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# KNOWLEDGE ECONOMY POLICY IN POLISH REGIONS*

**Abstract**: The aim of this paper is twofold. The first is to examine the level of the development of knowledge economy in Polish regions (NUTS 2 units, voivodeships). In order to assess the advances in building the knowledge economy in regions, the composite indicator for years 2003-2008 is constructed with the use of the Hellwig method based on creation of an abstract model. The second purpose is to analyse the regional authorities' policies directed towards supporting the pillars underlying the knowledge economy. To fulfil this aim first of all the funds of intraregional policy directed towards supporting the knowledge economy pillars will be assessed. Then the correlation between the level of development of knowledge-based economy and the share of expenditures of intraregional policies to reinforce the development of knowledge economy pillars will be calculated.
**Key words**: Regions based on knowledge, regional policy.

## Introduction

Although knowledge was an important factor for socio-economic development at any time during the development of human civilization, the idea of knowledge-based economy has become especially popular in the scientific community and the idea of the supporting its development has gained recognition among policy makers since the 90. of the previous century. This is in part related to the flowering of research on long-term factors of economic growth, beginning in the late 80s with the works of Romer [1986, 1990] and Lucas [1988] now belonging to the endogenous growth theory. The representatives of this trend, treating knowledge as an endogenous factor, have impact on economic development through mechanisms such as investment in human capital, skills, human capital, research and development or public infrastructure.

One major problem, which is associated with the concept of knowledge-based economy is the level of spatial differentiation of socio-economic development. The question whether the development of ICT and the activities of multinational corpora-

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tions promoting the spread of knowledge, leads to the end of economic geography (as distance does not matter), whether the development is local (because knowledge does not spread globally, and innovation, seen as a process resulting from institutional systems and social customs, are strongly associated with the location) is still valid and is the subject of many studies. In recent times there has been renewed interest in the region as a place of organization of economic life and the subject of economic policy. Regionalization, defined as economic activity dependent on resource-specific location, has become a popular trend [Storper 1997].

As a result of the claim that production, absorption and dissemination of knowledge is the key factor of competitiveness and development on macro-, mezo- and micro-level, public policies supporting science, technology and innovation are numerous in many countries. The necessity of government involvement in promoting the development of the knowledge economy is justified by the market failure such as: knowledge as a public good, high external benefits associated with the formation and spread of knowledge, the high risks associated with conducting research and development activities. It is also recognized that the state should provide the infrastructure, which will support the net of relationship and collaboration between research units and business [Lissowska 2007]. The program of the Lisbon European Council (Lisbon Strategy), whose aim was to create the most competitive knowledge economy, was one of the most important strategies which influenced the policy in the European Union, especially on the regional level. It is also stressed that the convergence with EU's strongest competitors in the era of globalisation requires the involvement of local and regional actors (government, research institutions, clusters of enterprises, innovative businesses, skilled work force) and restructuring the regions into knowledge economies [*European Commission* 2007].

The aim of this paper is twofold. The first is to examine the level of development of knowledge economy in Polish regions (NUTS 2 units, voivodeships). In order to assess the advances in building the knowledge economy in regions, the composite indicator for years 2003-2008 is constructed with the use of the Hellwig method based on creation of an abstract model. The second purpose is to analyse the regional authorities' policies directed towards supporting the pillars underlying the knowledge economy. To fulfil this aim, the funds of intraregional policy directed towards supporting the knowledge economy pillars will be assessed in the first place. Then the correlation between the level of development of knowledge-based economy and the share of expenditures of intraregional policies to reinforce the development of knowledge economy pillars will be calculated.

## 1. The definition of the regions based on knowledge

Although the term knowledge-based economy is widely used, it does not have a universal definition or methods of measurement. In the narrow sense, the knowledge economy is identified only with industries and services of high technology, which corresponds to the definition of Machlup's [1962] „sectors of knowledge economy" (*e.g.* OECD defines knowledge-based economy which is measured as a set of high-tech industries and sectors of skilled labour). This notion of knowledge-based economy is often confronted by criticism, pointing to the fact that the sectors considered to be low technology sectors can use knowledge intensive Smith [2002], for example, shows the high intensity of the use of knowledge by the food processing sector, considered as low technology industries). In a broader sense, the knowledge economy is perceived as a structure connecting a subsystem of knowledge creation (*e.g.* laboratories) with a subsystem of knowledge using (formed by companies, hospitals, *etc.*) [Cooke, Leydesdorff 2006]. One of the institutions which use a broader definition of KBE is the World Bank. It created the methodology named KAM (Knowledge Assessment Methodology), according to which knowledge-based economy is defined as "one that utilizes knowledge as the key engine of economic growth. It is an economy where knowledge is acquired, created, disseminated and used effectively to enhance economic development". Knowledge economy is based on four pillars, which constitute the Knowledge Economy framework:

