OLSZTYN ECONOMIC JOURNAL

● ● ● ● ● ● ● ● ● ● 11 (4/2016)

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SPIS TREŚCI

INVESTIGATING SOCIO-ECONOMIC AND PERCEPTUAL VARIABLES OF EARLY-STAGE ENTREPRENEURIAL ACTIVITY IN SELECTED EU COUNTRIES[1]

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K e y w o r d s: entrepreneurship, socio-economic, perceptions, GEM data.

A b s t r a c t

This paper investigates socio-economic and perceptual factors affecting the likelihood of being a total early-stage entrepreneur in selected EU countries (Denmark, Germany, Finland, Sweden and Latvia) during 2005–2012.

The data used for our empirical research comes from Global Entrepreneurship Monitor (GEM). Our findings show that the probability to become a total early-stage entrepreneur increases for males and younger individuals with a bachelor's degree or secondary education and who are working part time or full time. Furthermore, these entrepreneurs are characterised by a lower fear of failure and higher entrepreneurial skills and perception of opportunity.

Policy makers should improve the institutional framework that involves measures aimed at empowering potential entrepreneurs in finding new market opportunities. Territorial cooperation in a macro-regional perspective may be a facilitator aimed at entrepreneurial development.

BADANIE ZMIENNYCH SPOŁECZNO-EKONOMICZNYCH I PERCEPCYJNYCH PRZEDSIĘBIORCZOŚCI WE WCZESNEJ FAZIE ROZWOJU W WYBRANYCH KRAJACH UE

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Słowa kluczowe: przedsiębiorczość, społeczno-ekonomiczne, percepcja, dane GEM.

A b s t r a k t

W pracy zaprezentowano badania nad czynnikami społeczno-ekonomicznymi i percepcyjnymi mającymi wpływ na prawdopodobieństwo zostania początkującym przedsiębiorcą komercyjnym w wybranych krajach UE (Danii, Niemczech, Finlandii, Szwecji i Łotwie) w okresie 2005–2012.

Dane wykorzystane w badaniach empirycznych pochodzą z Globalnego Monitora Przedsiębiorczości (*Global Entrepreneurship Monitor* – GEM). Wnioski wskazują, że prawdopodobieństwo zostania początkującym przedsiębiorcą komercyjnym jest większe w przypadku osób płci męskiej oraz osób w młodszym wieku, mających licencjat lub wykształcenie średnie oraz pracujących w niepełnym lub pełnym wymiarze czasu. Ponadto przedsiębiorców takich cechuje niższy poziom lęku związanego z niepowodzeniem oraz lepsze umiejętności przedsiębiorcze oraz rozpoznawanie możliwości.

Decydenci powinni usprawnić ramy instytucjonalne, które są związane z działaniami mającymi na celu wspieranie potencjalnych przedsiębiorców w wyszukiwaniu nowych szans rynkowych. Współpraca terytorialna w perspektywie makroregionalnej może stanowić ułatwienie dla rozwoju przedsiębiorczości.

Introduction

Entrepreneurship is a topic both of individual interest (for entrepreneurs, traders, researchers, practitioners, employees, etc.) and social value.

In this view, entrepreneurship is a pillar for economic development and an intersection point of relations between different private and public operators.

The present work focuses on five EU countries (Denmark, Finland, Germany, Sweden, Latvia). This choice was motivated by three main reasons: Firstly, the level of development of the countries: Central-Northern European countries lead in the ranking of EU innovators; Sweden confirms its leadership in the field of human resources and quality of academic research; Denmark reached a high level of digital skills; Finland experienced the best governance and practices in R&D policy application; Germany achieved the highest performance in terms of private investments; and Latvia also records one of the highest growth rates in recent years. In fact, the GEM 2014 Report includes Latvia for the first time within the so-called "innovation driven economies".

These common characteristics and the territorial proximity define a form of macro-region, which represents the second motivation for our choice: to contextualise the analysis of entrepreneurship within the EU macro-regional framework. Our results confirm previous works and shed light on the processes of governance and organisation of different EU macro-regions. Incidentally, the entire Baltic Macro-region may be a driver for other macro-regional aggregations (such as the Danube, Adriatic Ionian, etc.), at least in terms of best practice (PIOTROWSKI, ORGANIŚCIAK-KRZYKOWSKA 2014), given that the five selected countries may be considered as the core of the Baltic Macro-region.

Thirdly, the choice is strictly related to the robustness of the outcomes. In fact, the preliminary approach, which involved other countries belonging to

the EU Baltic Macro-region, has been abandoned because of too much missing data.

This paper attempts to intercept the socio-economic and entrepreneurial factors affecting the probability of becoming an early-stage entrepreneur (individuals who are either a nascent entrepreneur or owner-manager of a new business between 18–64 years of age) in selected EU countries during 2005–2012.

The paper is organised as follows: In the first section, we present some empirical and theoretical aspects of literature. The second section describes the data used and research methods. The third section provides some characteristics of the sample, and the fourth section presents the results. In the final segment, the conclusions are presented.

A selection of theoretical and empirical aspects of entrepreneurship

Promoting entrepreneurship is one of the key targets of the European Union's cohesion policy (European Commission 2013). Entrepreneurship is considered by researchers, public authorities and stakeholders as a source of new job opportunities and a determinant of economic growth.

Since 1985, GARTNER has stated that entrepreneurship is a multi-dimensional phenomenon, which should be studied from various perspectives and with all its complexities. To date, this analysis has been conducted at different levels, such as micro- (individual), meso- (industry) and macro- (country or group of countries).

A few authors (FRITSCH et al. 2015, CUETO et al. 2015) have explained that the topic concerning the factors affecting entrepreneurial activity has not yet been completely examined; therefore, it is relevant to further investigate the factors contributing to the decision to start up new firms, as these factors may vary over time and across countries (KOELLINGER, THURIK 2012).

Many studies emphasise the role of socio-economic factors, such as age, education (VAN DER SLUIS et al. 2005), gender, income and work status in affecting entrepreneurial activity (GARCÍA-PEREIRO, DILEO 2015). For example, REYNOLDS et al. (2003) showed that men are more likely to start up new firms compared to females when they applied the empirical method to US entrepreneurial trends. ELAM and TERJESEN (2007) demonstrated that men are more likely to become entrepreneurs especially within areas specialised in agricultural activities.

However, research has confirmed that there are strong differences between young adults and other age groups, due to varying interplay within everyday

opportunities, risks and stages of cognitive development. Particularly, KLYVER et al. (2007), GRILO and THURIK (2008) underlined that various age groups have different impacts on the likelihood to start new firms, and LEVESQUE, MINNITI (2006) and ARENIUS, MINNITI (2005) demonstrated that the likelihood to start new businesses is higher for younger people.

AUTIO, ACS (2010) and DE CLERCQ et al. (2011), to name a few, demonstrated that the higher the educational level is, the more the awareness of own knowledge is in shaping the intention for undertaking entrepreneurial initiatives. Among socio-economic variables, literature also identifies employment status and income level as factors that directly influence the probability to start up a new business. Some studies (DAVIDSSON et al. 1994, REYNOLDS 1995, RITSILÄ, TERVO 2002) found evidence of the negative effect of unemployment on the birth of firms.

Over the past few decades, thanks to the Theory of Planned Behaviour (AJZEN 1991) and the Cognitive Psychology of Entrepreneurship (BANDURA 1986), many scholars have begun to analyse in-depth the relation between individual start up activity and perceptions.

In fact, to date, research mostly focuses on perceptual variables as factors influencing the decision to start up a new business (ARENIUS, MINNITI 2005, MINNITI, NARDONE 2007).

According to AJZEN (1991), SHANE et al. (2003), MCMULLEN, SHEPHERD (2006), BAYON et al. (2015), HESSELS et al. (2007) and FISHBEIN, AJZEN (2010), the perception of opportunity shapes entrepreneurial intentions (KRUEGER 2000) and, subsequently, the choice to start a new business. BOSMA, SCHUTJENS (2011) also showed that the individual perception of external characteristics is a crucial factor for an entrepreneurial decision.

One more factor influencing the creation of new firms is risk propensity. In literature on entrepreneurship, when fear of failure increases, individuals are more likely to back out as they are warned of the risk of investing resources for uncertain activities (ARENIUS, MINNITI 2005, LANGOWITZ, MINNITI 2007, MINNITI, NARDONE 2007). According to the cognitive approach, fear of failure may be considered similar to risk aversion (VAILLANT, LAFUENTE 2007, HESSELS et al. 2011, GÓMEZ-ARAUJO et al. 2015). WELPE et al. (2012) found that fear of failure may prevent unsuitable decisions and bad investments, and this strongly depends upon personal feeling (MITCHELL, SHEPHERD 2010, LI 2011, WOOD et al. 2014).

Many scholars (BANDURA 1977, BOYD, VOZIKIS 1994, MITCHELL, SHEPHERD 2010, GARCÍA-PEREIRO, DILEO 2015) have shown that the perception of having skills and knowledge is related to the probability to start a business. In fact, confidence in own skills influences entrepreneurial intentions and leads to the start up of new ventures (KRUEGER, BRAZEAL 1994, VERHEUL et al. 2003,

KARADENIS, OZDEMIR 2011). KOELLINGER (2008) identifies that the likelihood to valorise innovative business opportunities rather than imitative opportunities is strictly related to individuals characterised by a higher level of self-confidence.

Finally, social status can influence individual behaviour and stimulate the comparison between own attitudes and the most appreciated social symbols; this characteristic can foster or discourage the choice to start up a firm (URBANO, ALVAREZ 2014). Consequently, a desirable career choice is influenced by the common sense which changes around the world (XAVIER et al. 2013).

Data and methods

The data used for our empirical research derives from the Global Entrepreneurship Monitor (GEM), which is an exhaustive and well-harmonised worldwide data source, started in 1998 and coordinated by the London Business School (London, Great Britain) and Babson College (Boston, USA).

Every year the project provides international harmonised data on entrepreneurship, through a survey of a sample of at least 2,000 randomly chosen adults in a country (Adult Population Survey – APS) and standardised questionnaires of national experts (National Expert Survey – NES). Following the GEM key terminology, the NES is "administered to 36 'experts' in each GEM country and collects data on the context in which entrepreneurship takes place in a country".

According to the GEM Consortium, it is possible to identify entrepreneurs at three stages. First, Nascent Entrepreneurs – entrepreneurs whose businesses have been paying wages or any other payments to the owners for more than three months; New Business Owner-Managers – individuals who are currently the owner-manager of a running business, that have paid salaries, wages or any other payments to the owners for more than three months, but not more than 42 months; lastly, Established Business Owner-Managers – individuals who are currently the owner-manager of an established business, i.e. owning and managing a running business that has paid salaries, wages or any other payments to the owners for more than 42 months. All the categories take into consideration that the individuals are between 18–64 years of age.

Our empirical research includes APS data (from the national database) and takes into consideration individuals who are either a nascent entrepreneur or owner-manager of a new business between 18–64 years of age. This category is commonly defined as "Total Early-Stage Entrepreneurs".

To test our hypotheses, we performed a logistic regression model on a total of 31,609 observations, using as dependent variable the probability of being

involved in total early-stage entrepreneurial activity (TEA) during 2005–2012. We established a set of independent variables, such as Socio-economic (Gender, Age Class, Educational Level, Employment, Household Income), Entrepreneurial Perceptions (Opportunity, Fear of Failure, Entrepreneurial Skills) and Entrepreneurial Attitudes (Standard of Living, Entrepreneurial Career). Dependent variable takes the form of a dummy variable and explanatory variables are both dummy and categorical. Finally, we control for year and country effects.

Table 1

List of variables

Variable Name	Type	Description
Probability of being a total early-stage entrepreneur	Dependent	0=No; 1=Yes
Gender	Independent	Female/Male
Age Class	Independent	<24; 25–34; 35–44; 45–54; 55+
Educational level	Independent	Some secondary or less educational level; Secondary Degree; Post Secondary; Graduate experience
Employment	Independent	Working Part time or Full time; Not Working; Retired or Student
Household Income	Independent	In the upper 33% average; 33–66% and in the lower 33%
Opportunity	Independent	In the next six months there will be good opportunities for starting a business in the area where you live? (No; Yes)
Fear of Failure	Independent	Fear of failure to prevent you from starting a business? (No; Yes)
Entrepreneurial Skills	Independent	Do you have the knowledge, skill and experience required to start a new business? (No; Yes)
Standard of Living	Independent	In your country, most people would prefer that everyone had a similar standard of living (No; Yes)
Entrepreneurial Career	Independent	People consider starting a business a desirable career choice (No; Yes)

Source: own elaboration.

Characteristics of total early-stage entrepreneurship within selected EU countries

In this section, various descriptive statistics are shown. Figure 1 provides the percentage of individuals involved in TEA for our selected EU countries, comparing the first (2005) and the last year (2012). As we can see, each country experienced a growth in terms of individuals involved in TEA: Denmark's total early-stage entrepreneurial activity moved from 4.8% in 2005 to 5.4% in 2012,

and Sweden from 4.0% to 5.8%; Finland also exhibited a positive growth between the two years (5.00% vs. 5.90%), as well as Germany (5.1% vs. 5.6%), although with the lowest increase; finally, Latvia shows the highest TEA growth (6.00% vs. 13.3%).
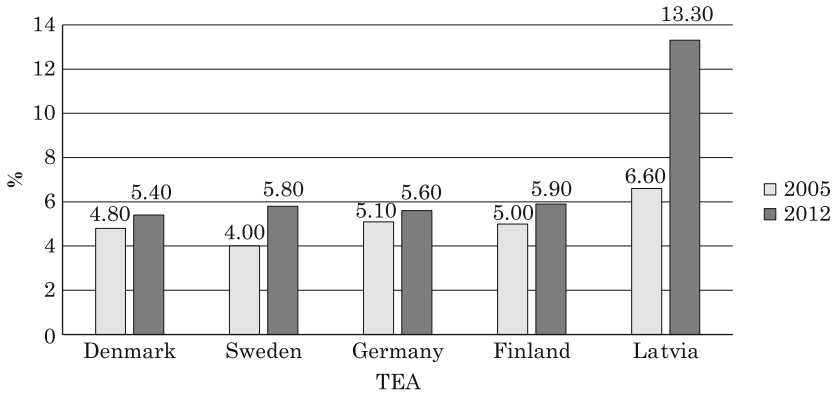
Fig. 1. Percentage of individuals involved in TEA (2005 and 2012)
Source: Own elaboration based on data from GEM.

Table 2

Characteristics of the sample (1)

	Variables		Not involved in TEA [%]	Involved in TEA [%]
Socio-Economic	Gender	Female	53.3	36.9
		Male	46.7	63.1
	Age Class	<24	11.4	10.0
		25–34	17.8	26.7
		35–44	22.7	29.6
		45–54	23.5	21.9
		55+	24.6	11.8
	Household Income	Lowest	33.0	22.3
		Middle	35.0	30.7
		Upper	32.0	47.0
	Educational Level	Some secondary or less	19.6	11.5
		Secondary Degree	29.7	28.6
		Post secondary Degree	34.5	39.3
		Graduate experience	16.2	20.6
	Employment Status	Working f-t; p-t	71.9	89.0
		Not working	11.0	6.6
		Retired/Student	17.1	4.4

Source: own elaboration based on data from GEM.

Table 2 describes the profiles of individuals involved in total early-stage entrepreneurial activity vs. individuals not involved, using the percentage

distribution of certain socio-economic factors. The first impact regards gender differences: from 2005 to 2012, a higher proportion of men involved in TEA emerged (63.1% vs. 36.9%). Another interesting element is the distribution per age. Individuals involved in TEA are mostly concentrated in the 35–44 (29.7%) and 25–34 (26.7%) age classes.

We also observe a higher proportion of individuals within the upper income class (47.0% vs. 32.0%), as well as a slightly higher percentage of individuals involved in TEA with Post-Secondary Degree and Graduate Experience compared to those not involved in TEA (39.3% vs. 34.5% and 20.6% vs. 16.2%, respectively). Finally, there is a higher quotient of entrepreneurs within the working (Part time/Full time) category (89.0% vs. 71.9%) compared to those who are not entrepreneurs.

If we take into consideration entrepreneurial variables, we observe a higher proportion of individuals involved in TEA who believe that starting a new business in the area where they are living represents a good opportunity when compared to individuals not involved in TEA (58.9% vs. 44.0%). Furthermore, a higher percentage of individuals involved in TEA declaring not to have a fear of failure (78.8% vs. 59.1%) and a higher percentage of individuals involved in TEA perceiving themselves to have the entrepreneurial skills to start a new business (85.4% vs. 39.5%) emerges. Finally, Table 3 presents a slightly higher percentage of entrepreneurs (43.2% vs. 41.1%) who do not believe that most people would prefer that everyone had a similar standard of living and a higher percentage of entrepreneurs who do not perceive that individuals consider starting a business a desirable career choice (51.4% vs. 48.2%).

Table 3

Characteristics of the sample (2)

	Variables		Not involved in TEA [%]	Involved in TEA [%]
Entrepreneurial Perceptions	Opportunity	NO YES	56.0 44.0	41.1 58.9
	Fear of Failure	NO YES	59.1 40.9	78.8 21.2
	Entrepreneurial Skills	NO YES	60.5 39.5	14.6 85.4
Entrepreneurial Attitudes	Standard of Living	NO YES	41.1 58.9	43.2 56.8
	Entreprenurial Career	NO YES	48.3 51.7	51.4 48.6

Source: Own elaboration based on GEM data.

Results

The results of logistic regression are shown in Table 4. The influence of independent variables on the dependent variable (TEA) is in line with the theory of entrepreneurship. Our results demonstrate that individuals involved

Table 4

Results from the logistic regression model

Socio-economics			*B*	Exp (*B*)	S.E.	Sign
Gender	(Female) Male		– 0.234	– 1.263	– 0.043	– ***
Age Class	(<24) 25–34 35–44 45–54 55+		– 0.021 –0.220 –0.562 –0.954	– 1.021 0.802 0.570 0.385	– 0.082 0.082 0.084 0.091	– – *** *** ***
Household Income	(Lowest) Middle Upper		– –0.104 0.005	– 0.901 1.005	– 0.570 0.056	– ** –
Educational Level	(Some Secondary/Less) Secondary Degree Post Secondary Degree Graduate Experience		– 0.103 0.204 0.233	– 1.108 1.227 1.263	– 0.074 0.070 0.080	– – *** ***
Employment Status	(Full–Time/Part–Time) Not Working Retired/Student		– –0.260 –1.008	– 0.771 0.365	– 0.082 0.101	– *** ***
Entrepreneurial perceptions						
Opportunity	(No) Yes		– 0.408	– 1.503	– 0.043	– ***
Fear of Failure	(No) Yes		– –0.532	– 0.587	– 0.049	– ***
Entrepreneurial Skills	(No) Yes		– 1.577	– 4.842	– 0.056	– ***
Entrepreneurial attitudes						
Standard of Living	(No) Yes		– 0.010	– 1.010	– 0.042	– –
Entreprenurial Career	(No) Yes		– –0.062	– 0.940	– 0.041	– –
Time Fixed Effects Country Fixed Effects	Yes Yes		– –	– –	– –	*** ***
Constant Obs Log Likelihood R–squared Nagelkerke			–2.977 – – –	0.051 – – –	0.140 31,609 16,805.52 0.223	*** – – –

In brackets: Reference Category.
Statistical significance = *: $p < 0.01$; **: $p < 0.005$; ***: $p < 0.001$.
Source: own elaboration, GEM 2005–2012.

in TEA are more likely to be males (Exp B = 1.263), and this result is consistent with ARENIUS, MINNITI (2005) and ARENIUS, DE CLERCQ (2005). The likelihood of becoming an entrepreneur decreases in older age groups (Exp B: 35-44 age class = 0.802; 45-54=0.570; 55+=0.385).

Entrepreneurs are characterised by a lower probability of being within the middle income level (Exp B = 0.901) and a higher probability of having received a Bachelor's Degree (Exp B = 1.263) or Post-Secondary Degree (Exp B = 1.227). It is also consistent with ARENIUS, DE CLERCQ (2005) and DAVIDSSON, HONIG (2003), who demonstrated the strong relation between highly educated people and the perception of opportunity in starting a new business.

Furthermore, entrepreneurs show a lower probability of being Not Working (Exp B = 0.771) or Retired/Students (Exp B = 0.365). This result is more likely associated with the fact that individuals start new ventures when they attain money from an existing job.

Regarding perceptions, it is more likely that entrepreneurs declare that they do have the skills for entrepreneurship (Exp B = 4.842). Perceived skills are also an important prerequisite influencing the decision to start a new venture. This is consistent with BAYON et al. (2015), who found that a positive perception of own knowledge leads individuals to convert the thought phase into action.

Our results have also pointed out that the likelihood to become a total early-stage entrepreneur is positively related to those believing that entrepreneurial activity will be an opportunity (Exp B = 1.503), and this positive impact has been recently confirmed by BAYON et al. (2015). In line with the recent outcomes by VAILLANT, LAFUENTE (2007) and WOOD et al. (2013), these entrepreneurs also have a lower fear of failure (Exp B = 0.587). The negative sign of this variable suggests that an increased fear of failure slows down entrepreneurial incentives to start new businesses.

