

ICT INNOVATIONS AS A RESPONSE TO THE REQUIREMENTS OF COMPETITIVE MARKET - POLAND'S CASE STUDY

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Abstract

The paper is dealing with ICT innovations as enterprises' tool to meet competition. The empirical study aims at pointing out the relationship between investments in innovations and firms' benefits from ICT. The scientific objective will be achieved by having considered three issues: market pressure for changing products and processes, the extent of competition by means of ICT tools, ICT innovations as a source of business benefits declared by the Polish enterprises.

Key words

Processes and products innovations; competitiveness of enterprises; ICT.

1. INTRODUCTION

The way of thinking on factors driving competitiveness has been changing over the time parallel to factors enabling economies to attain a long-term prosperity. According to the World Economic Forum competitiveness is the country's or/and enterprise's ability to create greater affluence than their competitors in the global market (World Competitiveness Report, 1994). OECD in turn refers competitiveness both to capability of firms, industries, regions, nations and international groupings to meet international competition as well as ensure relatively high rates of return on productive factors including reasonably high and stable employment (Industrial Structure Statistics, 1994).

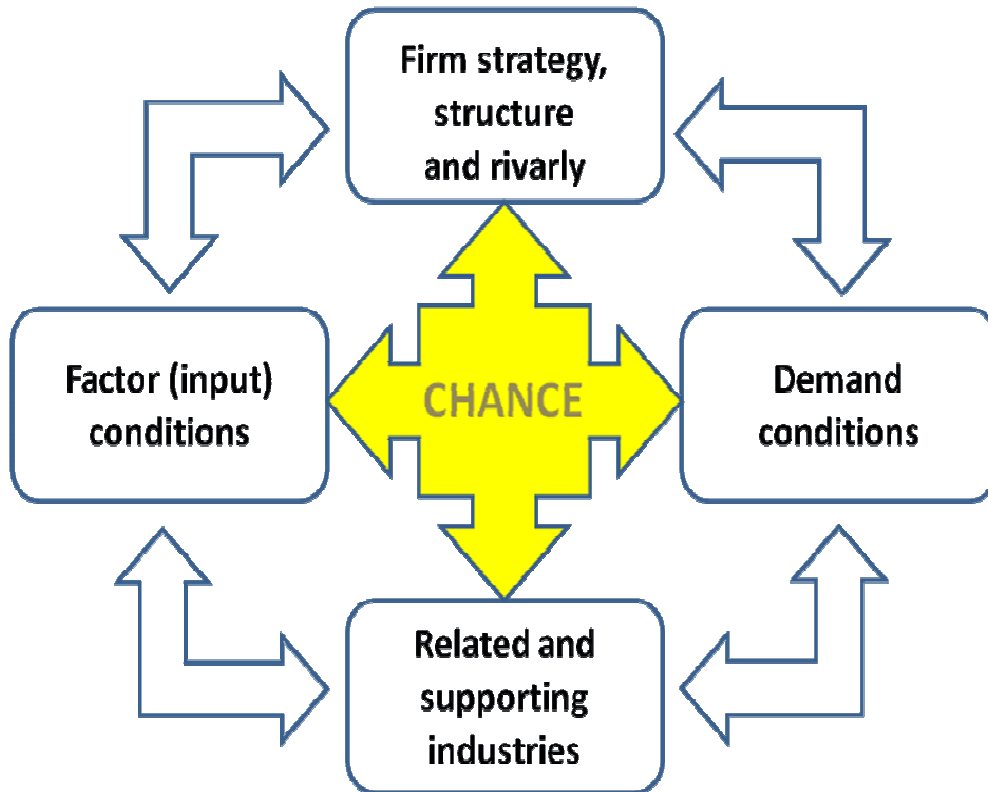
The competitive market forces the market agents to be business efficient in long term that means productive, fine-tuned to environmental evolution including responding to technological revolution, ready to diminish costs of various activities in different areas of economic, managerial and even social performance, and to take a price-war, if necessary. It seems to be indispensable for the Polish enterprises to have ideas and manners how to be competitive in order to cope with rivals in both domestic and foreign markets. The failure of many enterprises to grow despite huge investments made in physical capital proves that it is not enough to survive in business. Ceaseless seeking for sophisticated components became a challenge to succeed in outstripping rivals or at least to be equal to them.