- an economic and institutional regime that provides incentives for the efficient use of existing and new knowledge, and the flourishing of entrepreneurship;
- an educated and skilled population that can create, share, and use knowledge well;
- an efficient innovation system of firms, research centres, universities, think tanks, consultants, and other organizations that can tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new technology;
- information and Communication Technologies (ICT) that can facilitate the effective communication, dissemination, and processing of information.

The definition and methodology of the World Bank is a starting point for the methodology of assessing the level of development of regions based on knowledge in Poland in this paper. Three pillars of the knowledge economy in Polish voivodeships (NUTS 2 units) will be analysed, namely: education and human capital, innovation system, and information and communication system. In this analysis of the regions as knowledge-based economies it is assumed that the system of economic incentives and institutional regime, identified as one of the pillars of knowledge-based economy by the World Bank, is similar in all provinces, so it is not taken into account[1].

## 2. The level of development of knowledge economy in Polish regions

This part of the paper will be devoted to examination of the level of knowledge economy development in Polish regions (voivodeships). In order to assess the

[1] It would be of great importance and should be taken into account when comparisons is made with regions in other countries.

advances in building the knowledge economy in regions, the composite indicator for years 2003-2008 is constructed.

The method of measuring the development of regional economies as knowledge economies in Poland has three stages.

1. Selection of variables describing the three pillars (components) of KBE in regions: education and human capital (EiKL), innovation system (IS) and information and communication system (ICT) in terms of content – formal criteria.
2. Statistical analysis of variables describing the three pillars of the knowledge-based economy: the elimination of variables with low volatility and those highly correlated, which allows for use in further analysis of only those variables that hold the highest-value information.
3. Creation of sub-indices (partial indices) for the three pillars of KBE (Hellwig standard method) and the overall index (ROW) as an arithmetic mean of three sub-indices.

The first stage of this analysis is the selection of variables describing the knowledge economy. This choice depends on the definition of the knowledge economy. As already mentioned, the methodology of the World Bank is used in this paper to describe the KBE. The choice of diagnostic variables must arise from a clear merit connection with the qualitative phenomenon, which is the subject of study. The selection of diagnostic variables requires their content – formal analysis, which takes into account the generally accepted criteria, such as, according to Zeliaś [2000, pp. 37-38]:

1. Universality – variables should have recognized importance and significance.
2. Measurability – variables should be possible to measure directly or indirectly.

Table 1

The characteristics describing the pillars of the knowledge economy in Polish regions

| Education and Human Capital (E&HC) | | | |
|---|---|---|---|
| 1 | Students of high schools per 1000 people | 12 | Net education ratio for primary schools |
| 2 | Graduates of high schools per 1000 people | 13 | Net education ratio for lower secondary schools |
| 3 | Students of high technical schools per 1000 people | 14 | 6th Grade Achievements |
| 4 | Graduates of high technical schools per 1000 people | 15 | Gymnasium students achievement in Humanities |
| 5 | Computer Science students per 1000 people | 16 | Gymnasium students achievement in Math |
| 6 | Computer Science graduates per 1000 people | 17 | Achievements in maturity examination |
| 7 | Academic teachers per 1000 people | 18 | Life-long learning |
| 8 | Academic teachers of technical high schools per 1000 people | 19 | International migrations for permanent residence |
| | | 20 | InterVoivodship migrations per 1000 people |
| 9 | Postgraduate students per 10 000 people | 21 | R&D Workers per 1000 of the Active Labor Force |
| 10 | Phd students per 10 000 people | 22 | *Unemployment Rate* |
| 11 | School graduates receiving certificate of secondary education per 1000 people | 23 | Labour Activity Rate |
| | | 24 | Share of population > 15, with tertiary education |

