONPE stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	24	25	11	3
	J	40	73	26	4
	M	80	12	8	2
	Final value of assets	13558.21	18523.56	11880.63	14115.00

Source: own calculations.

## 20. TPSA (3791 trading sessions)

**Table 20. Optimal values of parameters as well as final values of assets for TPSA stocks**

Optimal value	Trading method				
		Donchian channels	RSI	MACD	MACD modified
	I	32	20	38	37
	J	38	83	86	54
	M	49	8	32	9
	Final value of assets	28316.83	33474.49	10702.80	6714.83

Source: own calculations.

All simulations leading to the above results has been performed using a home-made program written in Python. As the numerics has been rather simple, no special numerical packages except of the module Numpy have been used.

**Discussion**

Probably the most remarkable feature of the above data is that the optimal values of both DC and RSI parameters are completely different from the standard ones. Only the parameter *M* of the Donchian channel strategy (which gives the number of trading days after which the trader receives a signal of unconditional exit) in most cases comes close to the standard value of 80. What is also striking and strongly counterintuitive is that in most case the value of *J* is larger than that of *I*. This is counterintuitive because during the downward trends the prices decrease much faster than they increase during the upward trend.

As for the trading based on the Relative Value Index, let us first of all observe that the optimal number  $M$  is in most cases smaller than standard 14. It appears that in our stocks the optimal value of  $M$  favors strongly a short-time, even swing-like trading if indeed the latter is to be based on RSI. Another remarkable feature of the data provided in Tables 1-20 is that the maximal returns, are in several cases larger if DC-based strategy is used when compared to RSI-based strategies. This is again quite counterintuitive because DC-based trading appears to go exactly against the well-known saying „buy cheap and sell expensive”. Of course, this is just an appearance: trading using Donchian channels is an excellent method to follow a trend if a strong upward trend appears.

In addition, we have observed that the optimized strategies crushingly outperform both their standard counterparts and „buy and hold” strategy. Sometimes the difference may be of two orders of magnitude. What is particularly interesting is the very poor performance of the standard RSI trading system. For instance, in the ASSECOPOL case it can lead to almost catastrophic losses if unsupported by any other trading rule (3043.99 PLN made of initial 10000.00 PLN). One reason for that is the fact that RSI-based system does not possess any stop loss on its own, unlike DC-based system. On the other hand, optimal usage of RSI strategy can also lead to spectacular profits, as can also be seen from the Tables above. In general, both DC-based and RSI-based trading system bring better results than simple applications of MACD investigated here.

Let us stress that trading strategies considered make only very elementary attempts to really predict the future market behavior are made. DC-based strategy attempts to guess the appearance of upward and downward trends. RSI attempts to guess closeness to the upward and downward turning points.

The latter statement is also true about MACD-based methods. But these strategies as well as, in fact, all other technical-analysis systems, do not make any quantitative assumptions about possible correlations.

One might argue, however, that our findings are devastating for technical analysis. Indeed the standard recommendations regarding DC and RSI parameters appeared to be disproved, or at least shown to be very far from universal. And, needless to say, the optimal values of parameters can only be known *a posteriori*. The following questions naturally appear: can one obtain large (that is, far exceeding those provided by „buy and hold” strategy) returns if one reevaluates the optimal values of, say DC or RSI after some period of time so that the trading system is being updated with a particular frequency? Secondly, do there exist any reasonably stable islands of suboptimal values of parameters? Thirdly, can one find optimal or suboptimal islands of parameters in a portfolio of securities rather than single stocks? Work is in progress to find answers to the above questions which will be reported in a future publication.

Finally, let us note that the time evolution of stock market prices can be, and is, a subject of econometric and econophysical analyses. This matter, however, is obviously beyond the scope of the present paper.