The "Standard of Living" and "Entrepreneurial Career" variables are not statistically significant.

Conclusions

The present paper represents preliminary research aimed at collecting individual data on entrepreneurial activity, focusing on the so-called total early-stage entrepreneurship.

Our results are consistent with literature on the subject. Socio-economic variables play an important role in affecting the likelihood to start new ventures: the probability to become an early-stage entrepreneur increases for

males and younger individuals with higher education, a bachelor's degree or secondary education and who are working part time or full time.

Furthermore, this paper corroborates the role played by perceptual variables. In fact, individuals involved in total early-stage entrepreneurship are also characterised by a lower fear of failure and higher entrepreneurial skills and perception of opportunity.

As mentioned in the introduction, the countries analysed seem to be the best performers among EU countries in terms of entrepreneurial growth and innovation performance. However, our findings may be more likely justified through different reasons: the characteristics of the sample, the small number of countries analysed and the lack of institutional context. In fact, further research will be oriented towards testing if our findings also depend on specific conditions of development of entrepreneurship and the quality of the institutions.

Obviously, the recent economic crisis produced an overall slowdown of economic and entrepreneurial growth and increased internal disparities and exasperated the delicate equilibrium within the public budgets. The subsequent decrease of financial resources also had a negative impact on the propensity of individuals to start up new businesses and also impacted the mortality rates of many other firms.

Consequently, if our goal is to contextualise the findings in a macroregional perspective, further research will be oriented towards in-depth analysis of other EU macro-regional systems, such as the Adriatic Ionian and Danube systems, and compare each one in order to test the most representative policies and best practices.

However, the nexus between entrepreneurship and growth perspectives is not so easy to explain. In fact, although fostering entrepreneurial activities can be useful, mostly where unemployment rates are higher and job opportunities are lower, a positive and successful entrepreneurial policy may be followed through direct measures addressed to individuals who have a high degree of risk aversion, and mostly to those having the ability to successfully pursue an entrepreneurial upgrading.

Apart from the country, policy makers would have to strengthen the institutional framework that involves measures aimed at empowering potential entrepreneurs in finding new market opportunities. Territorial cooperation in a macro-regional perspective may be a facilitator aimed at entrepreneurial development; within such a framework, governments would have the important role of supporting innovative ventures and to consistently check the levels of skill of potentially eligible entrepreneurs.

If the objective of the EU is to stimulate new entrepreneurial activities, there will also need to be an understanding of whether this goal may be

reached within the framework of territorial aggregation strategies among member and non-member countries.

Territorial cooperation in a macro-regional perspective can be a facilitator for entrepreneurial development in the context of structural change where social and economic marginalisation is strong, mostly where the aggregation occurs between countries characterised by wider historical, economic and social differences and which are undermined by a lower level of development compared to other territorial aggregations.

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SOCIAL SECURITY OF POPULATION AS A BASIS FOR STABLE GROWTH OF BORDER REGIONS

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K e y w o r d s: social growth, social security, social environment transformation, employment, income of population.

A b s t r a c t

This article presents the issues of social development and social protection in border regions. An extensive analytical study shows that taking effective actions on social protection and social development is the basis of stable development of border regions. Theoretical foundations of social protection of the population were also presented. Using the example of national programs of social protection of the population in developed countries, the main directions of social protection of the population were examined. This paper also includes an assessment of capabilities and resource bases and their impact on the social protection of the population, a combination of cash and in-kind funds required to meet human needs and the functioning of the entire system of social protection of the population in border regions.

OCHRONA SOCJALNA LUDNOŚCI JAKO PODSTAWA STABILNEGO ROZWOJU REGIONÓW PRZYGRANICZNYCH

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S ł o w a k l u c z o w e: rozwój socjalny, ochrona socjalna, reformowanie sfery socjalnej, zatrudnienie, dochody ludności.

Abstrakt

W artykule przedstawiono problem rozwoju socjalnego i ochrony socjalnej w regionach przygranicznych. Na podstawie wyników obszernych badań analitycznych wykazano, że skuteczne działania w tych dwóch obszarach są podstawą stabilnego rozwoju regionów przygranicznych. Omówiono teoretyczne podstawy ochrony socjalnej ludności oraz przedstawiono jej przykłady w krajach rozwiniętych. Przebadano również podstawowe kierunki ochrony socjalnej społeczeństwa. Artykuł jest swoistą oceną potencjału oraz zaplecza surowcowego i ukazuje ich wpływ na społeczną ochronę ludności, pozyskiwanie środków pieniężnych niezbędnych do zaspokojenia potrzeb człowieka oraz funkcjonowanie całego systemu tej ochrony w regionach przygranicznych.

Introduction

Social security is the most important task of developing border regions, and this affects their sustainability. The relevance of this problem is obvious and shows that, to date, science intensively explores this important area. This study shows the theoretical basis of social protection of the population and the development program of developed countries concerning pension funds, insurance for the unemployed, sick, pensioners, orphans, as well as the multi-tiered structure of social security to ensure a safe income level and the specific problems of social protection of people. A specific example of two border regions of the Kaliningrad region and the Warmian-Masurian Voivodeship shows the most urgent problems of economic activity of the population and its natural movement, the average monthly income of the population, employment and unemployment. Special attention is paid to realization of practical measures for the social protection of the population and the system of maintaining and increasing jobs, which aims to improve the living conditions of the population using the traditions and experiences established on both sides of the border.

Theoretical foundations of social protection of the population

The "social security" category refers to specific actions of a government on enabling decent life conditions and unhindered growth for all social groups (employable, unemployable, socially vulnerable), which are narrowly targeted to particular groups and are aimed at protecting them from all kinds of risk.

Foreign and domestic economic theories of wealth, state programs of social welfare in economically developed countries, as well as a government's experience in providing welfare care constitute the theoretical underpinning of a social security policy. An analysis of the scientific publications of A. Pigou,

R. Titmuss, E. Hansen, S. Boulding, P. Samuelson, D. Eibessiere, L. Erhard and others leads to the conclusion that it is a fundamental right of a citizen to receive certain social benefits from the state (PIGOU 1985, HANSEN 2008). The mechanism of social security itself is a dynamic process of transformation of forms and methods of state intervention under the influence of the social class struggle condition and has a huge impact on a population's motivation.

Among the elements of national programs that we find most relevant, one can name the following: Great Britain – the idea of a retirement decade, retirement with examination of needs, national insurance for the unemployed, ill, retired, widows, orphans, pregnant women, as well as national support of a program for the unemployed; Sweden – with a universal character, large scale and broad availability of all elements of the social care system, high level of collective satisfaction of social needs, social insurance system; USA – multileveled structure of the social security system, participation principle, social security law, private programs, safe level income guarantee program, obligatory child security program. Without any doubt, other countries' wide experience in building social care systems should be studied, although in the process of it's implementation, certain specific problems of Russian citizens in the context of critical economic situation, as well as the complicated establishment process of market economy relations, should be taken into account.

In the process of development of social security mechanisms, it is considered necessary to rely on the fact that the main guarantee of a social security system for citizens is the constitution, e.g. in Russia, the Russian Constitution. According to the Constitution in the Russian Federation, the labor and health of all people shall be protected, a guaranteed minimum wage shall be established, state support shall be provided for the family, maternity, fatherhood and childhood, for the disabled and for elderly citizens, the system of social services shall be developed and State pensions, allowances and other social security guarantees shall be established. The Russian Constitution also states that every citizen shall be guaranteed with social security for old age, in case of illness, disability and loss of the main income provider, for the bringing up of children and in other cases specified by law (The Constitution of the Russian Federation of 12.12.1993).

At the same time, the established conditions and possibilities of the Russian state, in terms of effective social security system creation, should be taken into account. The high level of state budget deficit, sanctions and collapse of the Russian ruble make all currently implemented social security programs unrealistic. Whereas in developed countries which have a stable market economy, the presence and the outreach of social security systems are considered to be the main criteria and measure of a market economy's

civilizational development level. In Russia, the social security mechanism is rather a reaction on building social tensions and should be seen as an attempt to support social stability.

The practical direction of social protection of the population

In the course of a study on the stable economic growth of border areas and its impact on the condition of the social environment and prosperity of the population, it is worth pointing out the three main directions that characterize this multifaceted phenomenon. The first direction is related to the assessment of the potential and the resource base and their influence on social growth. Numerous studies prove that the higher the amount of high quality supplied to a border area, the higher the level of social development (BILCHAK et al. 2016). Human resources are the main and most important resource of border regions (Tab. 1).

Table 1

Population and working and non-working age population in the Kaliningrad region and the Warmian-Masurian Voivodeship in the years 2011–2015

Year	2011	2012	2013	2014	2015
Kaliningrad Region					
Population:	941,823	946,796	963,128	968,944	976,439
– males	442,054	444,420	452,309	454,927	458,430
– females	499,769	502,376	510,819	514,017	518,009
– population per 1 km²	62.3	63.1	64.0	64.0	64.6
– population at age:					
pre-working	145,437	148,364	157,808	162,065	167,223
working	588,026	584,245	578,702	573,739	569,283
rural areas	208,360	214,187	226,618	233,140	239,933
Warmian-Masurian Voivodeship					
Population:	1,452,596	1,450,697	1,446,915	1,443,967	1,439,675
– males	711,551	710,502	708,478	706,988	704,893
– females	741,045	740,195	738,437	736,979	734,782
– population per 1 km²	60.1	60.0	60.0	59.7	59.6
– population at age:					
pre-working	284,478	279,683	274,832	270,848	266,937
working	947,920	942,867	935,744	927,429	917,403
rural areas	220,198	228,147	236,339	245,690	255,335

Source: *Obwód kaliningradzki i województwo warmińsko-mazurskie w liczbach* (2012, 2013, 2014, 2015, 2016).

As can be seen from Table 1, in both border regions, there is a significant problem in the gender structure of the population. Starting from 2011, the number of females significantly exceeded the number of males, and this trend increases with each passing year. If in the Kaliningrad region in 2015 the number of females exceeds the number of males by 59,579, then in the Warmian-Masurian Voivodeship – by 29,889. Herewith, the total population of the Kaliningrad region tends to increase – it has increased by 43,616, but in the Warmian-Masurian Voivodeship, the population is reduced – by 12,921. A similar situation exists with population density. For example, in the Kaliningrad region, population density increased from 62.3 people per 1 km^2 in 2011 to 64.6 people per 1 km^2 in 2015. The Warmian-Masurian Voivodeship population density decreased from 60.1 people per 1 km^2 in 2011 to 50.6 people per 1 km^2 in 2015. Another characteristic feature in both border regions is the reduction of the working age population and the increase of the indicator over the working age population.

The second direction is related to the role of income in ensuring prosperity of the population and requires more detailed insight. In scientific literature, income formation issues are the most discussed, and the scientific definition of "income" changes whenever economic relations within a society change, reflecting objectively unavoidable mistakes and disputes.

Usually, income is defined as the total amount of money and natural resources necessary for satisfying human needs. In other words, income is a stable supply of money and other material goods and services measured within a certain period of time and which is capable of satisfying human needs. There are also other definitions of income. Taken as an economic category, income reflects a complex combination of economic relations, in which the total amount of newly produced value is distributed between owners of production factors and which materializes the relationship between members of a society as owners of these factors, as well as their relationship with the government in terms of appropriation and consumption of a certain part of the produced goods and services (SERGEEV et al. 2009).

Wage takes priority among the income of a population and defines its prosperity. Wage can be direct or social. Direct wage is related to production activity and measures the exact contribution of labor to the development of an enterprise. Social wage is understood as various types of transfers (Tab. 2).

As it can be seen from Table 2, the gross wages and salaries in the Warmian-Masurian Voivodeship are approximately 2-fold higher than in the Kaliningrad region, especially within industry. An even larger gap is observed in the provision of a pension to the population. In the Warmian-Masurian Voivodeship, this is approx. 2.5 times higher. Such an important figure as the average monthly income per capita in households also varies in favor of the

Average monthly income in the Kaliningrad region and the Warmian-Masurian Voivodeship in the years 2011–2015*

	Kaliningrad region					Warmian-Masurian Voivodeship				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Average monthly gross wages and salaries	19,911	21,526	25,104	26,639	28,262	3,019	2,996	2,996	3,107	3,223
Of which:										
– industry	18,916	20,616	22,076	24,527	26,991	2,800	2,895	2,895	3,011	3,149
– construction	19,543	19,351	25,593	26,326	28,038	2,611	2,486	2,486	2,533	2,645
Average monthly gross retirement pay and pension	7,893	8,724	9,562	10,358	11,492	1,501	1,588	1,670	1,734	1,790
Average monthly income per capita in households	11,649	12,527	13,829	14,630	18,290	1,097	1,110	1,109	1,230	1,281

* in Kaliningrad region in Ruble (RUB), in Warmian-Masurian Voivodeship in PLN.
Source: *Obwód kaliningradzki i województwo warmińsko-mazurskie w liczbach* (2012, 2013, 2014, 2015, 2016).

Warmian-Masurian Voivodeship, where it is 306 euros compared to 272 euros in the Kaliningrad region.

The third direction is related to the social security of a population. Survey results show that not only those who lack material assets to support their physical existence, but also those people who do not accept the fact of having any worse living standard than other social groups, their neighbors, etc., consider themselves to be poor.

Many people have a habit of correlating their needs to the "earned" level of income, their objective position within the social labor division system, as well as within the system of relations in terms of appropriation of individual and collective labor effects on the basis of one's abilities and private property, both in material and monetary forms.

Thus, in border regions, the orientation of a government's social security policy for low-income social groups (in terms of physical needs) should be considered unsuitable for the present realities. The government should focus on designing a multi-level social security system embracing all social groups with regard to the settlement dispersion aspect of an intraregional social policy of border regions.

The main form of social security is to provide useful forms of employment in general, as well as sufficiently paid employment in particular. The main goal is to establish a real price of a good (namely – labor force) and to develop the basic market mechanism for both the professional and territorial movement of the labor force. There should be a regulatory mechanism of social partnership on the basis of the use of the three-party principle: the relationship between

the state, employers and employees in the form of general agreements on social and economic issues, tariff agreements within industries and collective agreements. A significant role should be attributed to the social partnership mechanism, in which the principle of tariff autonomy can be used; in other words – when severe government intervention can be avoided. There is a need for a mediation institution composed of natural persons and for legal mechanism to solve contradiction between the voluntariness of taking obligations and their real performance to the full extent.

A non-traditional approach should be adopted to solve the problem of providing social security for those who need special care (women, school graduates, impaired people, people of pre-retirement age and others). With regard to the prosperity level of modern families in border areas, as well as the character of production activity, professional structure, the need for economic reforms and other social factors, it is expected that, apart from implementation of intra-regional sources of social wages (both in monetary and natural forms), certain administrative measures should be undertaken in order to increase the employability of a population (Tab. 3).

Table 3

Employment in the Kaliningrad region and the Warmian-Masurian Voivodeship in the years 2011–2015

	Kaliningrad region					Warmian-Masurian Voivodeship				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Average paid employment (in thousands)	470.5	478.2	476.5	477.7	473.9	203.5	280.4	267.9	263.2	265.6
– of which is industry	100.1	103.1	101.1	91.7	87.7	80.1	84.5	83.3	81.1	82.6
Economic activity of the population (annual averages) by LFSa										
Economically active persons (in thousands)	532	524	527	529	530	598	569	597	584	614
– of which are females	255	253	254	251	253	262	249	263	257	272
– employed persons	483	485	497	500	499	540	506	529	527	556
– of which are females	234	236	239	237	240	232	219	230	231	244
– unemployed persons	49	39	30	29	31	58	63	68	57	59
– of which are females	21	17	14	14	14	30	31	32	26	29
Economically inactive persons (in thousands)	215	217	214	213	214	548	537	551	557	563
– of which are females	133	133	132	135	133	334	322	326	334	336
Activity rate in %	71.2	70.7	71.1	71.3	71.3	52.2	51.4	52.0	51.1	52.1
Employment rate in %	64.6	65.5	67.1	67.4	67.2	47.1	45.8	46.1	46.1	47.2
Unemployed rate in %	9.2	7.4	5.6	5.4	5.7	9.7	11.1	11.4	9.8	9.4

Source: *Obwód kaliningradzki i województwo warmińsko-mazurskie w liczbach* (2012, 2013, 2014, 2015, 2016).

In 2015, the level of economic activity of the population reached 71.3% in the Kaliningrad region and 52.1% in the Warmian-Masurian Voivodeship. The unemployment rate was 5.7% in the Kaliningrad region and 9.4% in the Warmian-Masurian Voivodeship. What is more, in certain border counties, the unemployment rate reached 27.4% – Kętrzyn, and 27.3% – Braniewo (*Województwo warmińsko-mazurskie w liczbach* 2016).

It should be noted that in the Kaliningrad region, the economically inactive population is 214 thousand people, and in the Warmian-Masurian Voivodeship, it reaches 563 thousand. This is due to the level of employment in both regions. In 2015, this figure reached 67.2% in the Kaliningrad region, and in the Warmian-Masurian Voivodeship – 47.2%. Thus, the number of unemployed and the economically passive residents in the total population in the Warmian-Masurian Voivodeship is higher than in the Kaliningrad region.

In addition to the employment of the population, in practice, other, specific means of social protection are used. These can be both traditional indicators (such as nominal income level, family income, birth and death rates per 1000 people, distance to nearest economic and political center) and new ones (net migration rate and percentage rate of highly qualified human resources, percentage rate of unemployed among employable population, real dynamics of wages, dividends, incomes coming from property or enterprise, estimated value of personal property with regard to depletion and age prices, supply of housing, services, etc.).

In order to define a border region's ability to form non-budget funds, it is useful to calculate the index of pure profit supply level (for one resident) that remains at the disposal of that region's administrative entity. If that index is below the average level for the country, it means that this will prove difficult for that particular border region to form its intraregional reserves.

The social security mechanism should include a social partnership of administrative organs and new structures, such as non-government commercial and non-profit or charity organizations. There is a potential support mechanism for these organizations: creating the most favorable conditions, implementing a qualified non-intervention policy, tax and credit policy reform, providing assistance in solving urgent problems (selling of unfinished objects, lands, service facilities, etc.), providing consulting services.

Particular attention should be paid to support programs for small businesses. It is obvious that, along with the simultaneous change of economic structure in border regions and the change of character of interregional connections, and in the course of the transformational process, small businesses begin to involve a huge part of population – as new subjects of ownership, into the sphere of economic relations.

Small and medium-sized businesses of border areas are not only intended to help in the struggle during an ongoing critical situation, they are also capable of dealing with large, regional-level issues, such as general harmonization and rationalization of public production, developing a new structural policy of national economic complex within regions and eliminating the very heart of a monopoly on production of goods and services. Although in order to let small and medium-sized businesses successfully develop and perform their typical functions, appropriate conditions within regions should finally be created (BILCZAK et al. 2011).

There is an emerging challenge for enterprises of border areas to solve the social problems of their employees in a civilized manner. Social benefits attributed to members of staff are established at a cost of artificially increased product prices, monopolistic dictate on a segmented market, misuse of soft loans, etc. An intraregional mechanism of mutual interest for enterprises and local administrative organs in the development of social objects within regional production complexes should be created.

Practical recommendations on social protection

Within border areas, activation of a social policy should contribute to increasing the level of employment and income of the population. To that end, the attention of the business community and all branches of government should be drawn to the following issues:

1. Ensuring execution of the constitutional law of the residents of border areas to have free access to high quality education and health care services and, simultaneously, providing normative financial support, facilitating development of national social standards, gradual implementation of individual social loans into a high education system and classification of border areas in terms of their financial condition, having previously foreseen the primary role and anticipating the character of education and health care systems as compared to other branches of the economy. To carry out strict supervision over the disbursement of money from the non-budget fund of health insurance and transition towards an insurance-budget health care system according to the possibilities of each border region.

2. To develop an effective incentive system within regions in order to enhance the development of a multi-sectoral economy that gives people the freedom to choose jobs that fit within their sphere of interests. In this regard, full assistance will have to be provided in order to enhance new forms of self-organization of the population, which are aimed at creating new jobs, re-education, further training and increasing the level of social protection. Within

border regions, integrated programs aimed at retention and creating jobs; these programs should be geared at normalization of living conditions and sustenance among the population, with regard to existing traditions and experience on both sides of a border. At the same time, the possibilities deriving from a legal and regulatory framework should be used in order to execute such programs and provide financial and informational support to border regions. In this regard, there should be practical implementation of social expertise of the main economic solutions and programs in terms of their social consequences and impact on the level of employment and solutions for socially significant issues within the entire spectrum of the living standard and quality of life for the population of border regions.