| | | | |
|---|---|---|---|
| Innovation system (IS**)** | | | |
| 25 | Higher education institutions (total) | 35 | The share of Industrial enterprises, which introduced innovation |
| 26 | Investments outlays *per capita* | | |
| 27 | Private investments outlays *per capita* | 36 | Average expenditures for one enterprise with innovation activity in thous. zl.(current prices) |
| 28 | Gross Capital *per capita* | | |
| 29 | Research-development activity number of units | 37 | Means for automating production processes in the industrial enterprises in units per 1 000 companies |
| 30 | Research-development activity, number of enterprises | | |
| 31 | Total Expenditure on R&D *per capita* | 38 | Foreign capital *per capita* |
| 32 | Total Expenditure for R&D as % of GDP | 39 | Number of companies with foreign capital per 1000 people |
| 33 | Total expenditures on innovation activity *per capita* | | |
| 34 | Intramural expenditures on innovation activity *per capita* | 40 | Inventions patent applications per 1 mln people |
| | | 41 | Inventions patents granted per 1 mln people |
| ICT system (ICT) | | | |
| 42 | Households with personal computers (as % of total) | 50 | *Pupils of lower secondary schools (gymnasium) per one computer* |
| 43 | Households with personal computers with access to internet(as a % of total) | | |
| | | 51 | Enterprises with Local Area Network (LAN) |
| 44 | Households with mobile phones (as a % of total) | 52 | Internet users (companies) |
| 45 | Telephones per 1,000 people | 53 | Intranet users (companies) |
| 46 | Cable television subscribers per 100 people | 54 | Share of companies with own www site |
| 47 | Percentage of primary schools equipped with computers | 55 | Share of enterprises using the Internet in dealing with the public |
| 48 | Percentage of lower secondary schools (gymnasium) equipped with computers | 56 | Share of enterprises receiving orders via computer networks |
| 49 | *Pupils of primary school per one computer* | 57 | Share of enterprises placing orders via computer networks |

Source: Own elaboration (Tables 1-5).

3. The availability of the figures – the possibility of collecting all figures.
4. Quality of data – whether data collection is not burdened with large random errors.
5. Economic efficiency – high cost of acquiring the data should lead to minimizing the data set.
6. Possibility to interpret – condition for the selection of such variables that have a high substantive value, which means that they are consistent with the traditions of research and have clearly established interpretation.
7. The impact of variables – whether the variables are stimuli or destimuli.

Table 1 is used to present the set of characteristic which are proposed to be used for measuring the level of knowledge economy development.

All variables meet the above mentioned criteria. The cost of acquisition of variables describing the KBE for voivodeships is relatively small (the criterion of economic efficiency), most of them are in fact published on the Central Statistical Office (CSO) website. These data are available for the years 2003-2008 (the criterion of availability), the most in absolute terms, but can easily be expressed as relative and real values in order to eliminate the change of the money value in the period of time (the criterion of measurability). Most of them are stimuli, namely the higher value indicates the higher degree of development (only three variables are destimuli, marked with italics). It can also be stated that these data are reliable, because CSO collects them on the basis of international standards (mainly according to the recommendation of OECD and EUROSTAT, concluded in a series of textbooks called *Frascati Family Manuals*). They are also commonly used both in academic studies and in statistical studies created for various purposes (such as KAM or Australian Bureau of Statistics)[2].

Selected real characteristics, describing the pillars of KBE in regions, were afterwards a subject of statistical analysis. This analysis was performed in three steps. The first step was to calculate the coefficient of variation for variables. The purpose of this procedure was to eliminate variables with low levels of differentiation (so-called quasi-fixed variables). The coefficient of variation was calculated for each variable in the years 2003-2008, according to Formula 1:

Formula 1

$$CV = \frac{s}{\bar{x}}$$

where:

$s$ – is the standard deviation of the population,

$\bar{x}$ – arithmetic mean of the features in a given year.

In Table 2 the rejected variables are presented, for which the average coefficient of variation (arithmetic mean for the years 2003-2008) was less than 0.1.