## References

- Allen F., Karjalainen R. (1999), *Using genetic algorithms to find technical trading rules*, "Journal of Financial Economics", 51, pp. 245–271.
- Brock W., Lakonishok J., LeBaron B. (1992), *Simple Technical Trading Rules and the Stochastic Properties of Stock Returns*, "Journal of Finance", 47, pp. 1731–1764.
- Fama E.F., Blume M. (1966), *Filter Rules and Stock-Market Trading*, "Journal of Business", 39, pp. 226–241.
- Farlex (2012), Farlex Financial Dictionary, <http://financial-dictionary.thefreedictionary.com/Donchian+channel>.
- Kaufman P.J. (2013), *Trading Systems and Methods*, Wiley, New York.
- Lo A.W., MacKinley A.C. (1988), *Stock Market Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test*, "Review of Financial Studies", 1, pp. 41–66.
- Lo A.W., MacKinley A.C. (1999), *A Non-Random Walk down Wall Street*, Princeton University Press.
- Lo A.W., Mamayski H., Wang J. (2000), *Foundations of Technical Analysis: Computational Algorithms, Statistical Inference, and Empirical Implementation*, "Journal of Finance", 40, pp. 1705–1765.
- Malkiel B. (1981), *A Random Walk Down Wall Street*, Norton, New York.
- Murphy J. (1999), *Technical Analysis of Financial Markets*, New York Institute of Finance.
- Wilder Jr. J.W. (1978), *New Concepts in Technical Trading Systems*, Trend Research, New York.

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## Traveling salesman problem: approach to optimality

**Abstract:** Traveling Salesman Problem (TSP) is a basic and one of the most important transportation problems in operational logistics. It is also known in the literature as a Chinese postman problem or single vehicle routing problem. TSP can be shortly described as follows. Vehicle starting from the selected city must visit a set of another cities exactly once and return to the starting city in such a way that the total distance of the route is minimized.

In this paper first mathematical formulation of decision problem is presented. Then solution strategies of TSP are shown with selected algorithms as examples. In the last part of article, a computational results of selected methods are presented.

**Key-words:** traveling salesman problem, heuristics, Lin-Kernighan algorithm.

### Introduction

Traveling Salesman Problem (TSP) is a basic and one of the most important transportation problems in operational logistics. It is also known in the literature as a Chinese postman problem or single vehicle routing problem. TSP can be described as follows [Całczyński 2000, Ignasiak 1996]. Vehicle starting from the fixed point  $P_0$  (base) must visit  $N$  points:  $P_1, P_2, \dots, P_N$  (cities, customers) and return to starting point  $P_0$ . All points must be visited and exactly once. The objective is to find the shortest such trip.

The traveling salesman problem was presented first time in 1859 by W.R. Hamilton, while H. Whitney first time formulated TSP as a combinatorial problem in 1934 [Całczyński 1992].

The main purpose of this article is to present and compare a quality of the simple and fast heuristics used to solve TSP problems in practice by the decision makers who do not have advanced software tools.

In this paper first mathematical formulation of decision problem is presented. Then solution strategies of TSP are shown with selected algorithms as examples. In the last part of article, a computational results of selected methods are presented for a number of test problems.

### Problem formulation

Traveling Salesman Problem may be presented as a discrete optimization model [Szymanowski 1977, Szymanowski 1979]. First, it is needed to define decision variables:

$$x_{ij} = \begin{cases} 0 \\ 1 \end{cases} \quad \text{dla } i, j = 0, \dots, N \quad (1)$$

Variable  $x_{ij}$  indicates a connection between points  $P_i$  and  $P_j$ . It takes the value 1, if in the route of vehicle is a connection between points  $P_i$  and  $P_j$  and 0 in the other case.

Since, each point must be visited by the vehicle only once, constraints in the model are as follows:

$$\sum_{i=0}^N x_{ij} = 1 \quad \text{dla } j = 0, \dots, N \quad (2)$$

$$\sum_{j=0}^N x_{ij} = 1 \quad \text{dla } i = 0, \dots, N \quad (3)$$

$$z_i - z_j + (N+1)x_{ij} \leq (N+1) - 1 \quad \text{dla } i, j = 1, \dots, N; i \neq j; z_i, z_j \in R \quad (4)$$

The vehicle may enter only once given point, and to leave it what is shown by equations (2) and (3).

Another very important condition is that all points in the route must be visited. It is provided by set of inequalities (4). The number of these inequalities is very large and is  $N(N-1)$ . They contain other variables  $z_i$  and  $z_j$ , appropriate value of which make condition fulfilled. In other words, inequalities (4) provide that with the element of the set  $\{P_i, P_j / x_{ij}=1\}$  it is possible to build the sequence:  $(P_0, P_1), (P_1, P_2), (P_2, P_3), \dots, (P_{N-1}, P_N), (P_N, P_0)$  [Solich 1974]. No restrictions described by inequalities (4) transforms TSP to the assignment problem, which one of the solutions is shown on the figure 2.