3. In the aspect of social security of the population, particular emphasis should be placed upon consistent implementation of measures aimed at ensuring residents (especially the unemployable and socially vulnerable) guaranteed social security, to an extent adequate to their financial situation. In this regard, new government standards and licensing conditions for the social services sector should be implemented; new social technologies with particular emphasis on providing outreach services, as well as enhancing social security for certain categories of people. Particular attention should be paid to providing a guaranteed wage and maintaining its minimum level, which should be near the average subsistence level, along with its further systematic increase. Implementing a guaranteed minimum wage level within enterprises, with indexing depending upon price growth, minimizing social inequalities, designing a savings restoration mechanism, wage indexing in order to evaluate work input for the purposes of establishment of retirement rights and re-evaluation of its amount; also, bringing levels of salaries and pension levels closer to the subsistence minimum of developed countries.

4. Ensure integrated growth of social infrastructure related to protection of population. Also, by building new facilities and major reconstruction and renovation of existing nursing homes, orphanages, dormitories, rehabilitation centers, administrative buildings and social care facilities. At the same time, to provide full amount and broad availability of social services to all senior and disabled residents, or families with disabled children, including taking actions on designing appropriate home amenities for disabled adults and children, providing special rehabilitation items for self-service and care, purchase of special transportation facilities and technical rehabilitation equipment for disabled people.

5. To revise legal regulations on social care in order to eliminate all outdated regulations, as well as the declarativeness and unenforceability of particular articles and paragraphs. At the same time, to supplement the existing legislative system with additional norms and acts on the basis of

independent expertise, in order to ensure enforcement of the social rights and guarantees used in developed and progressive countries. To facilitate a social inventory system and to evaluate, on a basis of social norms and indexes, such factors as: supply of housing facilities, family and personal income, subsistence minimum, health care, educational, touristic, recreational, cultural and sport services as main development level indicators for the social environment.

Conclusions

Thus, the main strategic goal of the social policy in border areas should be seen as systematic work aimed at shaping social policy in the context of actual existing conditions within border areas. First of all, in the course of implementation of social measures, particular attention should be paid to the possibilities and potential of a resource base. Only then could the active social policy constitute a catalyst of stable economic growth.

In modern conditions of integration, internationalization and globalization of the economy, systemic changes take place in border regions, which are aimed at establishing new contacts, developing innovative forms of management and converging the legal, cultural and ethnographic differences existing among the population living in border areas. This material reflects the current problems of social protection of the population as a basis for sustainable development and the operation of border regions in new geopolitical conditions.

Translated by Słowoforma JANA RUTKOWSKA
Proofreading by IAN TRANSUE

Accepted for print 30.12.2016

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THE INNOVATION SYSTEM AS A PILLAR FOR A KNOWLEDGE-BASED ECONOMY – AN ANALYSIS OF REGIONAL DIVERSITY IN POLAND

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A b s t r a c t

The objective of the study was an evaluation of the regional diversity of the innovation system in Poland and changes which took place in this realm between 2009 and 2014. In the study, numerical taxonomy methods were used. A synthetic innovation index was built with the use of the non-model method. The results of analyses may be summarised as follows: regional disparities in the level of the innovation system in Poland have slightly decreased; however, they are still at the average level. This is confirmed by the value of the variability index, which dropped from the level of 31.6% in 2009 to the level of 29.9% in 2014. Regional convergence in the area of the innovation system was accompanied by internal convergence and divergence processes occurring in parallel in provinces. Internal convergence processes were observed in 11 provinces, and internal divergence processes were observed in the remaining five provinces, yet in the case of three of them, i.e. Kujawsko-Pomorskie, Świętokrzyskie and Warmińsko-Mazurskie, such processes had a marginalising effect.

SYSTEM INNOWACJI JAKO FILAR GOSPODARKI OPARTEJ NA WIEDZY – ANALIZA STANU ZRÓŻNICOWANIA REGIONALNEGO W POLSCE

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Abstrakt

Celem badań była ocena zróżnicowania regionalnego systemu innowacji w Polsce oraz zmian jakie zaszły w tym zakresie w latach 2009–2014. W badaniach wykorzystano metody taksonomii numerycznej. Syntetyczny wskaźnik systemu innowacji zbudowano z wykorzystaniem metod bez-wzorcowych. Wyniki analiz można podsumować następująco: regionalne dysproporcje w poziomie systemu innowacji w Polsce nieznacznie się zmniejszyły, nadal utrzymują się jednak na poziomie średnim. Potwierdzeniem tego jest m.in. wartość współczynnika zmienności, która z poziomu 31,6% w 2009 r., obniżyła się do poziomu 29,9% w 2014 r. Regionalnej konwergencji w zakresie systemu innowacji towarzyszyły równolegle zachodzące procesy konwergencji i dywergencji wewnętrznej województw. Procesy o charakterze konwergencji wewnętrznej obserwowano w jedenastu województwach, procesy dywergencji wewnętrznej w pozostałych pięciu, przy czym w przypadku trzech z nich: kujawsko-pomorskiego, świętokrzyskiego i warmińsko-mazurskiego, procesy te miały charakter efektu marginalizacji.

Introduction

According to the World Bank definition, the knowledge-based economy (KBE) is a type of economy where knowledge is created, acquired, transferred and used more effectively by enterprises, organisations, individuals and communities for greater economic and social development (DAHLMAN, ANDERSSON 2000, p. 32). Building a knowledge-based economy is closely related to the growth of innovation in the economy, increased significance of areas intensely using technology, and a highly qualified labour force (NOWAKOWSKA et al. 2011, p. 10). Such an economy is based on research and development activity, and innovations which lead to the modernisation of the economy and increased productivity, which, in turn, determines the volume of generated income (CZYŻ 2009, p. 79).

Four pillars are of key significance for the development of the KBE: a system of economic and institutional incentives, educated and skilled workers, an effective innovation system, and a modern and adequate information structure.

The third of the above-listed pillars of the KBE[1] – the innovation system – refers to the network of institutions, principles and procedures which influence the manner in which the economy purchases, generates, distributes and uses knowledge (CHEN, DAHLMAN 2006, p. 6). It may be defined as all public and private institutions that are inter-connected and that voice a demand for innovations, implement innovative projects, commercialise the results of R&D work, and influence the diffusion of innovations (KASPER-KIEWICZ 2014, p. 87). The institutions forming a part of the innovation system include (WERESA 2012, p. 34):

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[1] The remaining pillars of the KBE will be the object of separate studies in a series of articles regarding the issue of regional varieties of the KBE in Poland.

– enterprises, especially these which invest in innovative activity;

– universities and research institutes pursuing scientific studies;

– public and private institutions involved in general and vocational education;

– governmental institutions that finance, support and regulate innovative processes.

In other words, the innovation system is made up of mutually-engaged enterprises, scientific and research centres, universities, knowledge incubators and other organisations which may contribute to expanding the volume of knowledge, adapting it to local needs, and generating new products and services, technologies and methods of conducting business (SOKOŁOWSKA-WOŹNIAK 2006, p. 105). The operation of such a system relies on innovative processes occurring in enterprises and on the expanding of processes into other entities in sectors and regions, as well as on the shaping of such processes – mainly via state policy – at the national level (ZORSKA 2012, p. 33). Institutions that create the innovation system, form regional or even global research and innovation networks, and make skilful use of the growing knowledge resources thereby contribute to their development, commercialisation and market application (MADRAK-GROCHOWSKA 2013, p. 361). Cooperation among entities that make up the innovation system is beneficial for all of them, as it offers an opportunity for mutual learning and joint activities, and also creates social capital activating their work in a given system (SOETE et al. 2010, p. 1167).

An efficient innovation system is a system which creates an environment conducive to the conduct of research and development activity, leads to generation of new products, new processes and new knowledge, and thence is the main source of technical progress (CHEN, DAHLMAN 2006, p. 6). An efficient innovation system creates new technologies and enables efficient adaptation of the existing knowledge (ŻELAZNY 2006, p. 249). Proper management of innovative knowledge determines the use of knowledge resources and the creation of new knowledge (NOWAKOWSKA et al. 2011, p. 32). Therefore, an efficient innovation system is a system that enables efficient use of the existing resources of knowledge, the creation and distribution of new knowledge, and its transformation into innovations and the development of new technologies. The efficient innovation system should function both at the national level, as well as the regional level. Innovations are one of the factors influencing the modern diversity of the level of economic development. The spatial dimension of the innovation system is gaining increasing importance.

In the light of the above, the objective of the research was an evaluation of the regional innovation system in Poland, along with changes that took place in this respect between 2009 and 2014. An attempt was made to answer the

following question: *Do the changes taking place with respect to the regional diversification of the innovation system in Poland have the character of regional convergence or divergence processes?* The proposal for answering this research question was contained in the following research hypothesis: *Regional diversification of the innovation system in Poland is decreasing; thence, the process of regional convergence is taking place in this respect.*

The research was performed at the regional NUTS II level. The method of linear ordering was used, based on the synthetic variable and the method of grouping linearly ordered items. The time range of the study encompasses the period from 2009 and 2014, and was determined by the absence of complete and comparable data from the previous years for the variables selected for the study.

Study Methodology

In line with the Knowledge Assessment Methodology (KAM) developed in 1998 by World Bank experts, measurement of the knowledge-based economy takes place on the basis of numerous variables representing individual pillars of the KBE. Determinants of innovation taken into account in the above-mentioned methods include such variables as (CHEN, DAHLMAN 2006, p. 38, GORJI, ALIPOURIAN 2011, p. 49–54, UJWARY-GIL 2013, p. 165–168, *Measuring Knowledge...* 2016, p. 3):

– number of academic employees in the R&D sector;
– number of academic articles in academic and technical journals;
– patent applications granted by the United States Patent and Trademark Office (USPTO);
– expenditure on R&D as a percentage of GDP;
– level of enrolment to technical and nature studies;
– fees for licence usage;
– export of technologically-advanced products.

In the reference literature on the subject it is possible to find numerous studies on the KBE and its individual pillars conducted on the basis of modified sets of variables as compared to the KAM (cf.: CHOJNICKI, CZYŻ 2003, KUKLIŃSKI, BURZYŃSKI 2004, PIECH 2006, STRAHL 2009, DWORAK 2012, *Regionalne Systemy Innowacji...* 2013, DWORAK et al. 2014, SKRĘTOWICZ, KOŻUCH--PROKOPIUK 2015). When choosing the variables, the authors tried to select those variables that describe the examined phenomenon best and were adequate to the level of the performed analysis (not all variables proposed in the KAM are available at the regional level). Furthermore, the authors were guided by the availability of data for the adopted research period.

In line with the definition adopted by the author of this paper, the system of innovations is made up by entities cooperating with respect to the creation, diffusion and use of knowledge. Therefore, the innovation system refers to the level of innovation of companies, and the research centres, universities and other organisations collaborating with them in such a system. At the stage of selecting variables, the author tried to choose those variables which corresponded to the adopted definition best. The author also selected the variables with respect to statistical issues (variability of variables and the degree of correlation with other variables). The final set of diagnostic variables on the basis of which the synthetic index describing the innovation system in provinces was built included the following variables:

    – X_1: number of units which pursue R&D activity per 10,000 entities of the national economy entered in the National Official Register of Business Entities;

    – X_2: level of internal expenditure incurred in R&D activity in conversion per capita;

    – X_3: number of persons employed in R&D in a full-time equivalent (FTE) in conversion per 1,000 professionally active people;

    – X_4: percentage of industrial companies which invested in innovation activity;

    – X_5: share of net revenues from the sale of innovative products in industrial companies in total net sales revenues;

    – X_6: industrial companies cooperating as part of a cluster initiative or other formalised cooperation in the percentage of innovation-active companies;

    – X_7: number of companies possessing funds for the automation of production processes per 10,000 entities of the national economy entered in the National Official Register of Business Entities;

    – X_8: patents granted by the Patent Office of the Republic of Poland in conversion to 1 million residents;

    – X_9: share of human resources for science and technology[2] in the professionally active population;

    – X_{10}: percentage of students pursuing technical and nature studies.

Synthetisation of variables was conducted with the use of non-model methods which consist in averaging the values of normalised variables. The normalisation of variables was performed with the use of the zeroed unitarisation procedure. On account of the fact that all variables were assigned with the character of stimuli[3], the procedure was performed according to the following formula (PANEK, ZWIERZCHOWSKI 2013, p. 37):

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[2] Total number of persons currently involved or potentially involved in work related to the development, distribution and application of scientific and technical knowledge.

[3] The character of diagnostic variables was assessed on the basis of substantive premises. Verification of the adopted character of variables was performed *ex post*, checking the correlation of individual variables with the synthetic variable.

$$z_{ij} = \frac{x_{ij} - \min\limits_{i} \{x_{ij}\}}{\max\limits_{i} \{x_{ij}\} - \min\limits_{i} \{x_{ij}\}} \qquad i = 1,2, ..., n; j = 1,2, ..., m \qquad (1)$$

where:

z_{ij} – normalised value of the jth diagnostic variable in the ith object,

x_{ij} – value of the jth diagnostic variable in the ith object,

$\min\limits_{i} \{x_{ij}\}$, $\max\limits_{i} \{x_{ij}\}$ – minimum and maximum value of the jth diagnostic variable in the set of objects.

To ensure the comparability of provinces over years, diagnostic variables expressed in monetary units were provided in fixed prices of 2014; furthermore, all variables were treated as panel data. From the technical point of view, this means that in the formula according to which the unitarisation was performed, the minimum and the maximum values of each variable were designated from the entire panel of data, encompassing all years and provinces. The normalised variables were subjected to synthesising, in line with the following aggregating formula (PANEK, ZWIERZCHOWSKI 2013, p. 63):

$$s_i = \frac{1}{m} \sum_{j=1}^{m} z_{ij} \qquad i = 1,2, ..., n; j = 1,2, ..., m \qquad (2)$$

where:

s_i – value of the synthetic variable in the ith object,

z_{ij} – normalised values of the jth diagnostic variable in the ith object,

m – number of diagnostic variables.

The synthetic innovation index adopted values from the [0, 1] range. A higher value of the index means a more advantageous situation of a province with respect to the examined characteristics.

Regional Diversity of the Innovation System in Poland

The evaluation of regional diversity of the innovation system in Poland and changes that took place in this respect between 2009 and 2014 was performed on the basis of values of the synthetic innovation index in provinces which are presented in Table 1. The values higher than the average for a given year are marked in grey. The table also presents the arithmetic mean values of the synthetic innovation index for all provinces ($\bar{s}$), the variability index (V) and asymmetry (A), as well as the dynamics of changes occurring in individual provinces.

Table 1

Synthetic innovation index in provinces between 2009 and 2014

Province	Value of the synthetic innovation index in provinces						Dynamics of changes in 2009–2014
	2009	2010	2011	2012	2013	2014	
Dolnośląskie	0.36	0.32	0.47	0.50	0.53	0.55	1.53
Kujawsko-Pomorskie	0.21	0.22	0.23	0.25	0.25	0.27	1.29
Lubelskie	0.23	0.23	0.32	0.30	0.29	0.38	1.65
Lubuskie	0.15	0.15	0.17	0.21	0.26	0.26	1.73
Łódzkie	0.23	0.25	0.31	0.33	0.37	0.42	1.83
Małopolskie	0.38	0.35	0.43	0.44	0.46	0.52	1.37
Mazowieckie	0.44	0.43	0.47	0.54	0.56	0.62	1.41
Opolskie	0.23	0.18	0.28	0.39	0.33	0.39	1.70
Podkarpackie	0.33	0.34	0.40	0.38	0.45	0.52	1.58
Podlaskie	0.22	0.20	0.24	0.35	0.34	0.33	1.50
Pomorskie	0.32	0.35	0.38	0.41	0.39	0.45	1.41
Śląskie	0.38	0.39	0.40	0.46	0.43	0.55	1.45
Świętokrzyskie	0.20	0.18	0.28	0.28	0.26	0.25	1.25
Warmińsko-Mazurskie	0.20	0.24	0.30	0.22	0.27	0.26	1.30
Wielkopolskie	0.24	0.29	0.36	0.32	0.36	0.37	1.54
Zachodniopomorskie	0.19	0.18	0.27	0.26	0.26	0.31	1.63
$\bar{s}$	0.27	0.27	0.33	0.35	0.36	0.4	1.48
V	31.6%	31.8%	26.3%	28.3%	27.6%	29.9%	–
A	0.65	0.40	0.04	0.34	0.63	0.29	–

Source: author's own calculations on the basis of data from the Bank Danych Lokalnych (2016).

Between 2009 and 2014, a significant improvement with respect to the innovation system was noted in all provinces. The average value of the synthetic innovation index for all provinces grew by almost a half in the examined period. The growth dynamics of this index in individual provinces was diversified. The highest growth dynamics were recorded in Łódzkie Province – 1.83 and Lubuskie Province – 1.73. The lowest growth dynamics were recorded in the Świętokrzyskie Province – 1.25 and the Kujawsko-Pomorskie Province – 1.29. It is important to note that the regional diversification of the innovation system in Poland in the entire examined period was at an average level[4], whereas the scale of such diversity, in comparison to the years 2009 and 2014, slightly decreased. This is confirmed by the value of the diversity index

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[4] In line with the interpretation functioning in the reference literature on the subject, a value of the variability index below 10% means non-significant variability, a value between <10%;40%> means variability at the average level, a value above 40% means significant non-uniformity of the feature in the examined sample.

which, from the level of 31.6% in 2009 dropped to the level of 29.9% in 2014. It is also worth noting that the lowest value, amounting to 26.3%, was recorded in 2011, and in the subsequent years its value interchangeably grew and dropped. Nevertheless, analysing the entire study period, it may be asserted that regional diversification of the innovation system in Poland slightly decreased, which means that a slow process of regional convergence took place in this respect. The observed tendency is also confirmed by the fact that the relation between the maximum and the minimum values of the synthetic innovation index in a given year decreased. In 2009 it amounted to 2.9, whereas in 2014 it dropped to 2.5. In the examined period, the value of the asymmetry index was also reduced – in this case the right side asymmetry, which means that there are fewer non-typical regions in the group of provinces, i.e. provinces where the level of the synthetic innovation index is definitely higher than the values typical for the majority of provinces.

The fact that regional convergence with respect to the innovation system in Poland was accompanied by internal convergence and divergence of provinces occurring in parallel is worth noting. The character of processes occurring in individual provinces was identified on the basis of values of the synthetic innovation index in 2009 and the dynamics of its changes between 2009 and 2014 in comparison to the average value for all provinces. The classification results are presented in Table 2.

Table 2

Classification of provinces on account of the character of internal processes occurring in their innovation systems between 2009 and 2014

Specification		Synthetic innovation index in 2009 in comparison to the average value	
		Lower than average	Higher than average
Dynamics of changes in the synthetic innovation index between 2009 and 2014 in comparison to average dynamics of changes of this index in the examined period	Lower than average	Divergence (marginalisation effect)	Convergence (falling behind effect)
		Kujawsko-Pomorskie Świętokrzyskie Warmińsko-Mazurskie	Małopolskie Mazowieckie Pomorskie Śląskie
	Higher than average	Convergence (catching-up effect)	Divergence (falling behind effect)
		Lubelskie Lubuskie Łódzkie Opolskie Podlaskie Wielkopolskie Zachodniopomorskie	Dolnośląskie Podkarpackie

Source: author's own study on the basis of data presented in Table 1.

Internal convergence processes were identified in 11 provinces. In the case of seven of them, they had the nature of catching up, and in the case of other four falling behind. Convergence with the catch-up characteristics was recorded in the following provinces: Lubelskie, Lubuskie, Łódzkie, Opolskie, Podlaskie, Wielkopolskie and Zachodniopomorskie. In 2009, these provinces were characterised by lower than average levels of the synthetic innovation index among all provinces; however, on account of greater than average growth dynamics in this respect, their situation in comparison to the average situation in provinces improved. Second type convergence took place in the following provinces: Małopolskie, Mazowieckie, Pomorskie and Śląskie. Falling behind, caused by below average growth dynamics of the synthetic innovation index in these provinces, did not influence the situation in Mazowieckie Province, which retained the leading position in this respect, yet it aggravated the situation of Małopolskie Province (cf. WIERZBICKA 2014).

Internal divergence processes were observed in five provinces, whereas, similarly as in the case of convergence processes, they were of a dual character. A higher than average level of the innovation system characterised Dolnośląskie Province and Podkarpackie Province even at the beginning of the examined period; additionally, they recorded high growth dynamics in this respect and thence distanced themselves from the average situation in the country. On the other hand, in Kujawsko-Pomorskie Province, Świętokrzyskie Province and Warmińsko-Mazurskie Province, divergence with the marginalisation effect was noticed. The low level of the innovation system at the beginning of the examined period, combined with low growth dynamics in this respect caused aggravation of the situation of such provinces in comparison to the average situation in the country. For example, in 2009, the synthetic innovation index in Świętokrzyskie Province was lower by 26% than the average value for all provinces, whereas in 2014 the difference amounted to as much as 37.5%. A similar situation also took place in Warmińsko-Mazurskie Province.