Despite the multitude of complex determinants of competitiveness in the global or even country's economy level, which obviously impact and condition the mezo and micro levels, the subject of the paper focuses on ICT innovations implemented by enterprises to make their products more attractive and processes more effective. The empirical study aims at pointing out the relationship between investments in innovations and firms' benefits from ICT inputs, in particular. The hypothesis to substantiate is whether the achieved extent of advantages of ICT innovations declared by the Polish enterprises might be satisfactory to meet competition requirements. The scientific objective will be achieved by having considered:

1. Market pressure for changing products and processes. The theoretical fundament to have discussed the issue is a well-known Porter's diamond framework (Porter, 1990). Empirically, percentage share of the Polish enterprises that have implemented product and process innovations, and the input structure of innovations according to the innovation activities in 2008 will be used to illustrate the propensity to response the market pressure.
2. The extent of competition by means of ICT tools empirically studied by the market pressure to utilize ICT innovations over 2006-2007.
3. ICT innovations as a source of business benefits measured by a percentage share of enterprises declaring the achievement of the following advantages: simplification of routine activities, resources release, income increase and new products development. A size of the firm (small, medium, large) is taken as the descriptor in analyzing and concluding process.

2. MARKET PREASSURE FOR CHANGING PRODUCTS AND PROCESSES

As the diamond framework reveals (picture 1), nearly everything is significant for competitiveness, and therefore everything might create market pressure for changing both products and processes as well. The Porter thesis is that these factors interact with each other to create conditions where innovation and improved competitiveness occur (Porter, 1990). The impact of government has been omitted since it can influence each of the determinants and its interventions can occur at any level of economic activity. As considers chance events, which are occurrences being outside of control of a firm, they create discontinuities in which some gain competitive positions and some lose. The role of ICT innovations in a contemporary and future economy is comparable to that of traditional production factors in the past, such as steam or electricity.



Picture 1 The microeconomic business environment; source: Porter M.E., *The Competitive Advantage of Nations*, New York: Free Press, p. 127

Individual elements illustrated in the picture 1 are characterized in the following way:

Firm strategy, structure and rivalry

- rules that encourage investment and productivity (e.g. incentives for capital investments, intellectual protection),
- open and vigorous local competition, especially among locally based rivals.

Demand conditions

- the presence of demanding and sophisticated local customers,
- high customer expectations,
- local customer needs that anticipate those elsewhere,
- unusual local demand in specialized segments that can be served nationally and globally.

Factor (input) conditions

The efficiency, quality, and specialization of inputs available to firms:

- natural resources,
- human resources,
- capital resources,
- physical infrastructure,
- administrative infrastructure (e.g. registration, permits),
- information infrastructure (e.g. economic data, corporate disclosure),
- scientific and technological infrastructure.

Related and supporting industries:

- access to capable, locally based suppliers and firms in related fields,
- presence of clusters instead of isolated industries.

The microeconomic foundations of productivity rest on three interrelated areas (World Economic Forum, 2007):

1. the sophistication and capabilities with which domestic companies or foreign subsidiaries compete
2. the quality of the microeconomic business environment in which they operate
3. the state of development of clusters that provide benefits through proximity of related companies and institutions.

For the reason of the quality of the microeconomic environment, investing in ICT innovations is a major force in driving productivity in the micro scale and growth as well as prosperity in the macro scale as the benefits spread across the entire society.

The findings of different studies, focusing on the processes of application and usage of ICT within firms, prove that ICT has contributed greatly to productivity increase and competitiveness in the OECD countries in the last decade. One of the OECD's reports came to the conclusion that there is a need to reassess the notion of e-commerce or e-business as an outcome of the evolution of ICT use which comes closer to electronic business networking and brings about more interactive links between business processes within the firm and commercial processes in the market (www.infodev.org, 2007).

It is worth stressing that all these innovations work only if there are an accurate legal framework and a suitable infrastructure.