The variables characterizing the economic phenomenon as complex as the level of knowledge-based economy are closely linked in varying degrees, which means that they convey similar information. The task of the next step is to determine the diagnostic features to separate attributes, representative for each group of variables (in this case: education and human capital, innovation system and technical infrastructure). The set of all variables is divided into groups in such a way that [Zeliaś 2000, p 41]:

- in the same group there are variables, which carry similar information,
- in different groups there are variables, which carry various information.

The selection of variables representing the characteristics of each group is based on the parametric method of Hellwig [Hellwig 1981; Zeliaś 2000]. After applying this method the clusters of variables are obtained that can be a set with many elements (the central variable and at least one satellite variable) or a set with one element (so-called isolated variable). The algorithm of this method can be described in the following steps:

[2] More detailed content – formal analysis of variables was a subject of the other author's study: [Sokołowska-Woźniak 2010).

Table 2

Variables rejected (for which the average coefficient of variation is less than 0.1

| Pillar | Variable | Variable symbol | The value of the mean coefficient of variation (in %) |
|---|---|---|---|
| E&HC | Net education ratio for primary schools | v12 | 1.43 |
| E&HC | Net education ratio for lower secondary schools | v13 | 1.63 |
| E&HC | 6th Grade Achievements | v14 | 2.08 |
| E&HC | Gymnasium students achievement in Humanities | v15 | 3.21 |
| E&HC | Gymnasium students achievement in Math | v16 | 3.80 |
| E&HC | Achievements in maturity examination | v17 | 3.26 |
| E&HC | Labour Activity Rate | v23 | 3.63 |
| ICT | Households with personal computers (as % of total) | v42 | 9.53 |
| ICT | Households with mobile phones (as a % of total) | V44 | 6.86 |
| ICT | Percentage of primary schools equipped with computers | V47 | 6.05 |
| ICT | Percentage of lower secondary schools (gymnasium) equipped with computers | V48 | 4.66 |
| ICT | Pupils of lower secondary schools (gymnasium) per one computer | V50 | 8.81 |
| ICT | Enterprises with Local Area Network (LAN) | V51 | 7.76 |
| ICT | Internet users (companies) | V52 | 2.92 |
| ICT | Share of enterprises using the Internet in dealing with the public | V55 | 7.70 |

1. A matrix of linear correlation coefficients R between the variables of the group for voivodeships is prepared:

Formula 2

$$R = \begin{bmatrix} 1 & r_{12} & \dots & r_{1k} \\ r_{21} & 1 & \dots & r_{2k} \\ \dots & \dots & \dots & \dots \\ r_{k1} & r_{k2} & \dots & 1 \end{bmatrix}$$

where:

$r_{ij}$ means linear correlation coefficient between variable $V_i$ and variable $V_j$ ($i, j = 1, \dots, k; i \neq j$).

2. The sum of the elements of each column $R_j$ is calculated:

Formula 3

$$R_j = \sum_{i=1}^{k} |r_{ij}|$$

3. A column $s$ is identified, for which:

Formula 4

$$R_s = \max_j (R_j)$$

4. From the column *s* elements $r_{is}$ are selected, which satisfy the inequality:

Formula 5

$$|r_{is}| \geq r^*$$

where: r* is the threshold value of the correlation coefficient determined by the equation 6 [Nowak 1990; cited in Zeliaś 2000, p. 131]:

Formula 6

$$r^* = \min_i \max_j |r_{ij}|$$

Variable from the column ***s*** are considered to be the central variable, the variables for which the inequality exists are called satellite variables.

5. The matrix R is reduced by crossing out the designated central and satellite variables (crossing out rows and columns).
6. The procedure described in steps 1-5 is repeated until exhaustion set of variables. The Table 3 shows the results of the calculations.