The goal of the traveling salesman problem is to minimize following function (5):

$$f(x) = \sum_{i=0}^N \sum_{j=0}^N d_{ij} x_{ij} \rightarrow \min \quad \text{dla } i, j = 0, \dots, N \quad (5)$$

Function (5) presents vehicle total length. Factor  $d_{ij}$  indicates length between points  $P_i$  and  $P_j$ . It means, that  $d_{ij}$  are the elements of the length matrix  $D$  sizes  $(N+1) \times (N+1)$ .

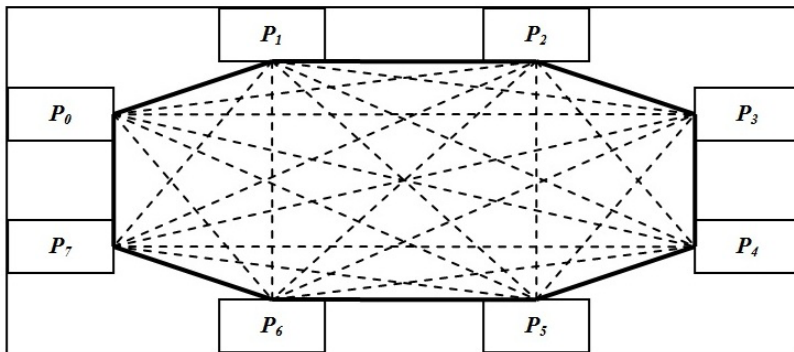
In the traveling salesman model (1)–(5) the number of decision variables is  $(N+1)^2$  and the number of all constraints is equal  $(N+1) + (N+1) + N^2$ .

Another definition of the traveling salesman problem may be formulated in graph theory [Sysło 1984]. TSP-problem can be presented in the form of undirected, complete and weighted graph  $G(V, E, d)$ , such that points are the graph's vertices (nodes). The number of vertices is equal  $N+1$  (including starting point). Edges connecting each pair of vertices  $i$  and  $j$  represent paths between visited points. Weight  $d_{ij}$  is the distance (length) between nodes  $i$  and  $j$ . One selected node is the starting (and ending) representing point  $P_0$ , where salesman starting and ending his route. The TSP route is the set of edges, where:

- first edge of the route begins in starting node;
- last edge of the route ends in starting node
- each node of the graph connects two and only two edges.

The set of the graph's edges is the sequence of connections between all graph's vertices and it is called Hamiltonian cycle in graph theory. Therefore, we can say that TSP route is feasible, if it is a Hamiltonian cycle (see Fig. 1). On the figure below there are shown all possible graph's edges for 8 nodes (including starting point  $P_0$ ) – solid and dotted lines.

**Figure 1. Example of Hamiltonian cycle in TSP problem**

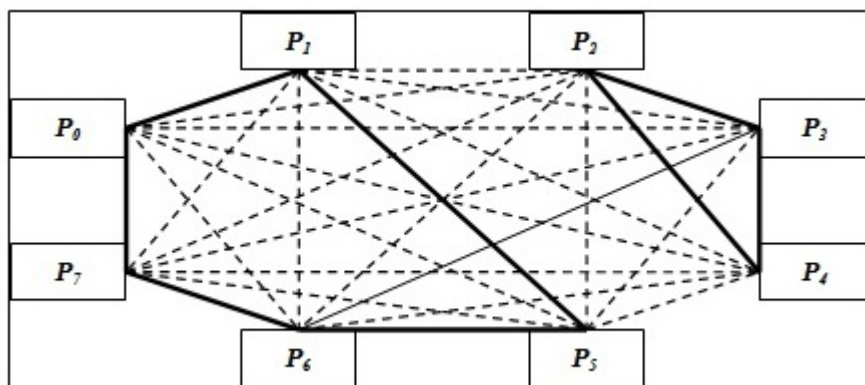


Source: own elaboration.

On the next figure (see Fig. 2) there is shown infeasible TSP route – solid line. Vehicle starting route from point  $P_0$  is visiting points:  $P_1, P_5, P_6, P_7$  (or:  $P_7, P_6, P_5, P_1$ ) and returns to point:  $P_0$ . Nodes  $P_2, P_3, P_4$  have been omitted. It means, that these points would have to be visited after restarting the route from

point  $P_0$ . This case cannot be acceptable, because one of the main assumptions (and constraints) says, that vehicle leave the starting point only once.