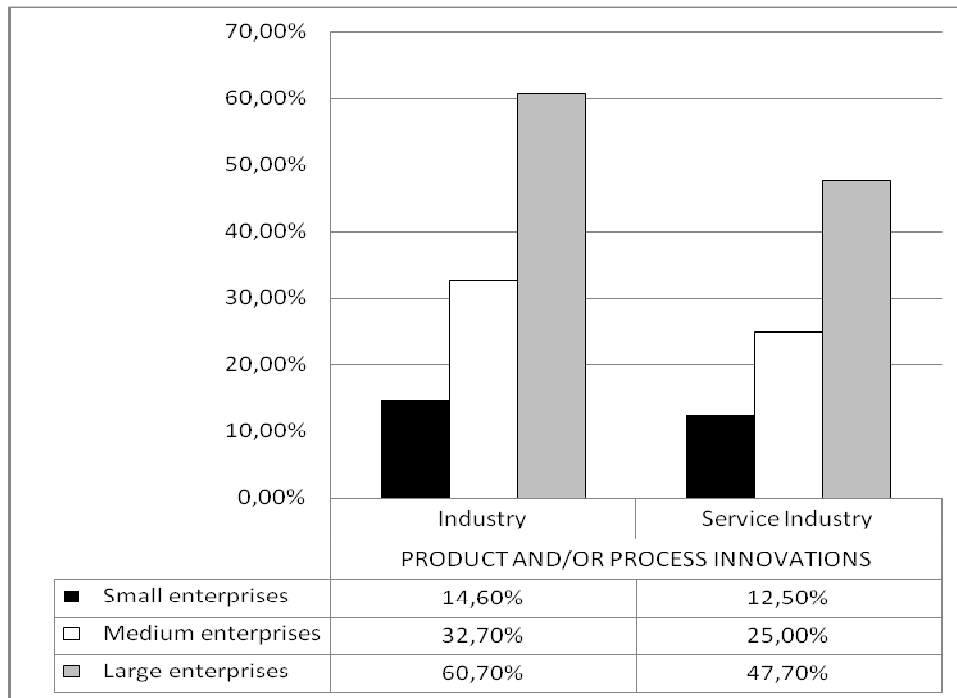
The study carried out by ECORYS Nederland B.V. in collaboration with TNO and IDEA relating to Estonia, Latvia, Lithuania, Poland and Russia point out that ICT usage is primarily geared towards improved production and transaction processes, e.g. organizational change and marketing to serve customers and markets, rather than the development of new or improved products. Therefore the former activities which are automated within half of the firms seem to be the most significant market force to keep economic relations with their business environment. Hence, it is mainly the less advanced ICT that is quickly spread, rather than the latest generation of it. Promoting the implementation of ICT for improved economic performance requires policies custom-made to the individual sector of economy. The later is very much dependent on technical infrastructure available within the individual countries (Ecorys Nederland B.V., 2007).

Performance indicator	Percent of firms with reported increase	ICT contribution (percent)	ICT in combination with other factors
Labour productivity	50,4	13,1	47,0
Operational costs	41,1	5,1	28,1
Revenue from sales	55,2	7,0	43,4
Profitability	44,0	10,5	48,2
Capital investment in innovation	51,5	16,1	57,5
ICT investment	45,4	30,2	46,0
Price competition	57,1	5,3	29,1
Quality competition	63,8	10,0	39,5
Percent of firms with reported decrease			
Operational costs	18,6	15,7	51,7

Table 1 ICT and economic performance of firms; source: ICT, Innovation, and Economic Growth in Transition Economies, A multi-country Study of Poland, Russia, and Baltic Countries, Information for Development Program, Ecorys Nederland B.V., The International Bank for Reconstruction and Development, Washington, 2007, <http://www.infodev.org/en/Publication.553.html>

Statistical data presented in table 1 indicate the relationship between ICT utilization and economic performance amid the enterprises in transition countries. This is reflected by the impact of ICT declared by enterprises on productivity (13,1 percent), profitability (10,5 percent), capital investment in innovation (16,1 percent), operational costs (a decrease was mentioned by 15,7 percent of the firms), and a double significant on quality competition (10 percent) than price competition (5,3 percent). Although more than half of them realize that price competition plays a crucial role in gaining market shares, it is not related to ICT directly. Nevertheless, nearly one third of firms perceive ICT as one of the factors that contributes to increasing market share thanks to price competition. Moreover, the fact that 30,2 percent of the enterprises point out a self-generating increases in ICT investment shows that engagement in ICT usage is to a certain extent a self-sustaining process that requires cumulative investment. The most meaningful is a combination of ICT and other factors for capital investment in innovation (57,5 percent), profitability (48,2 percent), and labour productivity (47,0 percent). Operational costs (28,1 percent) and price competition (29,1 percent) are mentioned to be the least significant with reference to complementary factors. Next important findings concern the factors reinforcing the positive effect of ICT such as: capital investment in equipment, a new marketing strategy, organisational change, own specification, training in staff, changing in salary structure. The most significant complementary combination from the market forces point of view are: capital investment in equipment that not only extend the capital resources but – what is more crucial – changes their technological structure and enables the productivity growth as well as lower operational costs and consequently increase in revenues; the new marketing strategy as a determinant of a vigorous competition that may translate into improvement of profitability due to marketing initiatives to strengthen the firm's position in existing markets or enter new ones; organizational changes that result in greater flexibility are favour productivity, hence lower operational costs, and eventually grow revenues, too.

The outcome of the above study has been verified by the survey of the selected dimensions relating to Poland over 2006-2008 using a size of enterprises as the main descriptor. Irrespectively the sector (industry, service) the greater the enterprise (measured by the number of employees) the larger investments in product or process innovations (picture 2). Large industrial firms dominated (a bit over 60 percent) as considers the percentage share of the entire statistical population. It was about double more than among the medium firms and almost quadruple more as regards small business. Similarly, the greatest number of large firms in the service sector (nearly 48 percent) invested in innovations, almost double more than in medium business, and nearly quadruple more considering the small ones.