In consequence of such processes, the position of individual provinces with respect to the remaining ones underwent quite significant changes in the examined period. This is confirmed by the results of rankings prepared on the basis of values of the synthetic innovation index and the results of the grouping of provinces which was performed with the use of the standard deviation method (Tab. 3). In line with the assumptions of this method, the borders of divisions were designated on the basis of values of the arithmetic mean of the synthetic innovation index for provinces in general $\bar{s}$ and the level of standard deviation of this index $S(s)$ in the examined year (PANEK, ZWIERZCHOWSKI 2013, p. 118, 119). The collection of the examined items was divided into four groups:

1. Group with **a very high** level of the innovation system, encompassing objects with the values of the synthetic index within the range of $s_i \geq \bar{s} + S(s)$;

2. Group with **a high** level of the innovation system, encompassing objects with values of the synthetic index within the range of $\bar{s} + S(s) > s_i \geq \bar{s}$;

3. Group with **a low** level of the innovation system, encompassing objects with values of the synthetic index within the range of $\bar{s} > s_i \geq \bar{s} - S(s)$;

4. Group with **a very low** level of the innovation system, encompassing objects with values of the synthetic index within the range of $s_i < \bar{s} - S(s)$.

Mazowieckie Province is the leader with respect to innovations. The advantage of this province is the highest number of units with R&D activity in conversion per 10,000 entities of the national economy entered in the National Official Register of Business Entities, the highest level of internal expenditure on R&D activity in conversion per capita, and the highest number of people employed in R&D in conversion per 1,000 professionally active people. Another strong side of Mazowieckie Province is the highest share of human resources for science and technology among professionally active people in the country, and the highest number of patents granted by the Patent Office of the Republic of Poland per number of residents. Śląskie Province also holds a high position in the ranking – from third position in 2009 it moved up to second place in 2014, and was a province with a very high level of the innovation system during the entire examined period. The advantage of this province is the very high number of entities which pursue R&D activity, a high share of human resources for science and technology among professionally active people, as well as a high share of net revenues from sales of innovative products in industrial companies. Małopolskie Province also belongs to the group of provinces with a very high level of the innovation system. The advantage of this province is the highest percentage of people following technical and nature studies, a very high level of internal expenditure on R&D activity in conversion per capita, and a very high number of people employed in R&D in conversion per 1,000 professionally active people. Importantly, the position of Małopolskie Province has slightly deteriorated over recent years. From second position in 2009 it moved down to fifth place in 2014, and it was caused, among other things: the highest dynamics of decline of industrial companies cooperating as part of a cluster initiative or other formalised cooperation in the percentage of innovation-active companies (0.54 in comparison to the national average amounting to 0.15), as well as a high dynamics of decline share of net revenues from sales of innovative products in industrial companies (0.26 in comparison to the national average of 0.1 and in comparison to the high growth dynamics in Dolnośląskie Province – 2.1 and Śląskie Province – 1.52).

On the other hand, Podkarpackie Province recorded a great improvement with respect to the innovation system; in 2009, Podkarpackie was in the group

Table 3

Results of linear ordering and grouping of provinces according to the synthetic innovation index in 2009 and 2014

2009			2014		
Position in ranking	Province	Level of innovation system	Position in ranking	Province	Level of innovation system
1	Mazowieckie	Very high $s_i \geq 0.35$	1	Mazowieckie	Very high $s_i \geq 0.52$
2	Małopolskie		2	Śląskie	
3	Śląskie		3	Dolnośląskie	
4	Dolnośląskie		4	Podkarpackie	
5	Podkarpackie	High $0.35 > s_i \geq 0.27$	5	Małopolskie	
6	Pomorskie		6	Pomorskie	High $0.52 > s_i \geq 0.40$
7	Wielkopolskie	Low $0.27 > s_i \geq 0.18$	7	Łódzkie	
8	Lubelskie		8	Opolskie	Low $0.40 > s_i \geq 0.28$
9	Opolskie		9	Lubelskie	
10	Łódzkie		10	Wielkopolskie	
11	Podlaskie		11	Podlaskie	
12	Kujawsko-Pomorskie		12	Zachodniopomorskie	Very low $s_i < 0.28$
13	Warmińsko-Mazurskie		13	Kujawsko-Pomorskie	
14	Świętokrzyskie		14	Lubuskie	
15	Zachodniopomorskie		15	Warmińsko-Mazurskie	
16	Lubuskie	Very low $s_i < 0.18$	16	Świętokrzyskie	

Source: author's own study on the basis of data presented in Table 1.

of provinces with a high level of the innovation system, yet in 2014 it was classified in the group with a very high level. Such great improvement within the realm of the innovation system in this province is an effect of the highest growth dynamics of internal expenditure on R&D activity in the country (4.3 in comparison to the national average amounting to 1.7), the number of people employed in R&D (4.1 in comparison to the national average of 1.5), and the percentage of people following technical and nature studies (1.6 with respect to the national average of 1.3).

The worst situation with respect to the innovation system is found in the following provinces: Świętokrzyskie, Warmińsko-Mazurskie, Lubuskie and Kujawsko-Pomorskie. These provinces were classified in 2014 in the group of provinces with a very low level of the innovation system. It is important to note that in 2009 only Lubuskie Province belonged to this group. Three other provinces joined this group as a result of internal divergence processes with a marginalising character that took place during the examined period. The weak side of Świętokrzyskie Province, which in 2014 had last position in the ranking of provinces, is the lowest percentage of industrial companies which invested in innovation activity in the country, and the number of people working in R&D. The weak side of Warmińsko-Mazurskie Province, which occupies the penultimate position in the ranking, is the lowest number of patents granted by the Patent Office of the Republic of Poland in the country in conversion per number of residents and the share of net revenues from the sale of innovative products in industrial companies. In Kujawsko-Pomorskie Province, the share of human resources in science and technology among professionally active people, and the percentage of students pursuing technical and nature studies is at the lowest level.

Summary

The prospects for Poland's economic development and building a knowledge-based economy depend, to a large degree, on its capacity for increasing the level of innovation in companies, universities, research institutes and public institutions. An efficient innovation system enables skilful use of the existing resources of knowledge, the creation and distribution of new knowledge, and its transformation into innovations and the development of new technologies. The spatial dimension of innovation systems is gaining greater significance. Innovations are significant factors influencing modern diversity in the level of economic development.

In the light of the above it is necessary to draw attention to the fact that a significant improvement with respect to the innovation system was recorded

in all provinces between 2009 and 2014. The average value of the synthetic innovation index grew by almost a half for all provinces in general. However, the dynamics of changes occurring in this respect in individual provinces was diverse. The highest growth dynamics of the synthetic innovation index were recorded in Łódzkie Province (1.83) and Lubuskie Province (1.73). The lowest growth dynamics were recorded in Świętokrzyskie Province (1.25) and Kujawsko-Pomorskie Province (1.29).

In consequence of the diverse dynamics of change and diverse levels of the innovation system at the beginning of the examined period, the group of provinces was characterised by internal convergence and divergence processes occurring in parallel. Convergence processes took place in the examined period in as many as 11 provinces. In the case of seven of them, i.e. Lubelskie, Lubuskie, Łódzkie, Opolskie, Podlaskie, Wielkopolskie and Zachodniopomorskie, they had the catching-up character, whereas in the case of the other four (Małopolskie, Mazowieckie, Pomorskie and Śląskie), they had the falling behind character. Only five provinces were characterised by divergence processes in this period, whereas in the case of two of them (Dolnośląskie and Podkarpackie) they had the character of distancing, and in the case of the remaining three – i.e. Kujawsko-Pomorskie, Świętokrzyskie and Warmińsko--Mazurskie, they had the marginalising character. This means that the situation in these three provinces was aggravated in comparison to the average situation in the country, whereas the distance dividing them from other provinces grew, and in 2014 was higher than at the beginning of the examined period. What is more, the position of these provinces also worsened in the ranking with respect to the innovation system. In 2014, they had the following positions: 13, 16 and 15, respectively, and were classified in the group of provinces with a very low level of the system of innovations; however, in 2009 they were included in a better typological group. The leader with respect to the innovation system is Mazowieckie Province, which – during the entire examined period – belonged to the group of provinces with a very high level of the innovation system. High positions in the ranking were also taken by Śląskie, Dolnośląskie, and Małopolskie, and in 2014 also by Podkarpackie, which, as a result of the divergence processes of a distancing character occurring in it, moved from the group with a high level to the group with a very high level of the system of innovations.

As a result of parallel processes of internal convergence and divergence, the structure of the group of provinces with respect to the innovation system became more uniform. The scale of regional diversity in this respect is still at the average level. This is confirmed by the value of the variability index, which dropped from the level of 31.6% in 2009 to the level of 29.9% in 2014. The decreasing dispersion of the innovation system in the group of provinces

means that a slow regional convergence process took place in this respect. The study hypothesis in which it was assumed that "regional diversity of the innovation system in Poland is decreasing, thence a regional convergence process is taking place in this respect" has been verified positively.

Summing up, changes which occurred between 2009 and 2014 with respect to the regional diversification of the innovation system in Poland are of a positive character. The speed of changes is, however, slow, and in relation to this Poland is a country where innovation processes are accompanied by quite significant diversification with respect to individual provinces.

Translated by ALICJA BRODOWICZ
Proofreading by PETER FOULDS

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SMART CITY, SLOW CITY AND SMART SLOW CITY AS DEVELOPMENT MODELS OF MODERN CITIES

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K e y w o r d s: *smart city, slow city, smart slow city*, city development.

A b s t r a c t

The objective of the study is characteristics of two development concepts of modern cities, i.e. *smart city* and *slow city*, and showing the possibilities of combining them in the proposed *slow city* model, drawing upon the assumptions of a *smart city,* which was determined as the *smart slow city*. Conclusions mainly rely on the performed reference literature studies (using the critical literature review method), which allowed for a synthetic presentation of the characteristics of the two discussed models of development, which are the basis for an independent description of the city model that unites these two approaches. The comparison of city development models was made on the basis of the following characteristics: the genesis of the city development idea, the rate of changes and the model of life related to it, key city development factors, the main objective of changes, key actors, activity areas, specialisation, scale of urban centres, city image, level of development policy, significance of cooperation, determinants or limitations in the implementation of the city development concept.

Such an attempt of combining, by modern cities, of the potential offered by two development concepts (*smart city* and *slow city*), may contribute to the creation of an image of a modern city, the so-called *smart slow city* which, as a member of the Cittàslow network, considers the quality of residents' life as a priority, and uses modern technological solutions.

A b s t r a k t

Celem badań była charakterystyka dwóch koncepcji rozwoju współczesnych miast, tj. *smart city* i *slow city*, oraz ukazanie możliwości ich łączenia w zaproponowanym modelu miasta *slow city* czerpiącym z założeń *smart city*, który określono jako *smart slow city*. Wnioskowanie oparto głównie na przeprowadzonych studiach literaturowych (z wykorzystaniem metody analizy i krytyki piśmiennictwa), które pozwoliły syntetycznie zaprezentować cechy dwóch przedmiotowych modeli rozwoju, będących podstawą do wykonania autorskiej charakterystyki modelu miasta, łączącego te dwa podejścia. Modele rozwoju miast porównano na podstawie następujących cech: genezy idei rozwoju miasta, tempa zmian i związanego z nim modelu życia, głównego czynnika rozwoju miasta, głównego celu zmian, głównych aktorów, obszarów aktywności, specjalizacji, skali ośrodków miejskich, wizerunku miasta, poziomu polityki rozwoju, znaczenia współpracy, uwarunkowań lub ograniczeń realizacji koncepcji rozwoju miasta.

Taka próba łączenia przez współczesne miasta możliwości, jakie dają obie koncepcje rozwoju (*smart city* i *slow city*), może się przyczynić do kreowania przez nie wizerunku nowoczesnego miasta, tzw. *smart slow city*, które jako członek sieci miast Cittaslow stawiającej na pierwszym miejscu jakość życia mieszkańców wykorzystuje nowoczesne rozwiązania technologiczne.

Introduction

Modern cities are constantly facing the dilemma of choosing the right development model which would allow them to accomplish such positive effects as: increased efficiency in utilising urban resources, increased quality of city capital, improvement of residents' level of life, development of entrepreneurship, as well as growing investment attractiveness and the city's competitiveness on local, regional or even global scales. Adopting a proper city development model which takes into account its size, specific nature, and the environment in which it functions may also result in the fact that *urban resilience* will grow, i.e. the city will deal better with problems of an internal character, such as the society's ageing, social exclusion, outflow of young people, drop in economic activity, increased unemployment and urban degradation, as well as improved resistance to internal disruptions such as growing competition and global crises (DROBNIAK 2015, p. 119–143).

The objective of the undertaken studies was characteristics of two development concepts of modern cities, i.e. *smart city* and *slow city,* as well as showing the possibilities of uniting them in the proposed *slow city* model, drawing upon the assumptions of *smart city*, which was called the *modern slow city* or the *smart slow city* by the authors of this article. Conclusions mainly rely on the performed studies of reference literature, which allowed for a synthetic presentation of the features of the two discussed development models which form the basis for independent characteristics of the city model combining these two approaches.

Smart City as a City Development Concept

A *smart city* may be defined as an area of high capacity for learning and innovation, creative, with research and development institutions, higher education, infrastructure and communication technologies, as well as a high level of management efficiency (KOMNINOS 2002, p. 1, following: STAWASZ et al. 2012, p. 98).

It is worth paying attention to the fact that the *smart city* uses the premises of the *knowledge-based cities*, which primarily focus on education, development of intellectual capital, lifelong learning, creativity, and preserving a high level of innovation, as well as the model of *digital cities*, whose development is based on advanced communication and IT technologies, and cities characterised by care for natural environment resources and use of renewable energy sources – the so-called eco-cities (STAWASZ et al. 2012, p. 99). Smart cities are therefore distinguished by a specific approach to solving social and environmental problems, and their efficient and participatory manner of city management.

The reference literature most frequently lists six dimensions making up the smart city concept (cf. e.g. STAWASZ et al. 2012, p. 100, *Smart Cities – Ranking of...* 2007, p. 10–12). These are the following areas:

– *smart economy*: which means that cities should be characterised by high productivity, an innovative climate and labour market flexibility;

– *smart mobility:* thanks to the ICT sector, the city is a network of connections with high speed, uniting all city resources;

– *smart environment:* the city develops in line with the principles of sustainable development, uses alternative energy sources and minimises emissions of pollution to the natural environment;

– *smart people:* the initiators of changes in cities are their residents, who are the greatest value of each city, and who, with relevant technical assistance, may implement activities aimed at eliminating negative environmental effects and improving the quality of life;

– *smart living:* the city provides its residents with access to technical and social infrastructure and to the necessary public services, has an appropriate cultural and entertainment offer, and a safe and natural environment of good quality;

– *smart governance:* relying on solid cooperation of the city authorities with various entities functioning in the city, and use of modern technologies.

A *smart city* is a city that has accomplished good and long-lasting effects in the economy, human potential, management, mobility, environment and quality of life, built on the combination of smart solutions encompassing subsidies and the activities of independent and conscious residents (TOMA-

SZEWSKA, GLIŃSKA 2015, p. 384). It may be stated that cities can be called *smart* if the quality of life improvement is accomplished thanks to the involvement of high quality human and social capital, modern transport and ICT infrastructure, and if the city management process relies on the participatory model and principles of sustainable development.

A city is smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance (CARAGLIU et al. 2011, p. 65–82). Smart cities are all urban settlements that make a conscious effort to capitalize on the new Information and Communications Technology (ICT) landscape in strategic way, seeking to achieve prosperity, effectiveness and competitiveness on multiple socio-economic levels (ANGELIDOU 2014, p. 3). Smart cities initiatives try to improve urban performance by using data, information and information technology (IT) to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration among different economic actors, and to encourage innovative business models in both the private and public sectors (MARSAL-LLACUNA et al. 2014, p. 611–622).

The most common characteristics of smart cities are: a city's networked infrastructure that enables political efficiency and social and cultural development; an emphasis on business-led urban development and creative activities for the promotion of urban growth; social inclusion of various urban residents and social capital in urban development and the natural environment as a strategic component for the future (ALBINO 2015, p. 13). A *smart city* is a model, that can be used by large and smaller cities (FAZLAGIĆ 2015, p. 1–11).

Slow City as a City Development Concept

The *slow city* model is an alternative approach to the traditionally understood economic development of a city, based on building its competitiveness in a globalising world. In this approach, special attention is paid to the strategies of local economic development, which are meant to offer increased vitality, justice, equal development opportunities, and sustainability of the local community. The introduction of *slow city* principles is conducive to the improved quality of life in the city, which becomes a more friendly place to live in (MIERZEJEWSKA 2009, p. 208).

The Cittàslow movement was born in 1999 from the idea of Paolo Saturnini, mayor of Greve di Chianti in Italy and mayors of other small cities, Bra, Orvieto, Positano, and the Slow Food Association; together, they established

the Cittàslow Association – the International Network of Cities Where Living is Good. To date, this idea has found its followers in 225 member cities in 30 countries around the world (data from June 2016) (Cittàslow International Network 2016).

The idea of the international Cittàslow movement is to promote a culture of good and harmonious living in smaller cities, being an alternative to big city rush and progressing globalisation. Cities associated in the network aim for sustainable development, i.e. a conscious urban policy ensuring proper relations between economic growth, care for the natural environment, and improvement in the quality of residents' life. The most important objectives of the Cittàslow movement include: the sustainable development of towns making use of local resources, improvement in the quality of residents' life by the establishment of proper urban infrastructure and leisure and recreation venues, environmental protection and promotion of pro-environmental stances among residents, care for historical city areas, renovation of monuments and aesthetic appearance, promotion of local products, local handicraft and cuisine, eliminating architectural barriers that make the mobility of people with disabilities difficult, drawing upon the accomplishments of modernity and new technologies in a scope which may be used for the implementation of the objectives of cities "where living is good", streamlining the work of local administration and adjusting the work of institutions to the residents' needs (Polish Cittàslow Network 2016).

The manifesto of cities that belong to the Cittàslow Network emphasises that life in such cities, as well as their management, is "a certain way of life, a characteristic feature for living daily life in a manner that is different from the dominant one; a slow mode, confident, less abrupt and less focused on efficiency, but definitely more humane and ecologically correct, more compliant with the present and future generations, respecting the local in a world that is becoming more and more global and internally communicated (...). Generally speaking, life in one of the SLOW cities, as well as its management, entails giving yourself time to create quality in all areas of urban life, slowing down the pace of life and reducing tension, in order to become aware, now and forever, of the value of the flavours, colours and scents of the city and the world" (*Żyć powoli: inna strona nowoczesności...* 2016, p. 1–2).

The Polish Cittàslow Network currently has (June 2016) twenty-five members (Barczewo, Bartoszyce, Biskupiec, Bisztynek, Działdowo, Dobre Miasto, Gołdap, Górowo Iławeckie, Jeziorany, Kalety, Lidzbark, Lidzbark Warmiński, Lubawa, Murowana Goślina, Nidzica, Nowe Miasto Lubawskie, Nowy Dwór Gdański, Orneta, Olsztynek, Pasym, Prudnik, Rejowiec Fabryczny, Reszel, Ryn, Sępopol) and one supporting member, i.e. the Marshal's Office of Warmia and Mazury Province. The Network associates cities where the number of residents does not exceed 50,000. In the verification process,

a candidate city has to fulfil a minimum of 50% of the criteria specified in the charter, which refer to seven key areas of development: energy and environmental policy, infrastructural policy, urban quality policy, agricultural, tourism and handicraft policy, hospitality policy, policy of awareness and education, and social integration and partnership. It is necessary to fulfil at least one parameter in each area (*Międzynarodowy statut miast Cittaslow* 2014, p. 25–29).

It is necessary to pay attention to the fact that the criteria are compliant with the premises of sustainable development, as to a significant degree they focus of the so-called *three E*, i.e. they take into account *environment*, *equity* and *economy* (MIERZEJEWSKA 2009, p. 209). Cittàslow complies with the principles of sustainable development not only by valorisation of the natural environment, but also by focusing on the role of the endogenous capital of the member cities (focus on locality, authenticity, tradition, regional products, activation of residents) (ZADĘCKA 2015, p. 180).

In spite of the fact that each of the cities that belongs to the Cittàslow network pursues distinct and individual objectives, they are united by the necessity of protecting their unique character and the city's community. Benefits for the member cities include: the possibility of attaching the network's logo in the form of an orange snail to their own visual designation, the possibility of making the logo available for public and private activities and initiatives consistent with the objectives of the movement, and the possibility of participating in activities organised as part of the movement, allowing for the acquisition of knowledge, exchange of experience and promotion of good practice in cities belonging to Cittàslow.

"The functioning of a city in a slow style does not mean slowing its development down; on the contrary, it entails development via ongoing improvement of the residents' quality of life, increasing the city's attractiveness and, at the same time, its competitiveness thanks to the possessed own resources, without concurrent violation of the surrounding ecosystem" (AUGUSTYN 2011, p. 745). The *Slow City* designation is a quality brand for smaller communities. Being *slow* does not mean being backwards. On the contrary, it means using new technologies in a manner to make towns and cities ideal places to live (Polish Cittàslow Network).