**Figure 2. Example of infeasible TSP route**

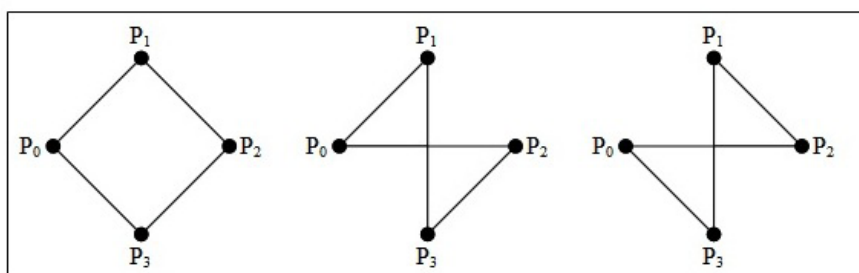


Source: own elaboration.

Optimal solution of travelling salesman problem in this formulation is the route, where total sum of edge's weights  $d_{ij}$  belonging to Hamiltonian cycle is the smallest.

The travelling salesman problem is the one of the most common problems of many logistic companies. It is also in the interest of mathematicians involved in combinatorial optimization. Formulation of the TSP problem is very easy, but to find optimal solution or even near optimal solution is not so clear. The number of feasible solutions (Hamiltonian cycles) is equal to number of all permutations of visiting points. Assuming that the route may be covered in the both directions, only for three points:  $P_1$ ,  $P_2$  i  $P_3$ , the number of possible routes is 6 (see Fig. 3).

**Figure 3. Possible variants of the vehicle route for three points**



Source: own elaboration.

If the number of points will increase the number of feasible solutions will grow at an exponential. For the TSP problem, where vehicle must visit  $N$  points and distance matrix  $\mathbf{D}$  is not symmetric ( $d_{ij} \neq d_{ji}$ ), the number of all possible routes will be  $N!$ . Table below (see Tab. 1) shows correlation between the number of visiting points and the number of possible routes.

**Table 1. The number of possible routes for asymmetric ( $d_{ij} \neq d_{ji}$ ) and symmetric TSP ( $d_{ij} = d_{ji}$ )**

Number of points	Number of routes (asymmetric)	Number of routes (symmetric)
1	---	---
2	2	1
3	6	3
4	24	12
5	120	60
6	720	360
7	5 040	2570
8	40 320	20 160
9	362 880	181 440
10	3 628 800	1 814 400
15	1 307 674 368 000	653 837 184 000
25	$1,55 \cdot 10^{25}$	$0,77 \cdot 10^{25}$
50	$3,04 \cdot 10^{64}$	$1,52 \cdot 10^{64}$
75	$2,48 \cdot 10^{109}$	$1,24 \cdot 10^{109}$
100	$9,33 \cdot 10^{157}$	$4,66 \cdot 10^{157}$

Source: own elaboration.

### Solutions strategies for TSP

The simplest way to find optimal solution for travelling salesman problem is to search all solution space (brute force strategy). List all possible permutations of the points and choose one with the shortest tour length. Unfortunately solution space is too large, so this procedure is not efficient. Time to find the optimal solution for large cases is not acceptable.

Due to the fact that there are not optimal solution (or even near optimal solution) in many parts of the solution space, search strategy should to skip these parts. This strategy is represented in branch and bound method (for example Little algorithm). Solution space is divided for two sets: containing or not connection between to point in the route. Next sets are further subdivided

for other sets and so on until complete route is obtained (set of marked earlier connections).

The Little algorithm is an exact algorithm [Little et al. 1963]. It means, that obtained solution is optimal. In the worst case, for  $N$  serving points, the total number of examined sets of the solution space may equal  $N!$ . It means examining all possible solutions, in other words all possible permutations of serving points (as in the case of brute force strategy). This procedure for large TSP problems is also inefficient.