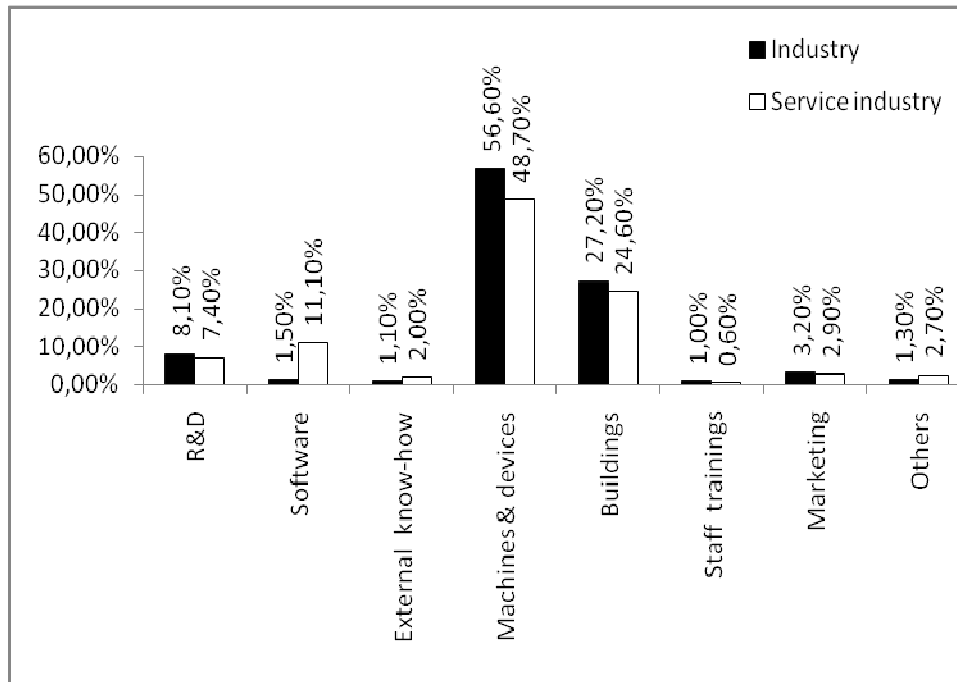


Picture 2 The percentage of products and process innovations implemented in the Polish enterprises between 2006 and 2008; source: own compilation based on Report of the Polish Central Statistical Office, „Innovation activity of enterprises in years 2006-2008“, http://www.stat.gov.pl/gus/5840_3574_PLK_HTML.htm

The picture of investments is being utterly changed regarding the structure of product or process investment according to the type of innovative activity (picture 3). Definitely, investment in the production technology (capital investment in equipment) is the first on the list (56,6 percent in industry; 48,7 percent in service sector, respectively). Other factors that motivate pro-innovating activities are also determinants of quantitative character rather than of qualitative attributes. Investments in various kinds of buildings take more or less one fourth of all inputs (27,2 percent and 24,6 percent, respectively), and investments in the genuine ICT conditioned activity, i.e. R&D activity and software purchasing reaches nearly 10 percent in industry and roughly 20 percent in service sector. Investments in external knowledge purchasing, marketing or staff training turns out to be inessential (5,3 percent of inputs in industry and 5,5 percent in service sector).

The data presented in pictures 2 and 3 do not confirm the finding (table 1) that ICT investment in Poland takes up a substantial part of the efforts of presented sectors to modernize. The finding that capital investment in equipment still is the most important factor is coincident with up-to-now carried out studies that confirm firms' behaviour typical for industrial stage of development than for a knowledge-based economy and still proves a lack of saturation with hard, physical capital both in industry and service sectors.

For transitional economies ICT is an opportunity to leapfrog some long and painful stages in the development process, thereby saving time and resources but unfortunately it is underestimated yet.



Picture 3 The structure of product or process investment according to the type of innovative activity in 2008; source: own compilation based on Report of the Polish Central Statistical Office, „Innovation activity of enterprises in years 2006-2008“, http://www.stat.gov.pl/gus/5840_3574_PLK_HTML.htm

3. COMPETING BY MEANS OF ICT TOOLS

To be an innovation-driven economy means to overcome diminishing returns of all the other factors by implementation of technological innovations that enable expanding standards of living in long run in particular in countries which have already reached the productivity frontier of traditional resources.