Smart Slow City as an Attempt at Combining Two City Development Concepts

The individual city development models provide information which factors and directions of implemented activities may offer positive social, economic or spatial effects, contribute to solving problems accumulated in urban areas and

thence be conducive to sustainable development of the whole city. There is no single universal city development model; therefore, attempts at combining and drawing knowledge from various concepts and models are made (MIERZEJEW-SKA 2015, p. 10). Such a synthetic approach is exemplified by the simultaneous use of the smart city concept and the slow city concept. Characteristics of features and attributes of a city relying in its development on the premises of the Cittàslow philosophy and using the possibilities offered by the *smart city* in this respect are presented in Table 1.

The above approach to the development of a city in the slow concept, which takes into account the *smart city* model, shows the possibility of applying the instruments characteristic for intelligent cities for the purpose of accomplishing the effects of residents' quality of life, and the development of social and cultural capital and local entrepreneurship, characteristic for slow cities. Modern technological, organisational and infrastructural solutions (which concern the municipal services, reduction of crime, integration of different form of transport, high-quality of ICT infrastructure, water and energy economy, promotion of cultural and sporting events, integration of residents etc.) may contribute to the development of a city compliant with the Cittàslow philosophy, as well as solidify the slow city image (yet not backwards), the image of a *modern slow city* – or even a *smart slow city*. This model of development of the city is addressed to small and medium-sized cities where the number of residents does not exceed 50,000. The basis for economic development of this cities may be cultural tourism and local services.

The growing popularity of the *smart city* concept results in the fact that relying on a marketing strategy for it offers the cities few chances for being distinguished; thence, they are forced to look for features other than *smart* that can distinguish them. "Even though the *smart city* idea is attractive, it has to be remembered that in the modern world cities are practically forced to be smart. In the longer perspective this direction is more of a necessity than a long-term competitive advantage; therefore, it is worth building the core of a city's brand relying on the specific DNA of the place" (*Przyszłość miast...* 2013, p. 80). Building the image of a *modern slow city* or even a *smart slow city*, based on the unique character and resources of cities that belong to the Cittàslow network, in Poland and around the world (vide BALL 2015, p. 571–578), seems to be an answer for the recommendations listed above. An important problem is for example that the small and medium sized cities compete for resources against larger and better-equipped cities; therefore they are less likely to be able to receive or afford the necessary funds for smart city projects (GIFFINGER et al. 2010, p. 299–312).

Table 1

Comparison of the *smart city* and *slow city* development concepts

Specification	Smart city	Slow city	Slow city with elements of *smart city* (*Smart slow city*)
1	2	3	4
Genesis of city development idea	Civilisation development and growing needs of societies with respect to the quality of transport, information and safety services; market economy, knowledge-based economy, technological and organisational progress, development of advanced IT and ICT, emphasis on increased efficiency of activities	Socio-economic development of countries and increase in ecological awareness of communities; market economy and consumption; increased affluence of societies; rapid speed of life and the necessity of "slowing down" and focus on the quality and contemplation of life; standardisation of production resulting in the necessity of protecting products and services of unique, individual and local character	Rapid speed of life and the need of "slowing down" with simultaneous access to high quality infrastructure, in particular information, conscious consumption of high quality products and local services produced or distributed with the use of modern technologies; advanced technological solutions in transport, energy, safety and social infrastructure facilities
Speed of changes and the model of life related to it	Very rapid, dynamic and changing; *smart living*	Slower and without so many changes, *slow life*	Thoughtful *slow life* with elements of *smart living* (e.g. smart mobility, smart governance)
Key city development factor	Technology and high quality human capital	Local cultural and social capital	Technology used to shape the quality of "slow" living and which allows the inclusion of citizens in the creation of the city
Main objective of changes	Increased efficiency, decrease in labour-intensity, decrease in costs of activity; improvement of the quality of life via technological progress	Increasing the quality of residents' life, care for local cultural and social capital	Improved quality of residents' life, care for local cultural and social capital, also with the use of modern technical solutions

cont. Table 1

1	2	3	4
Key actors	High importance of private entities applying new technological solutions, generating innovations; city authorities involved in public and private partnership during implementation of large and modern infrastructural projects	High importance of involvement of the local community, with the initiating, activating or coordinating function of city authorities	High importance of involvement of the local community, with coordinating function of city authorities and possible participation of the innovative private sector (e.g. SMEs)
Main areas of activity	Transport, energy, water management, waste management, health protection, safety	Gastronomy, handicraft, tourism, culture	Modern technological solutions for development of tourism and environmental protection (water management, waste management), but also transport, health protection and safety
Specialisation	Smart specialisation (especially thematic activity, theme cities, e.g. cities of design, cities of media arts, cities of film)	Local specialisations relying on the unique endogenous potential of cities (local products and services, tradition and identity of a place)	Domination of local cultural capital as the main factor for the city's development
Scale of urban centres	Large cities, metropoleis, smart city networks	Small urban centres; Cittàslow network (where the number of residents does not exceed 50,000)	Smaller urban centres, possibly united in networks (e.g. the Cittàslow network, where the number of residents does not exceed 50,000), cooperation of cities of various sizes – slow and smart cities
City image	Consistent concept of the smart city image, expressed mainly via broad use of modern technological, organisational and infrastructural solutions	*Slow city* image resulting from the adopted vision of development, consistent with the slow movement philosophy	The image of a *slow city* (yet not a backwards city) is created with the use of smart solutions; the image of a modern slow city or a smart city

cont. Table 1

1	2	3	4
Level of development policy	– international level: sectoral policy implemented at EU level – national level: urban and innovation policy of the country – regional level: innovation development strategy, smart specialisations – local level: smart infrastructural solutions, companies as innovation creators, smart city image and policy of city authorities	– international level: international association of Cittàslow and *Slow Food* – national level: national Cittàslow and *Slow Food* networks – regional level: regional development strategy, support of regional authorities – local level: initiatives and projects implemented in individual cities, policy of city authorities and image of a slow city	– international level: international association of Cittàslow and *Slow Food* – national level: national Cittàslow and *Slow Food* networks – regional level: regional development strategy, innovation development strategy, support of regional authorities – local level: initiatives and projects implemented with the use of modern solutions, *smart slow city* policy and city image
Significance of cooperation	High	High (mandatory condition for city development)	High (mandatory condition for city development)
Major determinants or restrictions for implementation of the city development concept	Technological, organisational and financial restrictions	Participation and awareness of residents (its absence), acceptance and identification with the development concept of a city as slow, and financial restrictions	Participation and awareness of residents (its absence), acceptance and identification with the development concept of a smart slow city, and technological, organisational and financial restrictions

Source: authors' own study.

Recapitulation

The number of models and concepts for the development of urban centres testifies to the fact that there is no single, universal model for city development which would, in a comprehensive and full manner, explain the problems of social, economic or spatial spheres of a city's operation and its relations to the environment. Cities constitute unique systems, functioning in a specific and changing environment (domestic, regional and local), so choosing the path of sustainable development is an individual issue for each of them. This individual character of cities and the dynamics of changes occurring in their environment require flexibility and creativity in the process of planning their long-term development. Therefore, choosing the right concept of development is a very important issue; such a concept, being an answer to the diverse needs of cities, may draw upon various, supplementary models of development. An example of such an approach may be the implementation of the model based on the *slow city* concept, with simultaneous use of the tools characteristic for the *smart city* model. Such an attempt at combining the possibilities offered by both development concepts may contribute to creating an image of a modern city that belongs to the Cittàslow network: a *modern slow city* or even a *smart slow city*, which puts the residents' quality of life in first place, using modern technological solutions. *Smart slow city* model can be useful to define the further objectives and tools of local policy of cities, which are members of Cittàslow network. This model can be considered as the next level in the development of *slow cities*.

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THE HOUSING SITUATION OF YOUNG MARRIED COUPLES IN OLSZTYN[*]

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K e y   w o r d s: dwelling, marriage, housing situation, living conditions (JEL: I31, J12, R21, R31, Y10).

A b s t r a c t

This article presents the results of a study on the housing situation of young married couples in Olsztyn. The results were derived from a survey addressed to newlyweds, which was developed according to J. KORNIŁOWICZ (2003). The research material was collected in collaboration with the Register Office in Olsztyn. An indicator method proposed by A. ANDRZEJEWSKI (1987) was applied to the processing of the data. The purpose of this study was to analyze the housing situation of young married couples. The results implicate quite a high self-evaluation of the housing situation by young married couples. The most common type of home occupied by newlyweds was their own flat (including mortgaged ones), followed by sharing a flat with the family of one of the spouses while starting the construction of one's own house. Furthermore, over 50% of the respondents considered temporary economic migration and nearly 40% declared they could feel forced to emigrate permanently due to their housing situation.

SYTUACJA MIESZKANIOWA MŁODYCH MAŁŻEŃSTW W OLSZTYNIE

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S ł o w a   k l u c z o w e: mieszkanie, małżeństwo, sytuacja mieszkaniowa, warunki życia (JEL: I31, J12, R21, R31, Y10).

A b s t r a k t

W artykule zaprezentowano wyniki badań nad sytuacją mieszkaniową młodych małżeństw w Olsztynie. Do badania wykorzystano ankietę skierowaną do nowożeńców, bazującą na pracy J. KORNIŁOWICZA (2003). Materiał badawczy zebrano we współpracy z Urzędem Stanu Cywilnego w Olsztynie. Do opracowania wyników badań wykorzystano metodę wskaźnikową, zaproponowaną przez A. ANDRZEJEWSKIEGO (1987). Celem pracy była analiza sytuacji mieszkaniowej młodych małżeństw. Wyniki badań wskazują na dość wysoką samoocenę warunków mieszkaniowych nowożeńców po ślubie. Najczęstszą formą zamieszkania po ślubie w opinii respondentów były: własne mieszkanie (w tym obciążone hipoteką), zamieszkiwanie wraz z rodziną jednego z małżonków oraz rozpoczęcie budowy domu. Ponadto ponad 50% respondentów rozważało migrację czasową, a blisko 40% stałą migrację zagraniczną, której determinantą jest sytuacja mieszkaniowa.

Introduction

It is a commonly held belief that getting married equates to living on one's own. Having one's own house or flat satisfies people's basic needs and, therefore, real property is the type of material goods essential for everyday life. This notwithstanding, it is often impossible for working age people who have just begun their professional career to become home owners. The main reasons are an inadequate housing policy and the unfavorable ratio of salaries to the price of flats per square meter of floor space. As a result, house-sharing with one's family or renting a room in a rented flat or house is a common solution[1]. In Poland, the housing situation particularly affects young people strongly.

This state of matters in turn has an influence on the housing situation within Poland as a whole. Polish flats are relatively small and overcrowded, placing Poland on one of the last positions among the EU member countries in this regard[2]. The unresolved problem of housing deters young people from getting married or having children. Due to the difficult labor market and relatively low available incomes of young people, they are forced to postpone the decision to start a family (KWAK 2001, p. 20–23, DĄBROWSKA 2001, p. 30–39).

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[1] The study completed at the University of Łódź for Notus Credit House in 2010 shows that over half of young married couples (54%) do not own any immovable property, and therefore they are tenants in housing cooperatives, rent accommodation or share it- with family or relatives. Cf. http://tuznajdziesz.pl/nieruchomosci/aktualnosci/mlodzi-nie-mieszkaja-na-swoim,648/ (access: 10.06.2014).

[2] The report *Better Life Index* proves that the housing situation in Poland places our country among the lowest-ranking OED states, cf. http://www.oecdbetterlifeindex.org/topics/housing/ (access: 10.06.2014). See also: *Sytuacja mieszkaniowa w Polsce 2012. Raport*, http://www.pzfd.pl/_files/ img_sites/Raport%20Sytuacja%20mieszkaniowa%20w%20Polsce.pdf (access: 10.06.2014).

Although the literature (ANDRZEJEWSKI 1987, p. 330, RUGG 1999, p. 16–60, CESARSKI 2007, p. 36–40, FORREST 2012, p. 56–95, CESARSKI 2013, p. 77–81) highlights the importance of research problems connected with the housing situation of young people, examples of empirical analysis (KULESZA 1998, p. 62–84, KORNIŁOWICZ 2003, p. 11–81, ŚWIETLIK, MUCHA 2008, p. 129, ULMAN 2011, ULMAN, WAŁĘGA 2012, p. 104–113) remain scanty. Particularly acute is the shortage of field research.

The above considerations have encouraged the author to undertake a study in this area and to analyze the housing situation of young married couples. The chosen research site is Olsztyn, the capital city of a Polish province with the lowest average usable floor area of dwellings in Poland. The direct inspiration came from the survey study of J. Korniłowicz from the Institute of Urban Development, conducted in 2002, which dealt with the housing situation of married couples in towns.

Research methodology and characteristics of the research sample

The research object, in accordance with the suggestions of A. AN-DRZEJEWSKI (1987), consists of the housing stock and its use. The data were subjected to structural and average indicator analyses.

To a large extent, the research method in this study is based on the questionnaire proposed by J. KORNIŁOWICZ (2003), which has been updated, as required, and adjusted to the current market trends. The questionnaire has also been expanded, following a review of the pertinent literature references, by adding a set of qualitative (evaluating) questions. This step is dictated by the currently prevalent tendency, especially in the Anglo-Saxon economy, to place much emphasis on qualitative features in research on social infrastructure, as these contribute to the well-being of a society. Housing conditions and their quality play a considerable role among such attributes.

Olsztyn is the capital city of the Province of Warmia and Mazury (województwo warmińsko-mazurskie) and the largest population centre in the region. In 2014, it was inhabited by 174,700 people[3], corresponding to 12% of the province's population, and nearly 25% of the town's population consisted of people aged 20–34 years.

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[3] All demographic data originated from the Bank of Local Data of the Central Statistical Office (GUS) in Poland.

As it was decided to conduct a comprehensive study[4], the author's intention was to reach all newlywed couples. The Register Office in Olsztyn was contacted and the questionnaire was posted there. The survey was addressed to all couples who become married in 2014[5].

For the purposes of the research, it was necessary to set the upper age limit at which it was justifiable to use the term "a young married couple". Considering the ongoing changes in the structure of society and in lifestyle (extended age of remaining outside the labour market, longer period of education and postponed decisions to become married or have children) as well as other similar problems noticed in the literature (e.g. ULMAN 2012, p. 487), it was decided to set – in accord with the terminology adopted by the Central Statistical Office in Poland – the upper age threshold at 35 years of age for both spouses. While there were 713 couples who entered into marriage in Olsztyn in 2014, the questionnaire was completed by 215 couples; hence the survey return rate was approximately 30%[6].

The most numerous group of couples getting married in Olsztyn in 2014 was composed of people aged 25–29 years (Fig. 1). This corresponds to the trend occurring in the whole of Poland, which is to delay marriage. The data provided by the Central Statistical Office show that the dominant age for a male spouse in 2014 was 28 years and for a female spouse – 26 years. At the moment of registering their marriage, nearly half of the women and men (53%) were within the above age interval. Our analysis of the age structure also demonstrates that men relatively more often than women became married while being older than 30 years of age. The age group between 18 and 24 years was distinctly dominated by women.

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[4] The author is aware that the progressing civilization changes affect family life, and among the consequences there is a decreasing number of wedded couples and a higher percentage of co-habiting partnerships. It is difficult to reach the former, and therefore, despite a certain degree of the imperfection of such research, it was decided to reach all couples who had officially entered into marriage. As the study demonstrated, it was sometimes impossible to contact all newlyweds, for example if they became married abroad or in a Civil Register Office other than in Olsztyn. In such cases, the home Civil Register Office is notified of a change of the marital status, without the presence of the person in question at the registrar's office according to his or her address of residence.

[5] This is a fundamental change with respect to the study by J. Korniłowicz, who collected data from parishes. It seems that by gathering information in registry offices enlarged the number of respondents. Even concordat marriages must be reported to the relevant Civil Register Office.

[6] This is the number of received questionnaires (for the newlyweds aged up to 35 years) versus the total number of concluded marriages in Olsztyn in 2014. Thus, the groups not covered by the study consisted of: 1. couples aged over 35 years; 2. couples who entered into marriage in another register office or abroad; 3. Couples who refused to participate in the study and did not complete the survey (despite the age). Despite his best efforts, the author was unable to determine the percentage of young married couples within the groups identified in points 2 and 3.
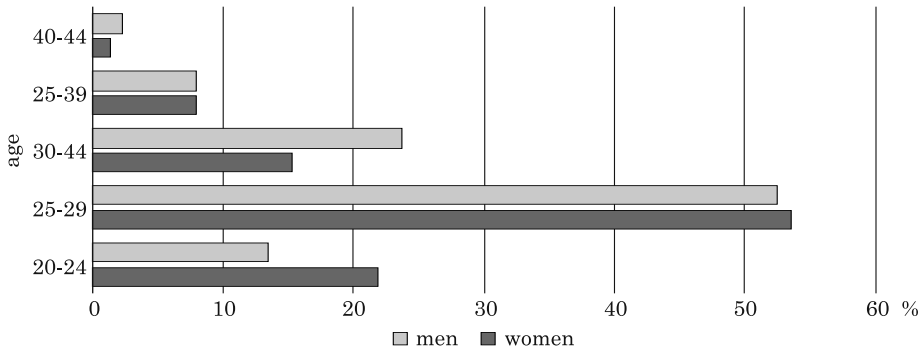
Fig. 1. Age structure of the newlyweds in Olsztyn in 2014, according to gender
Source: the author.

The women's education structure (Fig. 2) showed that most women (66%) had higher education, followed by 29% with secondary schooling. These results correspond to the trend throughout Poland, where an average Polish woman most often had higher or secondary education at the time of getting married. The situation among men was nearly the same: 57% of the respondents had higher education, while 31% had graduated from secondary schools. Meanwhile, it is true that town residents have better education than others, which is why the above percentages are higher than the country's average values. Analyses completed by the Central Statistical Office also show that the percentage of unmarried men and women with elementary vocational education is steadily decreasing, and this fact was confirmed by our respondents (although the above group continues to be dominated by men, as there were three-fold more men than women with vocational education among the couples who entered into marriage in 2014). Primary and lower secondary education was declared by a negligibly small percentage of the respondents.

The vast majority of the respondents declared that they lived in a town with a population of up to 200,000 (Fig. 3), which identifies urban centers. Over 62% of men and women stated that they lived in a town of this size (most probably in Olsztyn). The second most numerous group indicated a town with a population of over 200,000 as their place of residence, suggesting that they lived in some of the largest Polish cities. These results also verify the administrative profile of the area chosen for the research. It seems that the other indicated answers were a result of the migration flow to Olsztyn and, having settled down in it, the subsequent decision to stay in this town permanently.

With respect to income, the respondents' replies somewhat inscribed themselves into the economic image of the province, which belongs to the regions in which the labour market, the unemployment rate and, finally, the
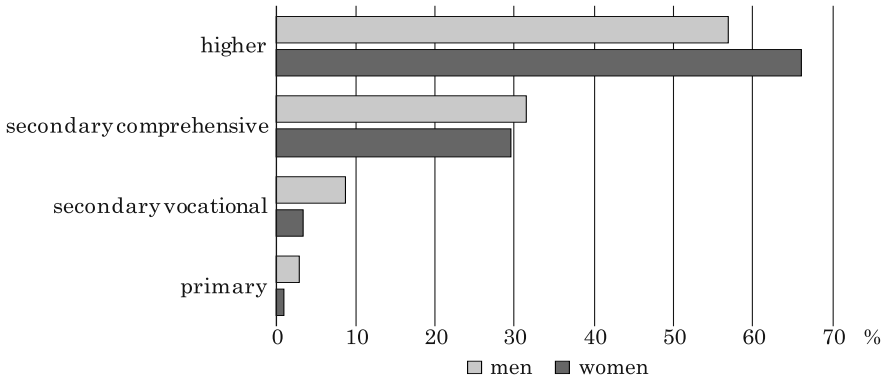
Fig. 2. Structure of education among newlyweds in Olsztyn in 2014, according to gender
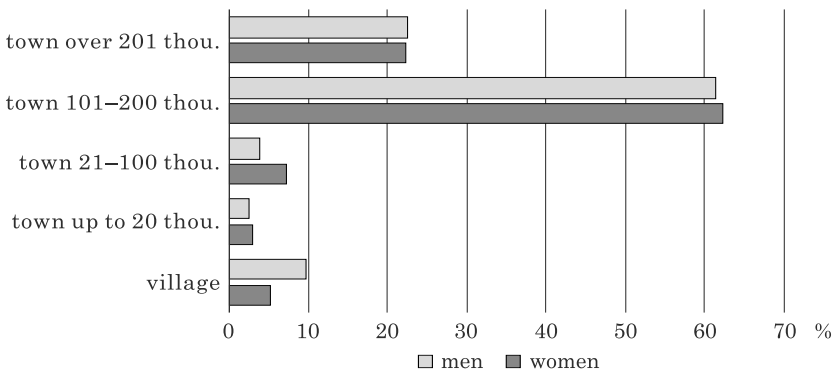Source: the author.

Fig. 3. Place of residence of newlyweds in Olsztyn in 2014, according to gender
Source: the author.

level of salaries and incomes are among the worst in Poland. Nearly 60% of the newlywed couples (Fig. 4) declared a net income in their new household at less than 2,000 PLN per capita. To some extent, it may have been caused by serious problems finding employment, but other contributing factors may have been modest professional experience and a short employment history. This in turn could have affected the level of remuneration. Noteworthy, about 23% of the households had a net income that was higher than Poland's average, and in our study it was declared to exceed 3,000 PLN per capita (a deeper analysis showed that a significant percentage of such indicators were represented by economic migrants working outside of Poland).