An alternative for exact methods are heuristic methods. Unfortunately they don't guarantee finding optimal solutions. However their main advantages are:

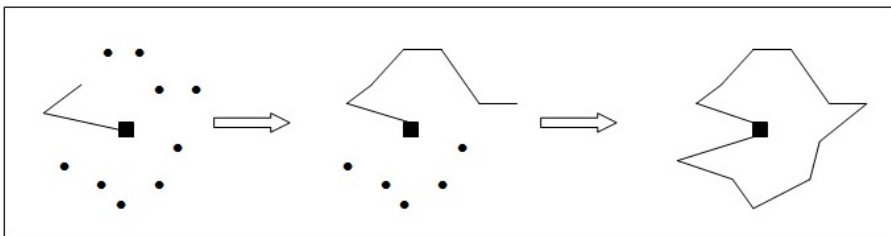
- simplicity of implementation;
- no need to have special mathematical knowledge about solving problem;
- short searching time of solution compared to exact methods;
- the quality of found solution is very often satisfactory for decision maker (first of all in terms of its search time).

Good heuristic algorithms can find near optimal solution, while these more sophisticated even optimal.

Among the heuristic methods for solving traveling salesman problem two main strategies should be distinguished: construction strategy and improvement strategy (local optimization).

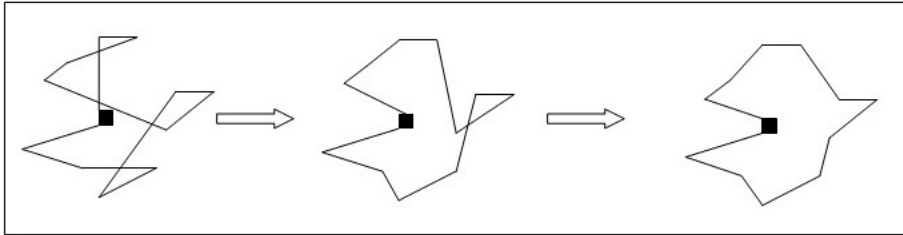
In the first one, TSP route is building step by step by adding new serving point to the partially constructed route (see Fig. 4).

**Figure 4. Construction strategy**



Source: own elaboration.

The second strategy is the systematic, according to a specific procedure improvement of already built route (see Fig. 5).

**Figure 5. Improvement strategy**

Source: own elaboration.

Representative of the construction strategy and one of the most popular method is the nearest neighbor search algorithm. The procedure of this algorithm can be stated as follows [Krawczyk 2001].

**Step 1**

Build the route  $T=\{P_0\}$

**Step 2** Select point  $P_j$  which is the nearest to the last point (last added) in the partially constructed route.

**Step 3**

Add selected point  $P_j$  on the end of the route.

**Step 4**

Repeat step 2 and 3 until all serving points will be added to the route.

As it is shown above, the procedure is very simple. Vehicle starting from point  $P_0$ , goes to the closest unvisited point. Then starting from this point, vehicle search next point which is located closest to the last visited. This procedure is repeated until TSP route will be completed.

Another, more sophisticated procedure, which realize construction strategy is nearest insertion algorithm [Sysło 1984, Krawczyk 2001].

**Step 1**

Build the route  $T=\{P_0\}$

**Step 2**

Select point  $P_j$  which is the closest to the partially constructed route.

**Step 3**

Insert selected point  $P_j$  in the best place of the partially constructed route.

**Step 4**

Repeat step 2 and 3 until all serving points will be added to the route.

This algorithm requires an explanation in step 2 and 3. Choosing the point closest to the route, there should be defined the distance of unvisited point

form partially constructed route. This distance can be defined as the length between unvisited point and closest located point in the partially constructed route (cycle). Form all unvisited points, there should be selected one, which distance from cycle is the smallest. Then selected point  $P_j$  should be inserted in the best place. In the cycle may be many places, where this point could be inserted. In step 3, for each pair of points  $P_m$  and  $P_n$  belonging to the partially constructed route, there should be calculated cost of insertion:  $\Delta_{m,n} = d_{m,j} + d_{j,n} - d_{m,n}$ . Insert point  $P_j$  between pair of point  $P_m$  and  $P_n$  where cost of insertion  $\Delta_{m,n}$  is the smallest.

Representative of the improvement strategy is the 2-opt algorithm [Lin 1973]. This is also the representative of wide class of local search heuristic algorithms.