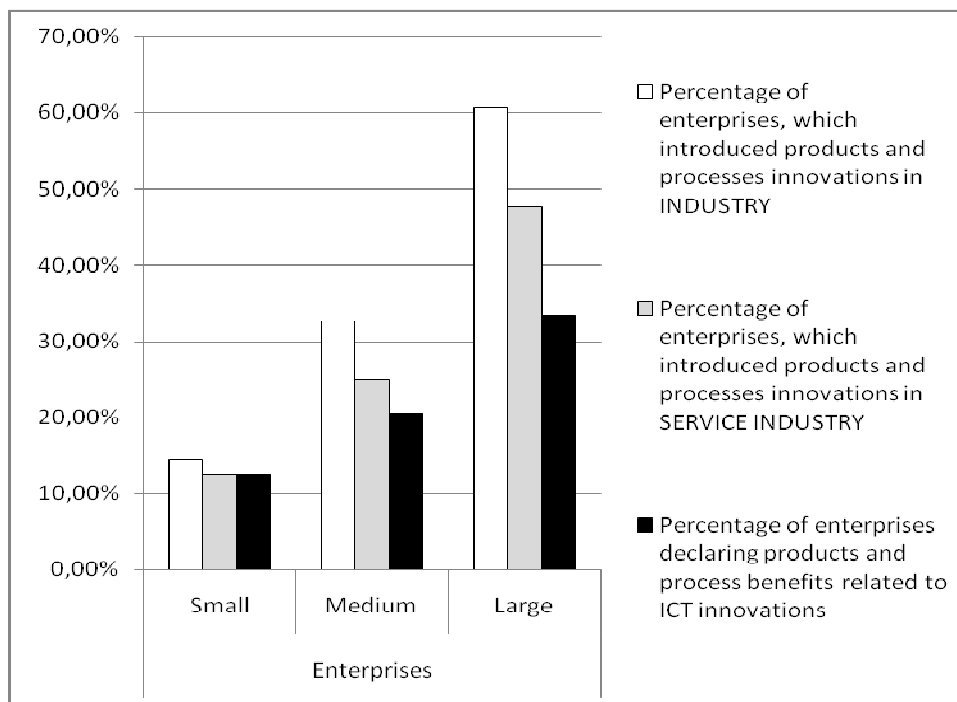
Less-advanced countries like Poland can still improve their productivity by adapting existing technologies or making incremental improvements in other areas, and ICT access and usage become fundamental to determine economies' overall level, given the critical spillovers of ICT to the other economic sectors and its role as efficient infrastructure for commercial transactions (Kaminska, Dzwonnik, 2009 (1)).

The central point is that the business community operating in the country has access to advanced products, processes and blueprints. However, the level of technology available to the firms in the country needs to be distinguished from the country's ability to innovate and expand the frontiers of knowledge by designing and developing cutting-edge products and processes to maintain a competitive edge (Kamińska, Dzwonnik, 2009 (2)).

The microeconomic foundations of productivity rest on three interrelated areas (World Economic Forum, op. cit):

1. the sophistication and capabilities with which domestic companies or foreign subsidiaries compete,
2. the quality of the microeconomic business environment in which they operate,
3. the state of development of clusters that provide benefits through proximity of related companies and institutions.

Focusing on the first area, ICT can be certainly regarded as a tool which meaningfully changes the way of competing. From this point of view it may be interesting to assess the extent to which in practice of the Polish enterprises ICT is involved in process and products innovations. Supplementing picture 2 with additional bars illustrating the percentage of enterprises which in analysed period introduced process and products innovations based on ICT (picture 4) it becomes clear that ICT supported nearly all products and process innovations implemented by small firms. In other words, for small enterprises it was still quite easy to improve their products and processes simply by ICT deployment. There's no doubt that the bigger enterprise the more factors affects its processes and final products. But even amid middle or big enterprises ICT had an effect on far more than a half of process and products innovations. These observation proofs that ICT is a powerful tool in rivalry driven by innovations.