However, this did not change the fact that the buying power of the town's residents, including their capability to purchase real estate, was low and highly undesirable in terms of the living standard it could secure.
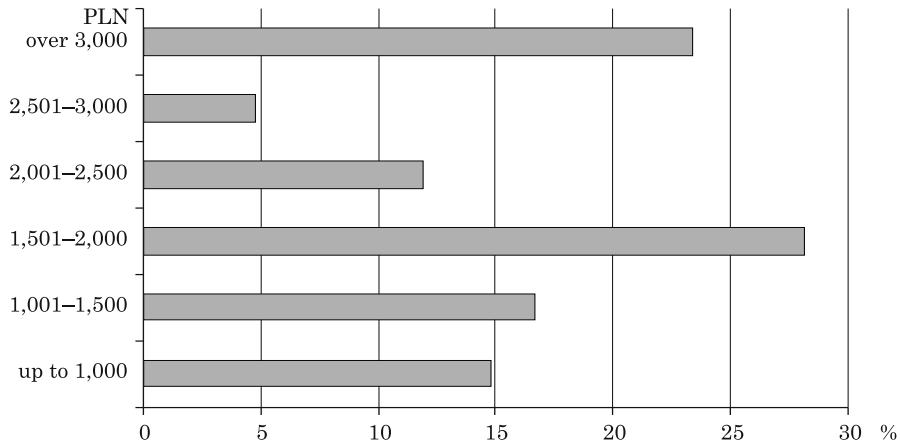
Fig. 4. Net income per capita among the newlywed couples in Olsztyn in 2014
Source: the author.

The housing situation of young married couples in Olsztyn

The theory of the second demographic transition explains the progressing transformations of lifestyle and demographic structure of a society. These changes have also affected some issues associated with the housing situation. As noted before, one of the superior goals for a newly created household is to be able to live on one's own. At present, such a form of being independent can be noticed even before the marriage is officially registered (Fig. 5). Among the young married couples surveyed in Olsztyn, just 32% lived separately before getting married. What seems particularly meaningful is that as many as 38% of newlyweds lived in their own flats, which they had bought together. It was also quite common to cohabitate in a rented flat, as indicated by 20% of the couples. he study therefore proved that the concept of settling down in one's own dwelling only after the wedding matters less today, and often is a consequence of the lack of alternatives to this situation. It is also worth noticing that another possible housing solution prior to the nuptials, indicated by the respondents, was cohabitation in a flat or house occupied by the family of one of the future spouses.

As mentioned before, studies on the housing situation also evaluate the housing stock, for example by analyzing the available sanitary and technical fittings and fixtures. All the flats (100%) which were occupied by young couples in Olsztyn before getting married were connected to waterworks and sewers, and just four (2.5%) did not have a bathroom or a flushing toilet; these four flats were rented from the city council. Likewise, the percentage of flats lacking
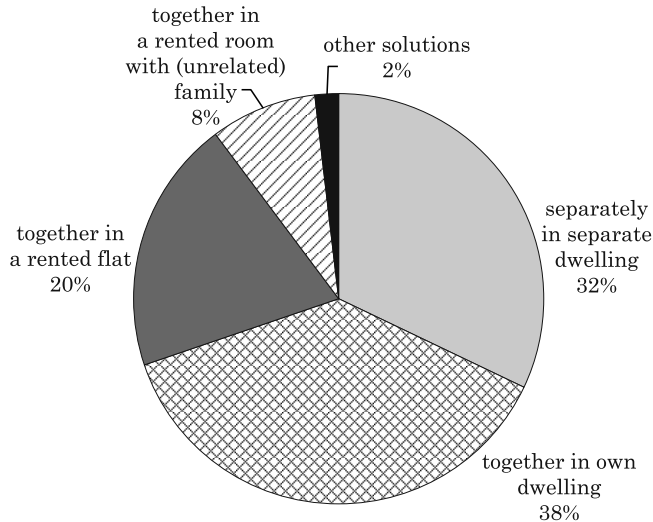
Fig. 5. Type of accommodation of young married couples before the wedding in Olsztyn in 2014
Source: the author.

central heating was very low, but nearly a third of the flats did not have piped gas installations. However, the lack of piped gas was increasingly more often a conscious decision rather than a nuisance. The share of technical amenities available in the flats occupied by the respondents was obviously higher than Poland's and the region's average availability of such conveniences, which is unsurprising when dealing with larger urban centers.

A fundamental question concerned the couple's plans regarding a place of dwelling after getting married. As the survey demonstrated (Fig. 6), an astonishing number of couples, taken the previous analysis of their incomes, declared they wanted to have a house built for them. Quite understandably, such declarations were much more often made by the respondents with the highest levels of income.

However, most respondents declared they would live in the flat purchased before the wedding (34%) or else they would buy a flat taking a mortgage loan for this purpose (19%). Practically speaking, respondents in any of the income brackets indicated these two solutions as the most preferred ones. Meanwhile, it should be added that some of the young couples might have presented a wishful thinking approach to solving their housing problem, not always convergent with their financial capabilities. Another popular solution was to move into a detached house occupied by one of the spouses' family, a choice quite frequently indicated in the lowest income group, up to 1,000 PLN. Relatively frequently, the respondents planned to rent a flat, which is easier

Fig. 6. Plans of the newlyweds regarding accommodation after the wedding in Olsztyn in 2014
Source: the author.

in towns. Rather infrequently, young couples were planning to make efforts to obtain a flat from the council or a social building society. Likewise, the respondents did not cherish the idea of renting a room in a shared rented accommodation (with other tenants) or a room in a dwelling occupied by unrelated owners. These options tended to be indicated by young married couples whose income per person was less than 1,000 PLN.

Another issue was the self-evaluation of one's housing situation by young couples after the wedding. The analysis suggests that – considering the income situation and housing conditions of the respondents before the nuptials – the young wives and husbands were generally satisfied with their housing conditions (Fig. 7). The largest group of respondents evaluated their housing
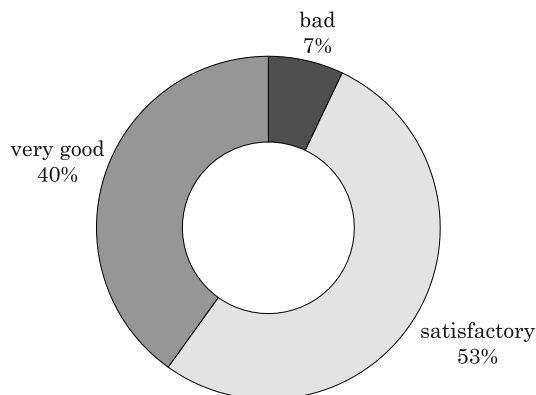

Fig. 7. Self-evaluation of the housing situation after the wedding among young couples married in Olsztyn in 2014
Source: the author.

situation as satisfying (53%). Forty per cent perceived their housing conditions as very good, in contrast to just 7% who said they were bad. Most often, positive replies were given by those who had lived in their own flat before they got married, were about to start the construction of their own house or lived in a detached house together with the family of one of the spouses.

The study also looked at the actual aspirations of young married couples regarding the ownership of a flat or house and its maintenance. The respondents were asked to indicate the preferred form of home and its size. Nearly 65% chose a flat in a block of flats as an optimal solution. Most often, they chose a flat with two or three rooms[7]. It seems such replies are a kind of compromise between aspirations and dreams and – on the other hand – a realistic approach based on the financial possibilities.

The young married couples surveyed were also asked whether they could consider taking a mortgage loan from a bank, migrating or emigrating abroad permanently (Tab. 1). The answers provided by the respondents implicate a modest interest in using a mortgage loan for the co-financing of a purchase of one's flat or house. This may have been caused by a rather restrictive policy of commercial banks addressed to potential clients and a realistic assessment of one's chances of obtaining a loan. Half of the couples had considered such an option to finance the purchase of real estate. In most cases, they were the respondents with higher education.

Table 1

Willingness to take a mortgage loan, migrate or leave Poland permanently among the newlyweds in Olsztyn in 2014 (in %)

Questions	Yes	No	Difficult to say
Are you considering taking a mortgage loan to buy own flat or house?	52.6	45.1	2.3
Would you be ready to leave Poland and to earn money abroad for buying a flat?	53.5	45.1	1.4
Would you be willing to leave Poland for good to find work and accommodation abroad?	38.6	59.5	1.9

Source: the author, based on the survey results.

Over half of the couples took into consideration a plan to travel abroad to earn money necessary for the purchase of a flat in Poland. This option was indicated mostly by persons with higher or secondary education, although the respondents with vocational education also implicated they could accept this solution.

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[7] In this case, the questionnaire asked about rooms (living room and bedrooms) rather than chambers (including kitchen), which is the principal category used in research by the Central Statistical Office in Poland.

Far fewer couples were willing to emigrate abroad permanently. Within the educational structure, there was a predominance of respondents with secondary, vocational and primary education who considered this option. It seems possible that having such plans was a consequence of the problems in the domestic labour market, due to high unemployment and relatively low wages. Nearly 60% of those questioned, however, declined this possibility in the near future.

Conclusions

During this study of the housing situation for young married couples, information was obtained from 215 couples living in Olsztyn. The survey results were juxtaposed with the demographic profile of men and women getting married in Poland. Afterwards, a detailed analysis was performed of the housing situation for the young married couples, paying special attention to declared housing plans after the formal registration of one's marriage. The study results justify several conclusions, of which the most important ones are:

1. The majority of brides and bridegrooms entering into marriage in Olsztyn had higher education and were within the age interval of 25–29 years. The demographic profile of the surveyed newlyweds corresponded to the data collected by the Central Statistical Office in Poland.

2. The brides and bridegrooms came mostly from towns with a population of up to 200,000 people, which is consistent with the administrative and urban profile of Olsztyn. Their household net income per person was not among Poland's highest bracket, and in 60% of cases did not exceed 2,000 PLN per capita.

3. Over 2/3 of the newlyweds had cohabited before entering into marriage, which inscribes itself in the currently changing lifestyle and confirms some social acceptance of this form of shared accommodation.

4. Among the types of real estate property perceived as optimal and possible to be maintained by young married couples, the respondents most frequently indicated flats with two or three rooms in a block of flats or, somewhat surprisingly, detached houses with three rooms. In the latter case, it seems the idea of an optimal type of dwelling prevailed over a rational evaluation of maintenance costs, taken the declared incomes of the respondents.

5. The respondents were moderately interested in mortgage loans as a source of funds for the purchase of their own flat or house. Relatively often, they considered economic emigration to earn the money for buying their own dwelling. However, they most often refused the idea of permanent emigration.

However, the latter solution was frequently chosen by couples living in rented accommodation (90% positive replies).

6. The couples who declared living with the family of one of the spouses after the wedding were mostly the ones with secondary education and an income of no more than 1,500 PLN per capita. Each of these couples confirmed that they had at least one room for their exclusive use. On the other hand, the married couples that declared buying a flat or a house with the help of a mortgage loan were distinguished by having a higher educational status for both the wife and the husband.

7. Surprisingly, many couples declared an intention to start construction of their own house. Those who indicated this option represented all income brackets and declared such a plan regardless of their educational background.

8. Out of the dwellings occupied by the couples at the time of research, the respondents very rarely indicated one-room (studio) flats. Most of the flats had two or three rooms. This is congruent with the national statistics, which show that Polish flats are small and overcrowded when compared to European standards.

It seems that the research data collated in this study will make an interesting contribution to the existing state of knowledge in this field of study. It may also stimulate further investigation regarding the housing situation of young married couples in Poland. The results presented in this article can serve as a reference point for complex demographic analyses of the housing situation throughout Poland. It appears that the most interesting observation made after elaborating the survey results is that there is considerable discrepancy between the perception of one's own housing situation and its reflection achieved by comparing relevant indicators against the European background. It is certainly worth considering the broadening of the research scope in the future, so as to capture certain regularities, which can be observed not only at the lowest tier of the state's administrative division, but also on the level of sub-regions or provinces.

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LABOUR PRODUCTIVITY, ICT AND COMPLEMENTARY FACTORS IN THE CEE REGION[1]

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K e y   w o r d s: labour productivity, ICT, complementarities, CEE countries.

A b s t r a c t

The paper discusses the role of Information and Communication Technologies for labour productivity in the Central and Eastern European countries, taking into account the consequences of the latest global economic crisis. It focuses on the factors (ICT complementarities) influencing the ICT diffusion trajectories, and thus having impact on labour productivity. The fixed effects models and least squares dummy variable (LSDV) regression was implemented with the use of panel data for 21 European Union member countries. The analysis revealed that only some complementary factors to ICT investments appeared significant to affect labour productivity in the CEE Region. It also showed that sources of labour productivity are sensitive to cyclical changes in the economy.

WYDAJNOŚĆ PRACY, TIK I CZYNNIKI KOMPLEMENTARNE W KRAJACH EUROPY ŚRODKOWO-WSCHODNIEJ

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S ł o w a   k l u c z o w e: wydajność pracy, TIK, czynniki komplementarne, kraje Europy Środkowo--Wschodniej.

A b s t r a k t

    W artykule przeanalizowano wpływ technologii informacyjnych i komunikacyjnych (TIK) na wydajność pracy w krajach Europy Środkowej i Wschodniej (EŚW), z uwzględnieniem skutków ostatniego globalnego kryzysu gospodarczego. Szczególną uwagę poświęcono czynnikom komplementarnym wobec TIK, które oddziałują na ich procesy dyfuzji, mając tym samym wpływ na wydajność pracy. Analizę ilościową przeprowadzono z wykorzystaniem estymacji modeli z efektami stałymi za pomocą metody najmniejszych kwadratów ze zmiennymi sztucznymi (LSDV), dla danych panelowych dla 21 państw członkowskich Unii Europejskiej. Wyniki analiz wykazały, że jedynie niektóre czynniki komplementarne wobec TIK miały istotny statystycznie wpływ na wydajność pracy w krajach EŚW. Okazało się również, że źródła wydajności pracy są wrażliwe na zmiany koniunktury gospodarczej.

Introduction

The role of Information and Communication Technologies (ICT) concerning economic growth and productivity has been widely discussed since Solow (1987) stated "You can see the computer age everywhere but in the productivity statistics". Nowadays, there is a broad consensus among researchers that ICT are of key importance for productivity performance. Although recent research studies point towards a positive relationship between ICT investments and productivity, even in developing (or emerging) economies, there are still a lot of questions that remain unanswered. The most important are related to the hypothesis of the leapfrogging effect and the factors influencing the ICT diffusion trajectories (ICT complementarities), which have an impact on labour productivity. Both questions are crucial; however, we will focus on the latter in this paper. Our goal is to identify which complementarities to ICT investments have been significant to labour productivity growth in Central and Eastern European (CEE) countries since the second half of 1990s. A macroeconometric analysis has been conducted for three periods: 1995–1999, 2000–2007 and 2008–2011, describing different stages of transition of CEE countries to a market economy, the last period including the effects of the world financial crisis. Thusly, we were able to assess whether economic cycles influence the impact of ICT complementarities on labour productivity.

Towards ICT complementarities –
a synthetic literature review

The ICT influence on economy can be described by two types of effects (JUNG, MERCENIER 2014). The first-order effect captures the impact of investments in ICT infrastructure on the stock of capital. The growth of ICT capital, as models of economic growth predict, positively influences GDP growth and labour productivity. The second-order effect (spillover effect) is a result of

complementary changes that are induced by ICT investments. This refers to outcomes of theoretical and empirical studies that were focused on "solving" the productivity paradox puzzle. The most accepted explanations include: mismeasurement of inputs and outputs related to ICT (BRYNJOLFSSON, SAUNDERS 2010, HALTIWANGER, JARMIN 2002, MOULTON 2002, YANG, BRYNJOLFSSON 2001), lags – ICT investments may not have an immediate impact on a company's productivity, as this requires a learning-by-doing form of experience (DAVID 1990, 2002, KLING, LAMB 2002), and finally the complementarity hypothesis, which argues that utilisation of the full potential of new technologies (including ICT) requires complementary changes (investments) related to work organisation, human capital or changes in business processes within companies (BRYNJOLFSSON 2005, MILGROM, ROBERTS 1990, 1995, MILGROM et al. 1991). These complementary changes affect Total Factor Productivity (TFP) and, as a result, productivity and economic growth. Literature provides many examples of adoption of organisational changes, new human resource management practices and the growing importance of human capital, which are treated as complementary factors.

BRESNAHAN et al. (2002) have shown evidence of a positive correlation between ICT use and workplace organisation and skilled labour that have affected productivity in the United States. They concluded that with the growing spread and access to ICT, investment in complementarities is crucial, particularly in skilled labour. BLACK and LYNCH (2001, 2004) showed, also for the US, that productivity growth during the 1990s had its source in changes in workplace organisation and innovations (employee involvement, team work, incentive pay and decision-making autonomy) along with the dissemination of computers. BRYNJOLFSSON (2005) described seven pillars of digital organisation, which in fact are ICT complementarities that enhance productivity and the market value of a company.

Research studies in other developed countries followed the path of analysis initiated in the Unites States. Analysis of panel data for British and French firms (CAROLI, VAN REENEN 2001) revealed that skilled workers adapt more easily to changes in organisation. Having this in mind, the authors presented empirical evidence of the relationship between workplace innovation and human capital, as well as its influence on productivity. Another comparative study of Swiss and Greek firms (ARVANITIS, LOUKIS 2009) shows the positive effects of physical capital, ICT, human capital and new organisational practices on labour productivity. It appeared that Swiss firms were more efficient in combining and implementing these factors, while in the Greeks firms, physical capital played a crucial role in relation to labour productivity.

The role of ICT complementarities has also been emphasised in macro-level research studies conducted in developing countries. PIATKOWSKI (2004) and

VAN ARK and PIATKOWSKI (2004) showed that ICT noticeably contributed to GDP and labour productivity growth in the CEE region in the second half of 1990. DEDRICK et al. (2013) found that in developed countries, ICT complementarities encompass foreign investments and cellular penetration, while in developing countries, these were the quality of human capital, foreign investments and the cost of communication services. NIEBEL'S (2014) analysis also indicates the existence of spillover effects and complementarities related to ICT investments in developed as well as in developing countries.

The interaction between ICT and complementary factors is a complex one. Access to technology is determined by the trade openness of an economy, which influences the transfer of know-how. The ability of a company to implement a given technology depends on whether it already possess adequately trained employees or is able to recruit them from the labour market. In order to bring about the expected results (e.g. increase in labour productivity), it also requires the introduction of changes in work organisation in connection with the redefinition of business processes that were performed with the use of previous-generation technology. Concurrently, the pace and scope of these changes are dependent largely upon the human capital of employees. Moreover, the institutional milieu plays an important role – it may support or hinder the implementation of this comprehensive process of changes in the organisation (e.g. more restrictive labour code regulations could hamper the introduction of changes in work organisation, while higher labour market flexibility should encourage greater openness to change among employees).

It should be emphasised that factors complementary to ICT are also reliant upon each other – changes in work organisation require access to modern technologies and suitably qualified human resources, while innovativeness and the scale of foreign investments are conditioned by the dissemination of technology and the quality of human capital.

ICT – driven productivity in the CEE countries

Statistical data shows that since 2000, the first- and second-order effects of ICT implementation have been more evident in the CEE region[2] than in the EU-15 countries. ICT capital grew 17.9% between 2000 and 2014 in the seven CEE countries, while in the EU-14, it reached 10.75%. As a result, the average contribution of ICT capital to GDP growth in the CEE region was above that of the EU-14, especially in Hungary, Bulgaria and Slovakia. TFP also played an

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[2] Due to a lack of data on ICT capital in the Conference Board 2015 database for Estonia, Latvia, Lithuania, Croatia and Luxembourg, there is no possibility to assess the magnitude of the first-order effect.

important role, especially in the CEE region, where its contribution to economic growth was, on average, positive[3] (Tab. 1).

However, there were perceptible differences between individual countries. In Romania, Poland and Slovakia, TFP was the main driver of GDP growth. A smaller, but still positive, TFP contribution was recorded in Estonia, Lithuania, Latvia, Czech Republic and Slovenia. At the same time, Bulgaria, Croatia and Hungary witnessed a negative TFP contribution to GDP growth – unfortunately, it is not possible to estimate to what extent this effect was caused by ICT, though it seems that other factors played a primary role.