### Step 1

Build the route  $T$  (Hamiltonian cycle)

### Step 2

Perform the following for all nodes until improvement of tour length is obtained:

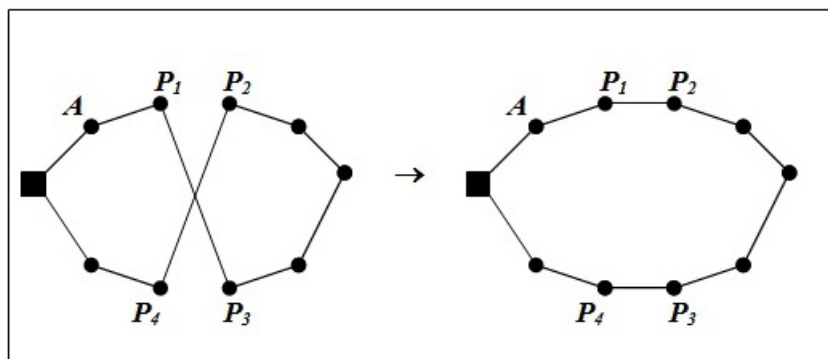
- select a node  $i$
- examine all 2-opt moves involving the edge between node  $i$  and its successor in the cycle; if it is possible do decrease the cycle length this way and construct new route  $T$ .

### Step 3

Return Step 1 until no improvement of current route  $T$  is obtained.

A 2-opt move is deleting two existing edges and reconnecting the two pairs of nodes to obtain a new route. This operation is shown below (see Fig. 6).

**Figure 6. 2-opt move**



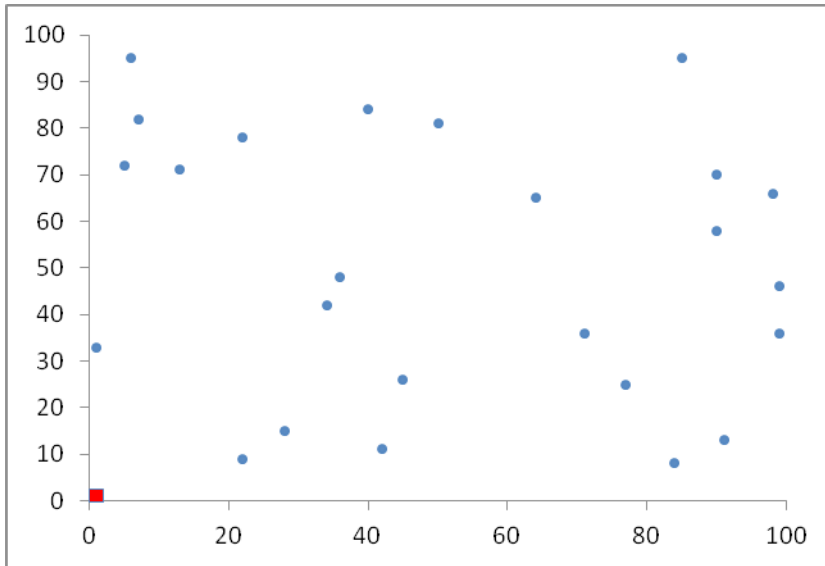
Source: own elaboration.

2-opt algorithm is an iterative procedure, which quality depends on the selected (constructed) starting solution (route). Starting solution may be generated randomly. It may be also the final outcome of another algorithm.

### Computational results

The performance of three presented simple heuristic algorithms was tested with four euclidean problems. Each of them contains a set of points represented by coordinates  $x$  and  $y$ , belonging to the interval (1,100). Starting point has always coordinates [1,1]. (see Fig.7)

**Figure 7. TSP problem with 25 points (TSP\_25)**



Source: own elaboration.

**Table 2. Coordinates for TSP\_25**

	x	y
P <sub>0</sub>	1	1
P <sub>1</sub>	13	71
P <sub>2</sub>	71	36
P <sub>3</sub>	1	33
P <sub>4</sub>	90	70
P <sub>5</sub>	42	11
P <sub>6</sub>	85	95
P <sub>7</sub>	91	13
P <sub>8</sub>	77	25

	x	y
P <sub>13</sub>	5	72
P <sub>14</sub>	6	95
P <sub>15</sub>	40	84
P <sub>16</sub>	64	65
P <sub>17</sub>	50	81
P <sub>18</sub>	36	48
P <sub>19</sub>	90	58
P <sub>20</sub>	28	15
P <sub>21</sub>	99	46