Table 3

Designation of central and isolated variables for the three pillars of KBE

| Pillar of KBE | Year | Value r* | Central variable | Satellite variables |
|---|---|---|---|---|
| Education and Human Capital (E&HL) | 2003 | 0.44 | V21, V5, V4 | V11, V19, V22 |
| | 2004 | 0.44 | V1, V5, V11 | V19 |
| | 2005 | 0.49 | V1, V5, V22 | - |
| | 2006 | 0.48 | V1, V6, V22 | - |
| | 2007 | 0.30 | V1, V11 | V6 |
| | 2008 | 0.39 | V1, V11 | V6 |
| Innovation System (SI) | 2003 | 0.52 | V29 | V35, V37 |
| | 2004 | 0.44 | V25, V37 | - |
| | 2005 | 0.50 | V29, V37 | - |
| | 2006 | 0.41 | V29 | V35, V37 |
| | 2007 | 0.66 | V30, V37 | V39 |
| | 2008 | 0.39 | V30 | V35, V37 |
| Information and Communication System (ICT) | 2003 | 0.36 | V56 | V49, V53 |
| | 2004 | 0.36 | V56 | V53, V54 |
| | 2005 | 0.36 | V56 | V43, V53 |
| | 2006 | 0.57 | V45 | V43, V53, V54 |
| | 2007 | 0.44 | V43 | V53 |
| | 2008 | 0.65 | V54, V49, V57 | - |

r* is the threshold value of the correlation coefficient determined by the equation 6.

In the last step the value of the coefficient of skewness has been taken into account. It was noted that the direction of the asymmetry factor was maintained throughout the period. Based on the coefficient of skewness no variable was eliminated. Table 4 presents the 15 variables, which ultimately were used to construct the index.

Table 4

The final list of diagnostic variables, used to construct the index

| Variable symbol | Variables representing the Education and Human Capital |
|---|---|
| V 1 | Students of high schools per 1000 people |
| V 5 | Computer Science students per 1000 people |
| V 6 | Computer Science graduates per 1000 people |
| V 11 | School graduates receiving certificate of secondary education per 1000 people |
| V 19 | International migrations for permanent residence |
| V 22 | Unemployment Rate |
| | Variables representing the innovation system |
| V 29 | Research-development activity number of units |
| V 30 | Research-development activity, number of enterprises |
| V 35 | The share of Industrial enterprises, which introduced innovation |
| V 37 | Means for automating production processes in the industrial enterprises in units/ 1 000 companies |
| | Variables representing the ICT system |
| V 43 | Households with personal computers with access to internet(as a % of total) |
| V 49 | Pupils of primary school per one computer |
| V 53 | Intranet users (companies) |
| V 54 | Share of companies with own www site |
| V 56 | Share of enterprises receiving orders via computer networks |

To construct the index, the Hellwig method [Hellwig 1968], based on the creation of an abstract unit Po – called a model unit – was used. A model unit can be a real object (region), if characterised by the best values of all variables. This method can be shortly described by the following steps:

a) Variables are classified as stimuli and destimuli, there are two destimuli (*Unemployment rate* and *Pupils of primary school per one computer*).The destimuli were changed into stimuli in accordance with the Formula 7 [Kolenda 2006]:

Formula7

$$z_i = 2\bar{x} - x_i$$

b) Standardization of variables (in order to eliminate the impact of the units of measurement) with the Formula 8:

Formula 8

$$Z_{ik} = \frac{x_{ik} - \overline{x}_k}{S_k}$$

where:
$Z_{ik}$ – standardized value of *k* features in the unit *i*
$x_{ik}$ – absolute value of *k* features in the unit *i*
$\overline{x}_k$ – the arithmetic mean of the k features
$S_k$ – standard deviation of k feature

c) The model unit (Po) is created, an object with highest values for stimuli (in this case models for the three systems KBE):

Formula 9

$$Z_{ok} = \max Z_{ik}$$

d) The Euclideal distances between model unit (Po) and other objects (regions) are calculated using Formula 10:

Formula 10

$$C_{io} = \sqrt{\sum_{k=1}^{k} (Z_{ik} - Z_{ok})^2}, \qquad (\mathrm{i} = 1, 2, 3, \ldots, \mathrm{N})$$

where:
$Z_{ik}$, $Z_{ok}$ – standardized value of k features in the unit i

e) The relative taxonomic development index is created, on the base of the Formula 11:

Formula 11

$$D_i = 1 - \frac{c_{io}}{c_0}, \qquad (i = 1, 2, 3, \ldots, \mathrm{N})$$

where:
$C_{io}$ Euclideal distances

$$c_o = \overline{c} + 3S_o:$$

$\overline{c}_o, S_o$ – arithmetic average, standard deviation in the sequence $\{c_{io}\}$ ($i$=1, 2, 3, …, $n$):

$$\overline{c}_o = \frac{1}{N}\sum_{i-1}^{N} c_{io} \qquad S_o = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(c_{io} - \overline{c}_o)^2}$$

This synthetic index of development $D_i$ takes the values from 0 to 1[3]. The closer the value of $D_i$ to 1, the smaller the distance of the object from the model and the higher level of development is.