Table 1

Sources of GDP growth in EU-15 and CEE countries in 2000–2014

Country	Labour Quality	Labour Quantity	ICT capital services	Non-ICT capital services	TFP growth
EU-15	0.24	0.18	0.50*	0.74	-0.26
CEE (11)	0.24	-0.20	–	1.59	0.91
CEE (7)	0.28	-0.20	0.92	1.19	0.78
Bulgaria	0.34	0.01	1.40	3.06	-1.44
Croatia	0.22	0.17	–	1.41	-0.73
Czech Republic	0.22	-0.09	0.41	1.41	0.58
Estonia	0.17	-0.03	–	1.91	1.86
Hungary	0.33	-0.4	1.53	0.72	-0.22
Latvia	0.14	-0.70	–	3.22	1.38
Lithuania	0.16	-0.19	–	2.13	2.07
Poland	0.21	0.09	0.71	1.20	1.40
Romania	0.25	-1.11	0.47	0.23	3.67
Slovak Republic	0.13	0.11	1.30	0.83	1.40
Slovenia	0.48	-0.02	0.61	0.86	0.06

* Average for EU-14 excluding Luxembourg.
Source: own elaboration based on the Total Economy Database. Average for 2000–2014.

In spite of rapid labour productivity growth, the gap in the level of productivity between CEE and EU-15 (Western European – WE) countries is still quite large. Comparing average levels of productivity for the periods between 2000 and 2014, it is clear that CEE countries experienced strong productivity improvement. Productivity in the CEE region increased, on average, by 48.4%, while in WE countries, it was only 7.7%. As a result, the labour productivity gap between the two regions was reduced by 25.5%.

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[3] It should be emphasised that the contribution of TFP to GDP growth in 2000–2014 in the EU-15 countries was negative.

Romania and Lithuania gained most – the increase in productivity levels in
2000–2014 accounted for 105% and 92%, respectively. However, productivity
levels in all CEE countries are still much lower than in other European
economies. Taking as a reference the year 2014, only Slovenia and the Slovak
Republic had higher labour productivity levels when compared to the least
performing EU-15 country – Portugal. The gap within the CEE region is
significant, e.g. labour productivity in Bulgaria in 2014 was 35% lower than the
average for the region. The productivity patterns in CEE countries resemble
those of advanced market economies and are mainly driven by efficiency gains
within individual firms. Rapid microeconomic progress in adoption of ICT
innovations proves the potential of the technological revolution for transition
countries (VAN ARK, PIATKOWSKI 2004). Figure 1 shows that in 2008–2014,
CEE countries, apart from Romania and the Czech Republic, have higher
levels of ICT capital contribution to GDP growth on average. However, in the
case of Romania, there is no clear relation between these two variables
– Romania is characterised by low ICT capital contribution and low GDP per
employee. Nevertheless, all countries improved labour productivity. It is
evident that CEE countries made a huge step after transition to restructure
their economies and have entered a convergence path towards that of Western
Europe. However, the convergence processes have been affected by the crisis to
a larger degree.
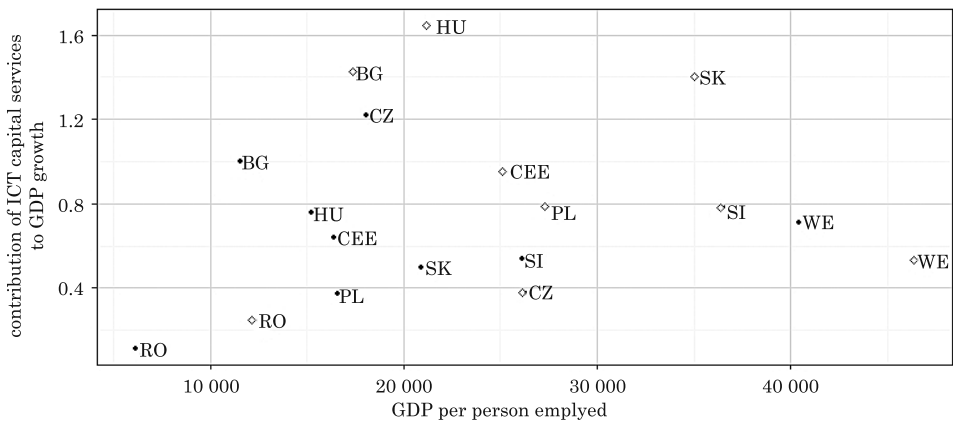
● – 1995-1999 average
◊ – 2008-2014 average

Fig. 1. Contribution of ICT capital services to GDP growth and GDP per person employed: 1995–1999
and 2008–2014

Source: own elaboration based on the Total Economy Database.

Identification of ICT complementarities

Macroeconometric modelling, used for quantitative analysis, is based on the Solow growth model (SOLOW 1957) and its extension by Jorgenson and GRILICHES (1967). This approach enabled us to measure the impact of ICT complementarities on labour productivity and to assess whether the role of these complementarities changed over time. The econometric analysis encompassed the years 1995–2011 due to the unavailability of more recent data.

The aggregate production function takes the form:

$$Y_{ti} = A_{ti}K_{ti}^{\alpha}L_{ti}^{1-\alpha} \tag{1}$$

where at any given time t, for a given country i, Y is Gross Domestic Product; A is Total Factor Productivity (TFP); K is input of physical capital; L is input of labour. After decomposition of capital and labour, equation (1) can be expressed as:

$$Y_{ti} = A_{ti}f(K_{ti}^{NOICT}, K_{ti}^{ICT}, L_{ti}^{U}, L_{ti}^{S}) \tag{2}$$

where K is decomposed to K^{NOICT} – non-ICT capital and K^{ICT} – ICT capital; and L to L^{S} – skilled labour and L^{U} – unskilled labour. Total Factor Productivity can be presented in the following functional form:

$$A_{ti} = \exp(\delta_0 Trade.Openness + \delta_1 Edu + \delta_2 INTuse + \delta_3 Patents + \\ + \delta_4 RDS + \delta_5 HRST) \tag{3}$$

After logarithm transformation, the final model takes the following form:

$$\ln LP = \beta_1 \ln GFCF + \beta_2 \ln EduS + \beta_3 \ln RDS + \beta_4 \ln ICTS + \beta_5 Trade.Openness + \\ + \beta_6 Edu + \beta_7 INTuse + \beta_8 \ln Patents + \beta_9 HRST \tag{4}$$

Equation (4) describes four sources of labour productivity: non-ICT capital (GFCF), ICT capital (ICTS), human capital (EduS) and Total Factor Productivity, represented by different variables (Tab. 2). These variables were selected taking into account the findings discussed in literature on productivity. It has been argued that productivity improvements in transition countries should be linked to the components of knowledge economy: ICT usage and knowledge, human capital development, workplace organisation and research and innovation (ARVANITIS, LOUKIS 2009, BRESNAHAN et al. 2002). There is also empirical evidence that investment in research, development and innovation affects TFP (JORGENSON, VU 2005). Domestic research and development is

needed for understanding and absorption of knowledge developed internationality, for improvement of local research and development (R&D) skills and active participation in international R&D networks.

A better quality of human capital can help countries to develop their technologies, as well as increase a country's ability to absorb high technology knowledge from abroad (CASELLI, COLEMAN 2001, POHJOLA 2000). Human capital derived from university education, but also from training and accumulated through learning by doing, can increase the efficiency of labour and also enhance TFP (ARVANITIS 2005, BLACK, LYNCH 2001). Moreover, human resource management within companies, organisations and institutions is an important factor in knowledge economy and one of the determining elements which enable the increase of competitiveness and improve individual and aggregated productivity (BRYNJOLFSSON, HITT 2003).

Finally, liberalised trade positively influences productivity and economic growth. This is particularly important for dissemination of knowledge and

Table 2

Variables and indicators used in econometric analysis

Name	Description	Source	Indicator
LP	Labour productivity per hour worked in 2012 USD (converted to 2012 price level with updated 2005 EKS PPPs)	Total Economy Database	Productivity
GFCF	Gross fixed capital formation as a percentage of GDP	World Bank (WDI)	Non-ICT capital
ICTS	Total ICT spending (computer hardware, software and services, and communications) as a percentage of GDP	WITSA Digital Planet	ICT capital
EduS	Total public expenditure on education per total annual hours worked	World Bank (WDI)/ Total Economy Database	Human Capital
RDS	Research and development expenditure as a percentage of GDP	World Bank (WDI)	Innovation capability
Trade. Openness	Net export as a percentage of GDP	World Bank (WDI)	Technology diffusion
Edu	Gross enrolment ratio	UNESCO UIS database	Adaptive capacity of technology
HRST	Human resources in science and technology percentage of active population from 25–64 years old	Eurostat	Adaptive capacity of technology
INTuse	Internet users per 100 people	World Bank (WDI)	Adaptive capacity of technology
Patents	Resident patents per 1000000 people	World Bank (WDI)	Technology creation

Source: own elaboration.

innovation. Open borders allow for international spillover effects, contributing to economic growth in developing countries and enhancing their catching-up process through adaptation of advanced foreign technologies. Openness to import makes different varieties of capital goods more accessible, which increases efficiency (BARRO, SALA-I-MARTIN 2004).

The econometric analysis was based on panel data for 21 European Union member countries divided into two groups: CEE countries (7 economies)[4] and WE countries (14 economies). We treat WE countries as a point of reference.

Equation (4) was estimated with the use of fixed effects models and least squares dummy variable (LSDV) regression. The results clearly indicate changes in the sources of labour productivity and the impact of ICT complementarities in CEE countries, as well as the influence of the economic crisis on changes in the relationship between ICT and productivity (Tab. 3).

Table 3

Influence of ICT and complementarities on labour productivity in CEE and WE countries in 1995–2011

Specification	Central and Eastern Europe			Western Europe		
	1995–1999	2000–2007	2008–2011	1995–1999	2000–2007	2008–2011
log(EduS)	0.000 (0.013)	0.050 (0.028)	-0.006 (0.017)	0.015 (0.010)	**0.077***** (0.019)	0.019 (0.015)
log(GFCF)	**0.333***** (0.073)	**0.160**** (0.046)	-0.017 (0.053)	**0.378***** (0.074)	0.021 (0.042)	**-0.093*** (0.044)
log(RDS)	-0.072 (0.051)	0.011 (0.026)	0.012 (0.016)	-0.007 (0.014)	0.003 (0.027)	**-0.041**** (0.015)
log(ICTS)	-0.183 (0.051)	**0.125***** (0.026)	-0.051 (0.127)	-0.083 (0.084)	**-0.038*** (0.019)	-0.169 (0.099)
log(Trade.Openness)	-0.183 (0.109)	0.021 (0.070)	**0.119**** (0.035)	0.167 (0.094)	**0.120**** (0.036)	**0.180***** (0.045)
Edu	-0.003 (0.003)	**0.012***** (0.002)	0.000 (0.002)	-0.001 (0.001)	0.000 (0.000)	0.000 (0.001)
INTuse	**0.017**** (0.006)	**0.003***** (0.001)	0.002 (0.002)	**0.002*** (0.001)	**0.002***** (0.000)	0.000 (0.001)
log(Patents)	0.049 (0.053)	0.063 (0.044)	0.038 (0.058)	0.009 (0.044)	-0.023 (0.020)	-0.042 (0.034)
HRST	0.005 (0.003)	**0.013**** (0.004)	0.004 (0.007)	0.001 (0.002)	**0.005*** (0.002)	0.003 (0.002)
R^2	0.838	0.947	0.757	0.753	0.823	0.622
Adj. R^2	0.455	0.676	0.324	0.506	0.654	0.367
Num. obs.	35	56	28	98	112	56
P-value	0.000	0.000	0.0125	0.000	0.000	0.000

Source: own elaboration.

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[4] Countries for which data on ICT capital is available in the Total Economy Database.

In the first sub-period (1995–1999), only gross fixed capital formation ($\beta=0.333$, $p<0.001$) and Internet usage ($\beta=0.017$, $p<0.01$) appeared to be significant and positively affected labour productivity in CEE and WE countries. In the years 2000–2007, ICT spending ($\beta=0.125$, $p<0.001$), gross enrolment ratio ($\beta=0.012$, $p<0.001$) and human resources in science and technology ($\beta=0.013$, $p<0.01$) also become significant in explaining the growth of labour productivity in Central and Eastern European countries. In WE countries, at that time, two other complementarities – human capital, measured by total public expenditure on education per total annual hours worked ($\beta=0.077$, $p<0.001$) and trade openness ($\beta=0.12$, $p<0.01$), along with human resources in science and technology ($\beta=0.005$, $p<0.01$) and Internet usage ($\beta=0.002$, $p<0.001$), positively influenced productivity. Interestingly, ICT capital had a significant but negative impact on labour productivity in Western European countries (generally, in all analysed sub-periods, the relationship between ICT spending and labour productivity in WE countries was negative). This may imply that new ICT investments in WE countries were too low to positively affect productivity. In contrast, it appears that CEE countries took advantage of the favourable economic situation in order to catch up to West European countries by investing in ICT capital. Unfortunately, the economic crisis reversed this trend – the impact of ICT capital on labour productivity in CEE countries in 2008–2011 became insignificant and negative.

Estimated models clearly show that in the recession period (2008–2011), explanatory power dropped significantly (to 32% in the case of CEE countries, and to 37% in the case of WE countries). Variables that previously explained changes of labour productivity became insignificant, and even some coefficients acquired negative numbers. The only significant variable (ICT complementarity), explaining labour productivity in CEE countries, was trade openness ($\beta=0.119$, $p<0.01$). This variable was also significant for WE countries ($\beta=0.18$, $p<0.001$), along with non-ICT capital and R&D expenditures (but in this case, the coefficients had negative numbers).

This leads to the conclusion that the relationship between ICT and productivity, and the importance of given ICT complementarities, are strongly dependent upon the economic situation and the phase of the economic cycle. Macroeconomic stability seems to be a crucial factor enhancing labour productivity through the use of Information and Communication Technologies in Western and Central and Eastern European countries. Thus, the convergence processes between CEE and WE countries are hampered during economic slowdown, not only because of a decrease of capital investments (in non-ICT and ICT capital), but also due to the diminished influence of ICT complementarities.

Conclusions

It has been widely acknowledged that Information and Communication Technologies play a crucial role concerning economic growth and productivity performance, not only in highly developed countries, but also in developing or emerging economies – e.g. CEE countries. Theoretical and empirical research studies on the relationship between ICT and labour productivity and TFP growth emphasises the importance of complementary factors enhancing the measurable effects of ICT implementation. The analysis presented in this paper focuses on identifying these complementarities in CEE and Western European countries.

Empirical research at the macroeconomic level, based on the Solow growth model, showed that ICT complementarities played an important role in enhancing labour productivity in CEE (and WE) countries, especially in the years 2000–2007. It also revealed that the global economic crisis had a significant and unfavourable impact on the relationship between ICT complementarities and labour productivity. The following conclusions, stemming from the analysis, seem exceptionally interesting.

Firstly, although there are a couple of potential ICT complementarities at the macro level, econometric modelling revealed that only some complementary factors to ICT investments appeared significant to affect labour productivity in CEE countries – almost all of them are related to human capital (gross enrolment ratio, human resources in science and technology and Internet usage determined by the digital skills of the users). At the same time, variables used as indicators of innovativeness turned out to be statistically insignificant.

Secondly, sources of labour productivity (including ICT complementarities) proved to be sensitive to cyclical changes in the economy. These are significant in explaining productivity when the economic situation is relatively stable, but during a recession, the relationship becomes insignificant. Obviously, this issue requires further examination. This conclusion is quite important, taking into account that CEE countries are still attempting to converge to the performance levels of the more developed Western European countries, and ICT seem to be an important factor in this process.

Thirdly, ICT contribution to labour productivity in CEE countries was significant only in 2000–2007 – a period when the economic situation was relatively good and stable in these countries. If companies invest in ICT mainly in times of promising financial prospects, the role of ICT complementarities shall be even more important when enhancing ICT-driven productivity.

Fourthly, trade liberalisation and openness to foreign investment appears to be an important factor determining the implementation of new technologies

and dissemination of knowledge and innovation to all European economies in times of crisis. Open borders allow for an international spillover effect that contributes to economic growth in developing countries and enhancement of their catching-up process through adaptation of advanced foreign technologies.

The obvious limitation of this research study is the relatively small sample of countries included in the estimation. We also keep in mind the existing disparities in labour productivity caused by heterogeneity across the analysed countries. Although there are more factors influencing labour productivity, we could not take all of them into consideration. Regarding the importance of this topic, especially for transition economies, there is a need to conduct further research studies in this area. This includes macro-level analyses (with more countries, improved indicators and more reliable longitudinal data taken into account), as well as micro-level studies. This company-level approach (requiring collection of primary data from small, medium and large enterprises) seems especially promising, as CARDONA et al. (2013) argue that differences between countries concerning ICT effects are much less significant at the micro-level than at the macro and sectoral level.

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ASSESSING THE EFFECTIVENESS OF PUBLIC INVESTMENT IN RESEARCH AND DEVELOPMENT BY FEDERAL EXECUTIVE BODIES IN RUSSIA

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A b s t r a c t

The purpose of this study is to develop an instrument to measure the effectiveness of public investment in R&D and make timely adjustments to scientific and technical policy. This will contribute to the growth of fundamental results, patents as well as their commercialization and innovative development for the overall economy. This article assesses the effectiveness of public investment in research and technological development (RTD), including attracted extra-budgetary funds, on the basis of the authors' methodology for assessing the efficiency of public spending on RTD projects. The main distributors of state budget funds in Russia are the Federal Executive Bodies (FEB). The proposed tool first allows the evaluation of the effectiveness of public expenditure on RTD in general, although it does not involve comparing individual FEB administrations, but only evaluates their work in promoting the development of their assigned research areas in terms of dynamics. This method sets the general rules for an evaluation of effectiveness in the state financial support of RTD, defines the key indicators reflecting the performance of such support and the use of science as a tool for ensuring the achievement of indicators and the socio-economic development of the state.

OCENA EFEKTYWNOŚCI INWESTYCJI PUBLICZNYCH W OBSZARZE BADAŃ I ROZWOJU FEDERALNYCH ORGANÓW WŁADZY WYKONAWCZEJ W ROSJI

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A b s t r a k t

Celem badań jest opracowanie narzędzia do oceny efektywności inwestycji publicznych w sferze badań i rozwoju oraz w zakresie polityki badań naukowo-technologicznych. Ma się to przyczynić do rozwoju badań podstawowych, patentów, a także ich komercjalizacji oraz rozwoju innowacyjności całej gospodarki. W artykule oceniono efektywność inwestycji publicznych w branży badań naukowych i rozwoju technologicznego (BRT), w tym pozyskanych środków pozabudżetowych. Ocenę przeprowadzono autorską metodą oceny efektywności wydatków publicznych na BRT. Głównym ośrodkiem rozdzielania środków budżetowych w Rosji są federalne organy władzy wykonawczej (FEB). Oferowane narzędzie pozwala ocenić efektywność całkowitych wydatków publicznych na badania i rozwój, chociaż nie porównuje poszczególnych instytucji federalnych organów wykonawczych, tylko ocenia ich pracę na rzecz rozwoju powierzonych kierunków badań. Metoda ta określa ogólne zasady oceny efektywności rządowego wsparcia finansowego na BRT. Definiuje główne wskaźniki odzwierciedlające skuteczność takiego wsparcia i wykorzystania nauki jako narzędzia gwarantującego osiągnięcie rozwoju społeczno-gospodarczego kraju.

Introduction

Assessing the effectiveness of public RTD spending is a necessary element of public administration to ensure technological transition by creating a critical mass of new technologies, as well as technologies that may remove the dependence on imports of industrial technology by Russia, which is unparalleled in the world. The developed methodology defines a unified approach to effectiveness monitoring of the state allocators of budget funds, which is aimed at the development of an active innovation economy. This would enable the transition to more effective models of RTD investment management (ILYINA 2015). In addition, the methodology identifies key indicators and a procedure for state financial support effectiveness evaluation in relation to research, developmental and technological works and the use of RTD project results to ensure sustainable development of the economy (SHASH, BORODIN 2015).

The indicators used to assess the efficiency of public spending on RTD are typical for all government programs in terms of RTD support. These indicators need to be converted to a single system of measurement by calculating the ratio of their values for the current period with regards to the previous period.

$$S_i' = \frac{S_i^T}{S_i^{T-1}} \tag{1}$$

where:
S_i^T is the value of the corresponding indicator in the assessment year;
S_i^{T-1} is the value of the corresponding indicator in the previous year or planned value.

The next step is the calculation of the ratio of budgetary to extra-budgetary funds.

$$R' = \frac{R^T}{R} \tag{2}$$

where:
R – the amount of budgetary funds raised to finance research;
R^T – the amount of extra-budgetary funds raised to finance research.

The calculation of the change in RTD financing indicators is made by calculating the relationship values of all funding in the current year to the corresponding value in funding during the previous period, defined by using correlation analysis.

The change in RTD funding in general (F') is calculated as the ratio of the volume of RTD project funding in the current year (F^T) to appropriate funding in the previous period ($F_j^{T-1}F^{T-1}$).

$$F' = \frac{F^T}{F^{T-1}} \tag{3}$$

Then the total ratio of productivity growth with regards to extra budgetary resources of public expenditure on RTD (P) is calculated.

$$P = \frac{\sqrt[32]{(\Pi_{i=1}^{31} S_i') \cdot R'}}{F'} \tag{4}$$

If $P{>}1$, then the activities of the FEB are effective, as the average rate of productivity growth is above the financing growth rate. If $P{<}1$, then the activities of the FEB are ineffective.