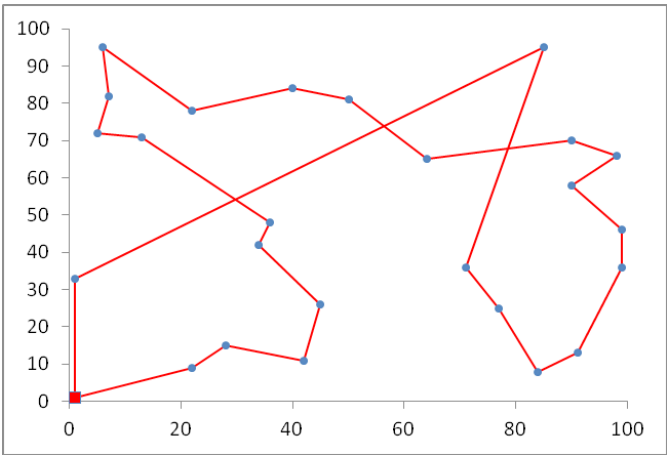
$P_9$	99	36
$P_{10}$	22	9
$P_{11}$	84	8
$P_{12}$	34	42

$P_{22}$	22	78
$P_{23}$	7	82
$P_{24}$	45	26
$P_{25}$	98	66

Source: own elaboration.

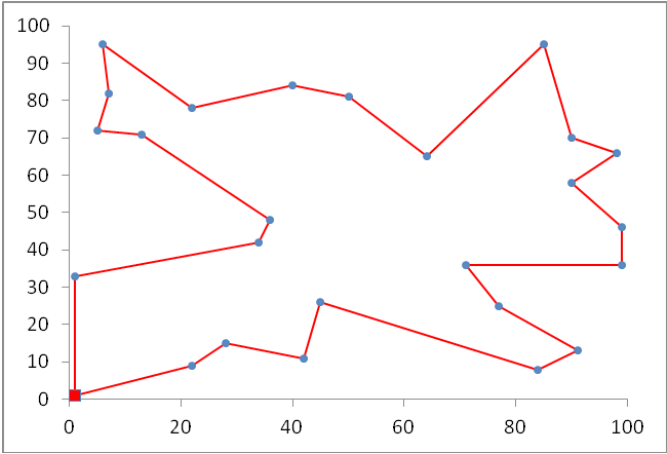
All TSP problems were solved by the nearest neighbor algorithm (NNA), nearest insertion algorithm (NIA) and 2-opt algorithm (2OPT). In the figures below there are shown routes obtained by each of three algorithms (see Fig. 8, Fig. 9 and Fig. 10).

**Figure 8. NNA solution for TSP\_25. Tour length: 557,05**

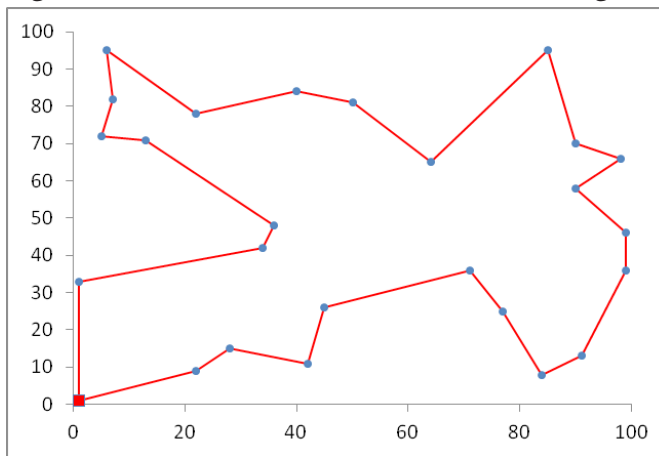


Source: own elaboration.

**Figure 9. NIA solution for TSP\_25. Tour length: 489,09**



Source: own elaboration.

**Figure 10 2OPT solution for TSP\_25. Tour length: 470,29**

Source: own elaboration.

The best solution was generated by 2-opt algorithm. The tour length is equal 470,29 and it is about 4% less than NIA's tour length and 15,5% less than NNA's tour length.

As has been told before, 2-opt algorithm may generate different quality solutions according to starting solution. Route shown in Fig. 10 is the best obtained solution for 12 runs 2-opt algorithm. 10 runs had randomly generated starting solution. One run 2OPT started from the solution generated by NNA and one from the route constructed by NIA. The results are shown in the table below (see Tab. 3).

**Table 3. Results for 12 runs of 2OPT for TSP\_25**

Run	2OPT tour length	Number of improvements
1	470,29	50
2	471,97	59
3	471,97	37
4	504,61	56
5	481,72	55
6	526,17	58
7	470,29	59
8	470,29	62
9	470,29	67
10	481,72	60
NNA starting solution	512,75	7
NIA starting solution	470,29	2

Source: own elaboration.