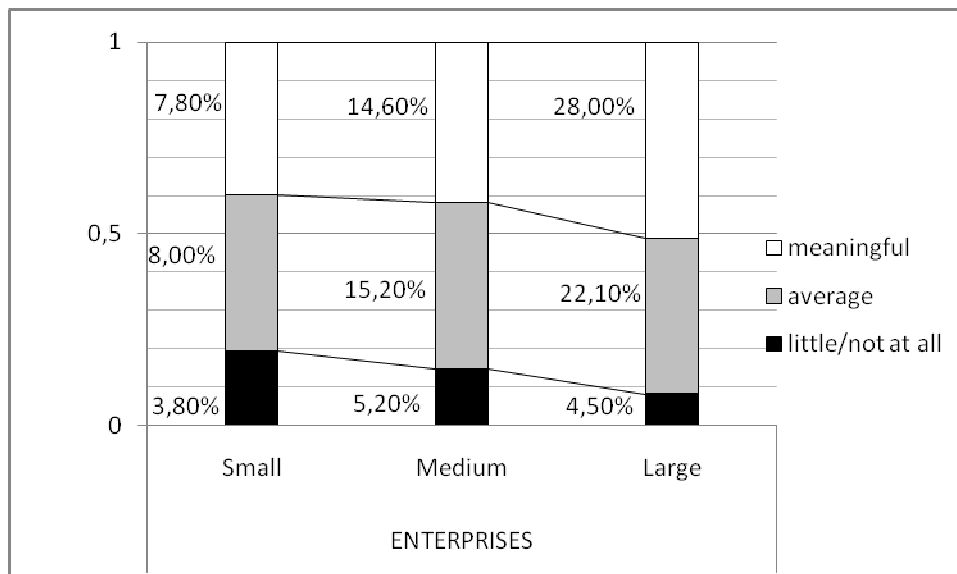
Picture 4 The percentage of products and process innovations implemented in the Polish enterprises between 2006 and 2008; sources: own compilation based on Reports of the Polish Central Statistical Office, „Innovation activity of enterprises in years 2006-2008“, http://www.stat.gov.pl/gus/5840_3574_PLK_HTML.htm and „Utilization of ICT in enterprises, households and by individuals in 2008“, http://www.stat.gov.pl/gus/5840_3730_PLK_HTML.htm

4. ICT INNOVATIONS AS A SOURCE OF BUSINESS BENEFITS

According to the survey conducted in 2008 in order to inquire the benefits of products and process innovations based on ICT implementation over 2006-2007 period managers of the Polish enterprises declared as the most valued the following:

1. simplification of routine activities,
2. resources release,
3. income increase,
4. new products development.

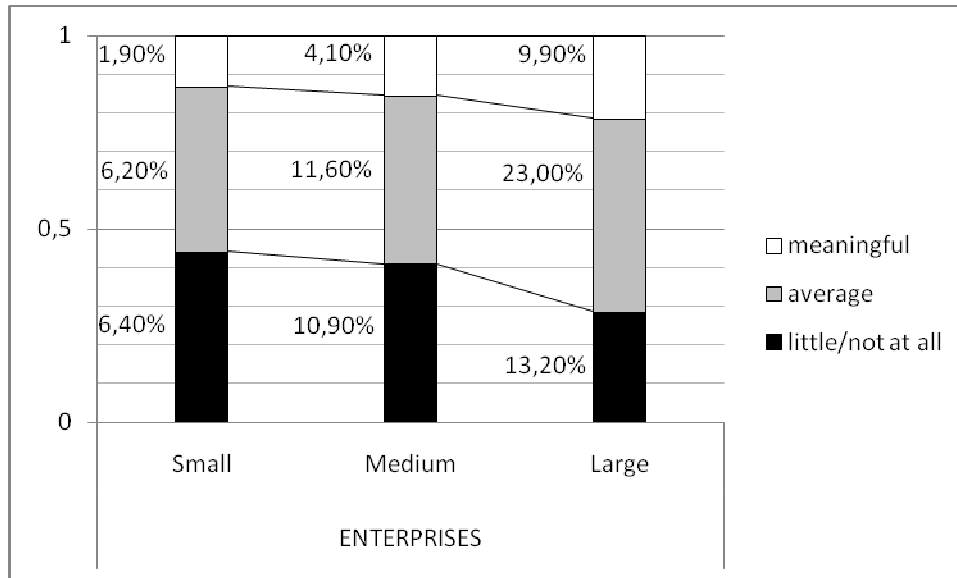
In details the results of the survey are illustrated on pictures 5-8. Each bar represents all enterprises that realised ICT projects (it is expressed by value "1" (one) on the y-axis). The sum of individual percentage values shows how many of them were among the whole population of enterprises in each size group. Different colours distinguish between these which assessed the benefits as meaningful, average and little/or declared no benefits of particular kind.