Assessing the effectiveness of public sector investment in RTD made by the FEB is done through an analysis of their activities over a certain period on the basis of several relative indicators. This is done because a comparison between FEB agencies is not valid due to the nature of their activities.

Openness and transparency of FEB activity in the Russian Federation are among the main indicators of their work in the implementation of established powers, as well as a necessary element for evaluating the effectiveness of public investment in R&D (ZHURAVLEVA 2011).

This article presents an analysis of the effectiveness of RTD funding from the ESF, in accordance with the data presented by the Federal system of monitoring the effectiveness of scientific organizations (FSMSO) implementation of research, development and engineering work in 2013 and 2014 (*Federal System...* 2016). FSMSO aggregates information on the activities of scientific organizations, including the financing of scientific research and the received results of intellectual activity. The analysis is based on data from 1013 organizations carrying out scientific activities that had posted reports in FSMSO during the analyzed period. The organizations selected were grouped according to departmental affiliation. On the basis of this grouping, 14 FEB (see Table 1) with the highest number of subordinated organizations (starting from three) were selected.

Table 1

The designation of the FEB studied in the research

Full Title	Abbreviated Title
The Ministry of Science and Education	Minobrnauki
The Ministry of Culture	Minculture
The Federal Biomedical Agency	FMBA
The Federal Service for Supervision of Consumer Rights Protection and Human Well-Being	Rospotrebnadzor
The Ministry of Industry and Trade of the Russian Federation	Minpromtorg
The Federal Service for Hydrometeorology and Environmental Monitoring of Russia	Roshydromet
The Federal Agency for subsoil use	Rosnedra
Ministry of Sports in Russia	Minsport
The Russian Federation Ministry of Agriculture	Minsel'khoz
The Federal Agency for fishery	Rosrybolovstvo
Federal Agency on Technical Regulation and Metrology	Rosstandart
The Ministry of Energy of the Russian Federation	Minenergo
The Roscosmos State Corporation for Space Activities	Roscosmos
The Ministry of Health of the Russian Federation	Minzdrav

Source: own elaboration.

Assessing the effectiveness of public RTD investment by the FEB is calculated on the basis of the developed technique of comparing the productivity growth rate and RTD funding. The efficiency of public investment in RTD must be assessed against the strategic target indicators. This assessment will allow prompt adjustment to the direction of expenditure, in order to achieve maximum cost-effectiveness (ILYINA, SERGEEVA 2015). Indicators of publication, patent and innovative activity are the main performance indicators of RTD financed by the FEB.

The total inventory of performance indicators used in assessing the efficiency of public RTD investment by the FEB, formed on the basis of the data from the unified state information accounting system of RTD (EGISU NIOKTR) and FSMSO, is presented in Table 2.

Table 2

The performance indicators used in assessing the efficiency of public R&D investment directed by the FEB

The Performance Indicators	No.
1	2
Publication activity	
Number of publications in Web of Science	1
Number of publications in Scopus	2
Number of publications in Russian Science Citation Index	3
Citation of publications indexed in the Russian science citation index	4
The number of publications in WoS and Scopus per each researcher	5
Patent activity	
The number of scientific, design and technological works	6
Number of RIA (results of intellectual activity) created	7
The amount of RIA taken into account in the state information systems	8
The number of RIA with state registration and (or) legal protection in Russia	9
The amount of RIA that have legal protection outside of Russia	10
The number of RIA used	11
The number of RIA used, confirmed by acts of use (implementation)	12
The number of RIA used, transferred under a license agreement	13
The number of RIA used, transferred by contract for alienation, including those submitted as collateral	14
The number of RIA used, made as a contribution to the authorized capital	15
Income from RIA use	16
The average net income for a single RIA	17
Small innovative enterprises	
The number of SIE created	18
The total average number of SIE employees	19
Comprehensive income from SIE	20

1	2
Scientific Personnel	
The number of scientific conferences with international participation	21
The percentage of young researchers (up to 39 years) in the total number of researchers	22
The percentage of postgraduates in the total number of students	23
The number of researchers working in leading Russian and international scientific and educational organizations	24
Scientific infrastructure	
The total cost of CCU (center for collective use)	25
The total cost of USI (unique scientific installations)	26
Financial and quantitative indicators of R&D	
Revenues from RTD	27
Income from scientific-technical services	28
The share of extra-budgetary funds in the total amount of funds received	29
The amount of fundamental research	30
The amount of applied research	31
The number of RTD works	32

Source: own elaboration.

The highest average growth rate of performance indicators of RTD presented in the context of the 20 indicators, including the number of RIA with legal protection abroad; the number of RIA used, confirmed by acts of use (introduction); the number of RIA used, given by contract for alienation, including those submitted as collateral; revenues from scientific and technical services, etc. (see Figure 1).

Indicators whose value is less than one, characterizes the decline in the effectiveness of RTD, and requires analysis of the factors influencing that decline, as well as the development of a number of measures aimed at creating favorable conditions for their growth. Reduced growth rates have been observed for 12 of the 32 indicators: the number of fundamental research, the share of extra-budgetary funds in the total amount of funds received, the percentage of graduate students in the total number of students, the number of the generated SIE etc.

Each FEB has an impact on the overall performance of the RTD sector within the framework of its activities. A comparative diagram demonstrating the average growth rate of RTD productivity, the FEB studied and RTD productivity growth rate of Minobrnauki, Minzdrav, Minpromtorg and Minsport is presented below (see Figure 2).
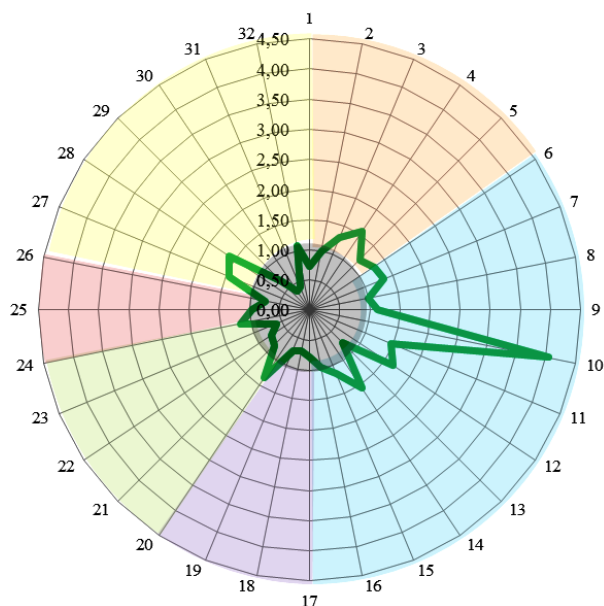
Fig. 1. The average growth rate of performance indicators of R&D by the FEB studied from 2014–2015

Source: own elaboration.

The value of the Minobrnauki effectiveness is above average for the 22 indicators which include total income of SIE, the number of publications in WoS and Scopus per each researcher, the number of RIA used, confirmed by acts of use (implementation), the share of extrabudgetary funds in the total amount of funds received etc.

Minzdrav shows values above the average for the 21 performance indicators including total income of SIE, the proportion of young researchers (up to 39 years of age) within the total number of researchers, the proportion of postgraduates in the total number of students, the total cost of center for collective use (CCU), the number of Web of Science publications etc.

Minpromtorg has values above the average for the 17 performance indicators, including the number of Scopus publications, citations of publications indexed in the Russian science citation index, the average net income for a single RIA, the percentage of young researchers (up to 39 years of age) within the total number of researchers, number of researchers working in leading Russian and international scientific and scientific-educational organizations, etc.

Minsport has values above average for the 12 performance indicators including the number of Scopus publications, income from RIA use, the
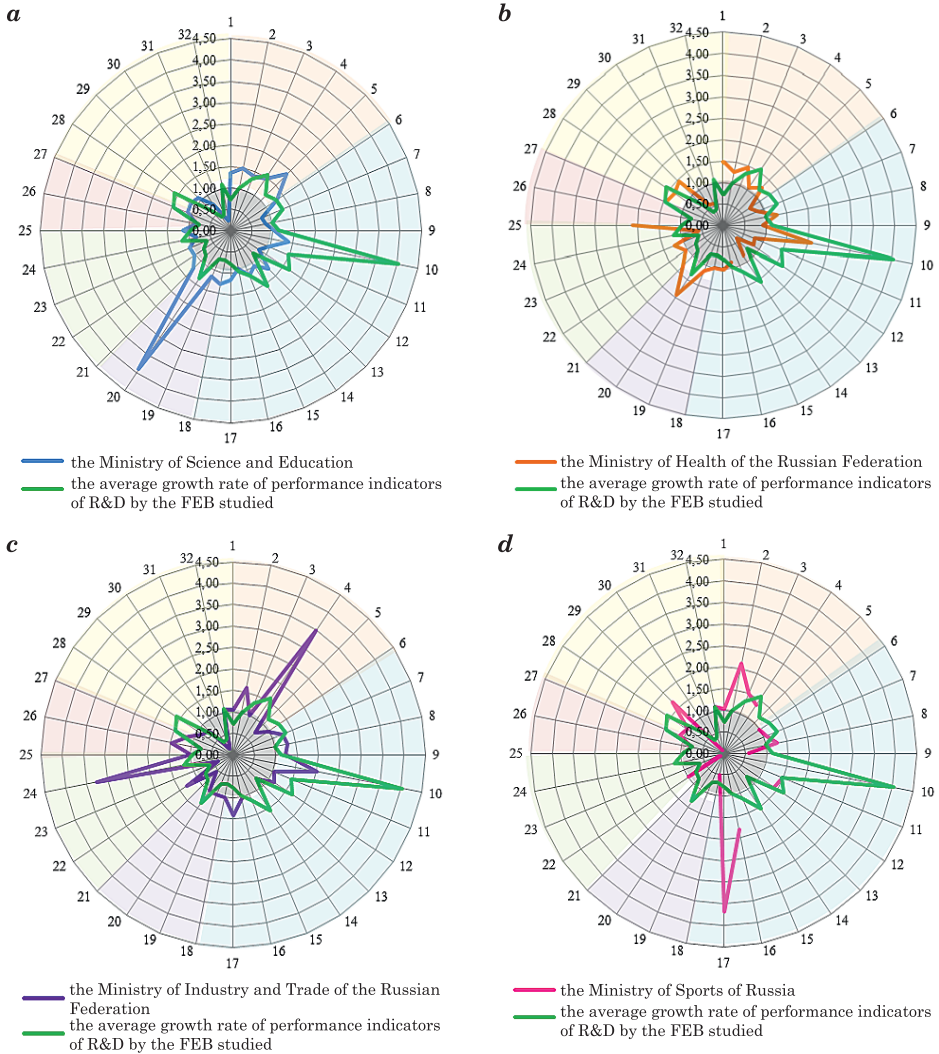
Fig. 2. A comparison of the average growth rate of productivity of the FEB studied with the rates of productivity growth for: *a* – Minobrnauki, *b* – Minzdrav, *c* – Minpromtorg, *d* – Minsport
Source: own elaboration.

average net income for a single RIA, the share of extra-budgetary funds within the total amount of funds received etc.

Thus, the greatest contribution to the increase of RIA productivity by the studied FEB is observed in such groups of indicators as scientific staff (Minzdrav, Minpromtorg); small innovative enterprises (Minzdrav, Minobrnauki); publication activity (Minpromtorg, Minobrnauki, Minsport);

research infrastructure (the Ministry of Trade and Industry); and patent activity (Minsport). It should be noted that the increase in the share of extra-budgetary resources also had a positive growth rate within Minobrnauki and Minsport.

For the purpose of testing the proposed methodology and the choice of the optimal lag between the RTD funding and its performance calculations of the funding growth rate from 2010 to 2013, the following research was carried out. The costs of applied and fundamental research directed from the Federal budget are presented in Table 3.

Table 3

Expenditure on applied and fundamental research directed from the Federal budget

FEB	Spending on basic and applied research from the Federal budget, thousand rubles				The growth rate of costs		
	2011	2012	2013	2014	2011–2012	2012–2013	2014–2015
The Ministry of Science and Education	39,309,302	47,861,088	33,639,825	31,365,887	1.218	0.703	0.932
Minculture	296,699.2	312,943.5	425,464.3	380,625.4	1.055	1.360	0.895
FMBA	976,269.5	1,348,104	2,248,812	1,496,599	1.381	1.668	0.666
Rospotrebnadzor	1,256,562	1,725,792	2,359,338	2,266,875	1.373	1.367	0.961
Minpromtorg	42,120,411	66,500,878	79,139,440	82,777,688	1.579	1.190	1.046
Roshydromet	1,309,349	1,598,911	1,579,735	1,635,279	1.221	0.988	1.035
Rosnedra	231,411.8	221,068.8	221,068.8	205,015.4	0.955	1.000	0.927
Minsport	264,599.9	496,735.3	349,820.4	326,681.5	1.877	0.704	0.934
Minsel'khoz	458,666.5	461,826.9	367,950	376,400.5	1.007	0.797	1.023
Rosrybolovstvo	3,854,646	3,641,847	3,558,568	3,563,665	0.945	0.977	1.001
Rosstandart	619,619.7	359,167.6	838,475.2	1,256,475	0.580	2.334	1.499
Minenergo	775,796	828,767.8	1,183,780	1,138,137	1.068	1.428	0.961
Roscosmos	50,838,512	57,846,270	72,749,480	87,763,809	1.138	1.258	1.206
Minzdrav	3,858,474	5,954,863	7251,925	24,179,764	1.543	1.218	3.334

Source: own elaboration.

In order to identify the correlation between funding and performance, an analysis of these indicators with a lag of 1, 2 and 3 years was carried out. The correlation coefficient between the average growth rate of productivity in 2015–2016 and the growth rate of consumption in 2012–2013 is 0.462, which illustrates a close positive relationship. For the growth rate of expenditure in 2011–2012, the correlation is -0.125, and the correlation for the growth rate of expenditure in 2013–2014 is 0.018. Due to the fact that the correlation coefficient between the average growth rate of productivity over the period

2013–2014 and the growth rate of public expenditures in 2012–2013 is at a maximum, there is correspondence with our hypothesis for the existence of a positive relationship between RTD funding and the growth of productivity, we can conclude that a lag of 2 years is optimal for evaluating the effectiveness of public expenditure on RTD conducted by the FEB. The results of the evaluation of public RTD expenditure effectiveness for the studied FEB are presented in Figure 3.
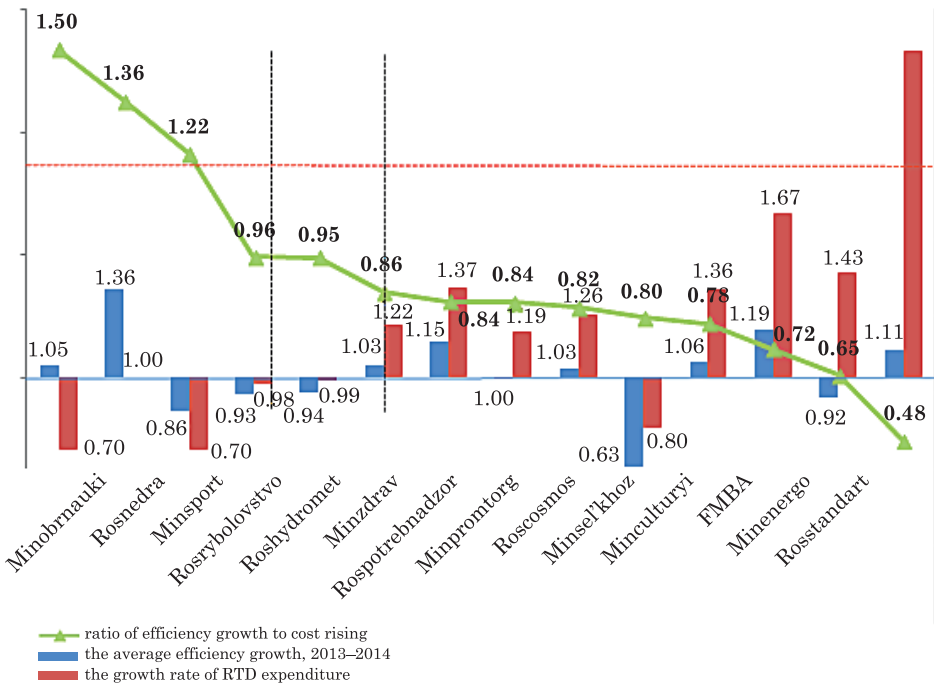

Fig. 3. Evaluation of public spending efficiency for the studied FEB
Source: own elaboration.

According to the results of the effectiveness evaluation for public RTD expenditures made by the studied FEB, we can draw the following conclusions:

– the leaders are the FEB which have a ratio of productivity growth to RTD expenditure growth larger than one (Minobrnauki, Rosnedra, Minpsport);

– the effective FEB are those whose ratio of productivity growth to the RTD expenditure growth is approximately equal to one (Rosrybolovstvo, Roshydromet);

– the lagging entities (not effective) are those FEB whose ratio of productivity growth to RTD expenditure growth is less than one (Minzdrav, Rospotrebnadzor, Minpromtorg, Roscosmos, Minsel'khoz, Minculture, FMBA, Minenergo, Rosstandart).

The reduction of RTD expenditure in 2013 by 30% within Minobrnauki and Minsport (as compared to 2012) led to productivity growth within Minobrnauki by 5% in 2015, and reduced the efficiency of Minsport by 16% (less than the cost of RTD by 14%). In the absence of RTD expenditures, changes during the analyzed period showed an increase in performance of Rosnedra by up to 36%.

A direct impact on the efficiency of FEB was made by a significant growth of performance indicators for such groups as the publication activity and small innovative enterprises (Minobrnauki), the patent and publication activity (Minsport and Rosnedra), financial performance (in terms of increasing the share of extra-budgetary resources, Minobrnauki, Minsport, Rosnedra).

However, the Rosstandard's 2.3 time RTD expenditure increase led to an increase in productivity of only 11%, while Minenergo's performance decreased by 8% with a cost increase of 43%. Perhaps this is due to the implementation of long-term research projects. Analysis of this fact requires a more detailed study of FEB activities.

Summary

The main task of the FEB in the short term is to create a pool of technology ready for practical application. The effectiveness of R&D expenditure is directly dependent on the measures taken by the FEB as an investor / regulator to promote the introduction and use of technology. In the medium term, the FEB needs to focus on creating infrastructure for the development of new knowledge-based industries. In the long term, it should concentrate on the formation of a fundamental basis for the development of new industries, as well as the knowledge economy. By partially financing the cost of RTD, the government increases the attractiveness of the sector for business. Taking into account an advanced foreign experience and existing target indicators for the strategic development of the RTD sector, the following percentages of cost by the state and business is offered: in the short term it should aim for a 30% government participation and a 70% real sector participation; in the medium term it should aim for a 70% and 30% balance, respectively. For the long term, basic research funding should be carried out mainly by the state. The pursuit of such a ratio will provide an optimal effective interaction between the state and business in the development of an innovative economy. It is necessary to conduct periodic comprehensive assessments of the effectiveness of public RTD expenditure via the monitoring of the effectiveness of public incentives for RTD and innovation activities in order to work out timely management decisions. The results of the monitoring will allow observers to evaluate the

efficiency of public expenditure on RTD as a whole, to identify barriers to the planned development of the budget, and to determine the direction of activities that require additional stimulation in order to achieve the socio-economic goals and objectives of the state.

Translated by Irina Ilina and Aleksandr Borodin
Proofreading by Michael Thoene

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GUIDELINES FOR TEXT PREPARATION FOR THE
"OLSZTYN ECONOMIC JOURNAL"

The "Olsztyn Economic Journal" (ISSN 1897–2721) is a scientific magazine published in English at the Faculty of Economic Sciences of the University of Warmia and Mazury in Olsztyn. During the years 2007–2012 the magazine was published semi-annually and as of 2013 it was transformed into a quarterly. It publishes scientific papers of methodical, review and empirical nature in economic sciences. The Olsztyn Economic Journal is published by the University of Warmia and Mazury in Olsztyn Publishing House. The printed format is the primary form of the magazine. Additionally, all numbers of the magazine are available also in the electronic format on the website: http://www.uwm.edu.pl/wne/oej.php, http://wydawnictwo.uwm.edu.pl (subpage Czytelnia).

„Olsztyn Economic Journal" is indexed in the following reference databases: BazEcon, BazHum, Index Copernicus Master List (ICV in 2015 74.19 pts), The Central European Journal of Social Sciences Humanities (CEJSH), Central and Eastern European Online Library (CEEOL).

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After receiving the review, the author shall send to the editor:

1) a copy of the paper with the reviewer's comments,

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1) At least two independent reviewers from outside the scientific unit affiliated by the publication author are appointed for evaluation of every publication.

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Tomczyk Z. 1996. *Wynalazczość i racjonalizacja źródłem postępu technicznego*. Gosp. Narod., 6: 21–25.

Unpublished papers: Malicki K. 1990. *Ubój świń. Instytut Żywienia Zwierząt ART*, Olsztyn (typewritten text). Kowalski H. 1992. *Wychów cieląt. Katedra Hodowli Bydła ART*, Olsztyn (doctoral dissertation).

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