The best tour length 470,29 was obtained 4 times. Average tour length for 10 runs is equal 481,93 with standard deviation 18,89, what is better result than NNA's and NIA's solution. The 2-opt algorithm needs average 56 improvements with standard deviation 8, but only a few improvements if it starts from the route constructed by the one of other heuristics.

In table below there are shown computational results for all tested TSP problems (see Tab. 4).

**Table 4. Performance of the selected algorithms for tested problems**

TSP problem	Number of points	NNA	NIA	2OPT <sup>BEST</sup>	2OPT <sup>AVG</sup>
TSP_25	25	557,05	489,09	470,29	481,93±18,89
TSP_50	50	864,80	631,20	625,15	638,87±10,99
TSP_75	75	945,41	771,30	754,67	769,57±16,29
TSP_100	100	890,30	838,70	779,84	812,71±23,03

Source: own elaboration.

Analyzing the results shown in the table above it can be concluded, that solution quality of nearest neighbor algorithm is very poor compared to 2-opt results. The difference between nearest insertion algorithm and 2-opt is not so evident, but it should be noted, that 2-opt procedure is less complicated than NIA. From the other side, NNA and NIA needs less time to generate solution than 2-opt.

## Conclusions

In this paper the traveling salesman problem and its solution strategies was described. Construction and improvement strategies are two main approaches to solve TSP. It cannot be clearly concluded which strategy is better. Each has its advantages and disadvantages.

Considering the time of the algorithm execution, presented construction strategy methods run faster than improvement procedures. Improvement algorithms need more time to generate solutions and every time this it may be different. The reason is first of all quality of the starting solution.

Moreover, improvement algorithms not guarantee the same quality of achieved solution in contrast to the construction methods, what can be considered as a significant disadvantage. However, average quality of the solutions seems to be a little better than those obtained by construction algorithms.

It should also be noted, that simplicity and speed of both types of algorithms has another undeniable advantage. There is possibility to combine the advantages of both methods by finding good solution by NIA algorithm and then improving using 2-opt algorithm. Use of not one but several simple algo-

rithms may be a some kind of good proposal for solving hard decision problems which is TSP. It can be a good alternative for analysts or decision makers for which equally important is: simplicity of the algorithms, time required to generate good solution and quality of obtained solution.

## References

- Całczyński A. (1992), *Metody optymalizacji w obsłudze transportowej rynku*, PWE, Warszawa.
- Całczyński A., Kędzierska-Stróż D., Orzechowska D., Śleszyński Z. (2000), *Elementy badań operacyjnych w zarządzaniu*, Wydawnictwo Politechniki Radomskiej, Radom.
- Ignasiak E. (1996), *Badania operacyjne*, PWE, Warszawa.
- Junhert M., Reinelt G., Rinnaldi G. (1995), *The travelling salesman problem* in: M.O. Ball et al. (Eds), *Handbook in OR&MS*, Vol. 7, Elsevier.
- Krawczyk S. (2001), *Metody ilościowe w logistyce (przedsiębiorstwa)*, Academia Oeconomica, Warszawa.
- Lin S., Kernighan B.W. (1973), *An effective heuristic for the traveling salesman problem*, "Operations Research", Vol. 21, pp. 498–516.
- Little J.D.C., Murty K.G., Sweeney D.W., Karel C. (1963), *An algorithm for the traveling salesman problem*, "Operations Research", Vol. 11.
- Solich R. (1974), *Pewne uogólnienia zadania komiwojażera*, Prace Centrum Obliczeniowego PAN, Nr 14.
- Syśło M.M. (1984), *Optymalizacja kombinatoryczna* [w:] T. Kasprzak (red), *Optymalizacja dyskretna. Zastosowania ekonomiczne*, PWE, Warszawa.
- Szymanowski W. (red.) (1977), *Optymalizacja dostaw do sieci punktów sprzedaży z uwzględnieniem warunków ich działalności operatywnej*, Uniwersytet Warszawski, Wydział Nauk Ekonomicznych.
- Szymanowski W. (red.) (1979), *Optymalizacja dostaw do miejskiej sieci detalicznej*, Praca zbiorowa, Instytut Handlu Wewnętrznego i Rynku, Warszawa.