Picture 5 The percentage of the Polish enterprises which between 2006 and 2007 realised ICT projects and declared, as a result, simplification of routine activities; source: own compilation based on Report of the Polish Central Statistical Office, „Utilization of ICT in enterprises, households and by individuals in 2008“, http://www.stat.gov.pl/gus/5840_3730_PLK_HTML.htm

Following this interpretive framework it is easy to observe that the bigger enterprise the stronger belief about ICT influence on simplification of routine activities (picture 5). In the group of small enterprises, where nearly 20% of the whole population realised ICT projects more than 80% of them declared that the subject benefits were meaningful or at least average. Amid

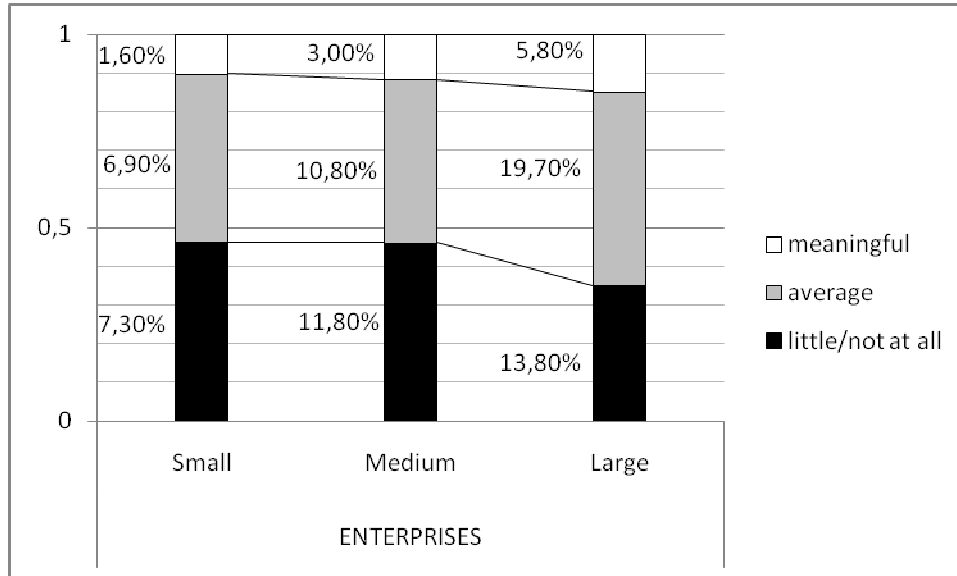
medium enterprises this belief shared 85% of these, which implemented ICT innovations (34,8% of all enterprises of this size). The most impressive evidence of the ICT role in simplification of routine activities are declarations of large firms' representatives. In this case more than 90% from among these which ran ICT projects (54,6% of the population) admitted that the benefits can be characterized as meaningful or average.



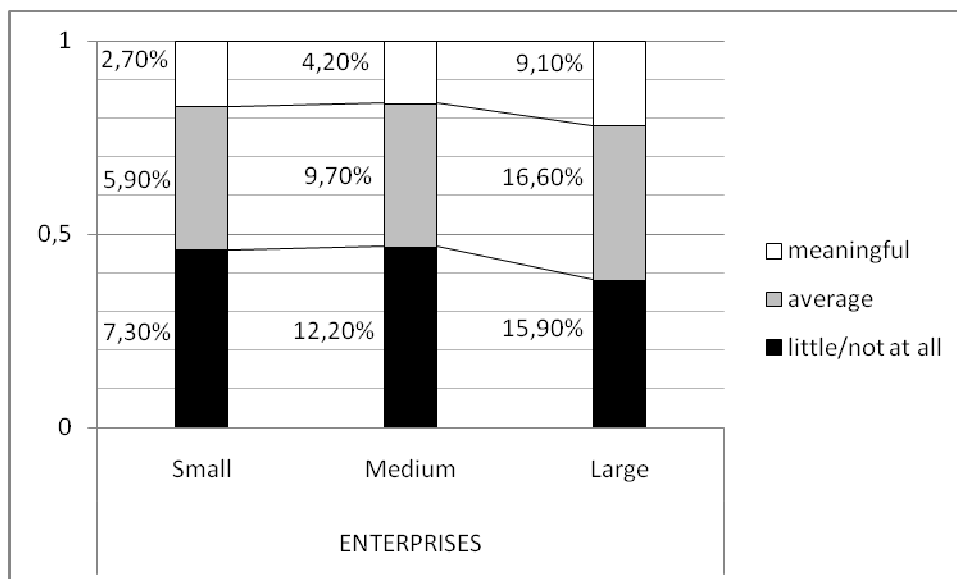
Picture 6 The percentage of the Polish enterprises which between 2006 and 2007 realised ICT projects and declared, as a result, resources release; source: own compilation based on Report of the Polish Central Statistical Office, „Utilization of ICT in enterprises, households and by individuals in 2008“, http://www.stat.gov.pl/gus/5840_3730_PLK_HTML.htm

With reference to resources release (picture 6) still more than a half of all enterprises in each size group pointed out that their ICT projects brought meaningful or average benefits, however the percentage of those convicted only for meaningful results is not so impressive (about 13% among small entities, 17% and 21% if taken into account the medium and large firms, respectively).

Similar structure of responses was achieved during the assessment of income increase (only about 46% of respondents in small and medium enterprises and 35% in large ones noticed little or no benefits; picture 7) and new products development (there sceptics constituted roughly 45% in small firms and 48% and 39% in medium and large, respectively; picture 8). The general trend that the bigger enterprise the higher declared ICT contribution in achieving particular kinds of benefits was hold.



Picture 7 The percentage of the Polish enterprises which between 2006 and 2007 realised ICT projects and declared, as a result, income increase; source: own compilation based on Report of the Polish Central Statistical Office, „Utilization of ICT in enterprises, households and by individuals in 2008“, http://www.stat.gov.pl/gus/5840_3730_PLK_HTML.htm



Picture 8 The percentage of the Polish enterprises which between 2006 and 2007 realised ICT projects and declared, as a result, new products development; source: own compilation based on Report of the Polish Central Statistical Office, „Utilization of ICT in enterprises, households and by individuals in 2008“, http://www.stat.gov.pl/gus/5840_3730_PLK_HTML.htm

5. CONCLUSION

1. If taken the size of enterprises into account market pressure for changing products and processes varies significantly.

2. In analysed period amid small and even middle enterprises far less than a half of them competed by introducing new products and/or changing their processes.
3. This kind of market pressure affected strongly large enterprises where about half of them (in industry 60,7% and in service industry 47,7%) invested in products and process innovations.
4. In a group of small enterprises nearly all products and process improvements were achieved by means of ICT.
5. More complex organizational context of bigger enterprises makes it difficult to base only on technology in their quest of improvements. But even in this case, where competing has to be more sophisticated, ICT projects were declared to be a source of more than a half of products and process benefits. With reference to medium enterprises it was between 82% and 63% while large enterprises reached the ratio values range from 70% to 55%, for service industry and industry, respectively.
6. The most often declared products and process benefits related to introduced ICT innovations are the following:
 - a. simplification of routine activities,
 - b. resources release,
 - c. income increase,
 - d. new products development.
7. In all the above cases benefits brought by ICT projects were noticed as meaningful or at least average by more than a half of enterprises.
8. The bigger enterprise the stronger conviction that ICT is a powerful tool in products and process improvements.
9. Strong correlation between the percentage of enterprises, which introduced products and processes innovations, and the percentage of enterprises declaring products and processes benefits related to ICT innovations seems to prove that the latter might be reckoned to be crucial for successful pro-efficient transformations of the Polish enterprises, which confirms the hypothesis.

Literature:

- Ecorys Nederland B.V.: ICT, Innovation, and Economic Growth in Transition Economies, A multi-country Study of Poland, Russia, and Baltic Countries, Information for Development Program, The International

Bank for Reconstruction and Development, Washington, 2007, p. 155,
<http://www.infodev.org/en/Article.247.html>

- Kamińska T., Dzwonnik G.: An Enterprise's Size and Technological Innovations. Economies of Scale and Scope in the Polish Enterprises [in:] Cele i uwarunkowania funkcjonowania współczesnych przedsiębiorstw, ed. Dworak J., Falencikowski T., Gdańsk: Wyższa Szkoła Bankowa w Gdańsku, 2009 (1), p. 314, ISBN 978-83-61712-12-1
- Kamińska T., Dzwonnik G.: Types of Enterprise Ownership and Pro-Innovativeness. The Analysis of SME Sector [in:] Innovativeness and Competitiveness of Modern Enterprises and Regions - Sources, Mechanisms, Indications, ed. Fedan R., Kaliszczak L., Rzeszów: Uniwersytet Rzeszowski, 2009 (2), p. 186, ISBN 83-917781-9-3
- OECD: Industrial Structure Statistics, OECD Publishing, 1994, p.360, ISBN: 9789264040359
- Porter M.E., Sala-i-Martin X., Schwab K.: World Economic Forum: The Global Competitiveness Report 2007-2008, Geneva: Palgrave Macmillan, 2007, p. 519, ISBN 978-1-4039-9637-4
- Sala-i-Martin X., Schwab K., Greenhill R., World Economic Forum: The Global Competitiveness Report 2009-2010, Geneva: Palgrave Macmillan, 2009, p. 479, ISBN-13: 978-92-95044-25-8
- The Polish Central Statistical Office: Innovation Activity of Enterprises in years 2006-2008, http://www.stat.gov.pl/gus/5840_3574_PLK_HTML.htm. p. 11.
- The Polish Central Statistical Office, Utilization of ICT in Enterprises, Households and by Individuals in 2008“, http://www.stat.gov.pl/gus/5840_3730_PLK_HTML.htm

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