[3] The probability for the value to be below zero is very small.

Table 5

The classification of the voivodeships in 2008 on the basis of ROW
(numbers in parentheses indicate the place of a region in a given year)

| | Voivodeship | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|
| 1 | Mazowieckie | (1) 0.495 | (1) 0.543 | (1) 0.575 | (1) 0.583 | (1) 0.551 | 0.519 |
| 2 | Małopolskie | (4) 0.338 | (4) 0.389 | (3) 0.464 | (5) 0.433 | (3) 0.458 | 0.420 |
| 3 | Dolnośląskie | (5) 0.294 | (6) 0.355 | (5) 0.423 | (3) 0.447 | (4) 0.431 | 0.418 |
| 4 | Śląskie | (3) 0.361 | (2) 0.441 | (2) 0.509 | (2) 0.455 | (2) 0.464 | 0.415 |
| 5 | Łódzkie | (2) 0.370 | (3) 0.420 | (4) 0.449 | (4) 0.443 | (5) 0.423 | 0.381 |
| 6 | Wielkopolskie | (12) 0.264 | (8) 0.337 | (8) 0.397 | (7) 0.383 | (8) 0.365 | 0.365 |
| 7 | Pomorskie | (8) 0.283 | (10) 0.325 | (9) 0.369 | (9) 0.369 | (7) 0.366 | 0.344 |
| 8 | Podkarpackie | (7) 0.291 | (7) 0.348 | (6) 0.413 | (8) 0.370 | (6) 0.379 | 0.339 |
| 9 | Podlaskie | (6) 0.294 | (5) 0.371 | (7) 0.406 | (6) 0.389 | (9) 0.346 | 0.316 |
| 10 | Kujawsko-Pomorskie | (13) 0.261 | (13) 0.285 | (16) 0.324 | (15) 0.300 | (10) 0.342 | 0.274 |
| 11 | Opolskie | (16) 0.193 | (15) 0.272 | (14) 0.341 | (16) 0.289 | (12) 0.298 | 0.271 |
| 12 | Lubelskie | (14) 0.243 | (14) 0.278 | (13) 0.343 | (11) 0.324 | (11) 0.303 | 0.249 |
| 13 | Zachodniopomorskie | (11) 0.269 | (9) 0.327 | (12) 0.346 | (12) 0.324 | (15) 0.284 | 0.245 |
| 14 | Warmińsko-Mazurskie | (10) 0.271 | (11) 0.304 | (11) 0.352 | (10) 0.325 | (14) 0.292 | 0.239 |
| 15 | Świętokrzyskie | (15) 0.228 | (16) 0.262 | (15) 0.325 | (14) 0.315 | (16) 0.266 | 0.236 |
| 16 | Lubuskie | (9) 0.276 | (12) 0.295 | (10) 0.354 | (13) 0.319 | (13) 0.294 | 0.217 |

f) The creation of the overall synthetic index (ROW) in the regions as the arithmetic mean of three sub-indices pillars of knowledge based economy.

The overall synthetic index of the knowledge-based economy in regions (ROW) is calculated as the arithmetic mean of three indices of knowledge economy pillars. It should be emphasized that the above calculations take into account the values of variables in all years together, which enables comparison the growth rate during the time period.

Table 5 presents the values of the overall index of KBE in regions (ROW), calculated as described in the previous paragraphs for the Polish regions in the years 2003-2008. Regions are ranked according to the classification in 2008.

The best results in the transformation into knowledge-based regions, throughout the period, were found in Mazowieckie Voivodeship. The second position in 2008 is occupied by the Małopolskie, which throughout the whole period occupied high positions in the ranking (lowest – fifth); similar description can be applied to Dolnośląskie (Lower Silesia), occupying the third position (lowest – sixth). The worst performers in this regard are Lubuskie, Świętokrzyskie and Warmińśko-Mazurskie. It seems that there is a positive correlation between ROW and the level of economic development but further calculations should be carried out to prove this statement.

## 3. The policies to develop knowledge economy in Polish regions

In this part of the paper the regional authorities' policies directed towards supporting the pillars underlying the knowledge economy will be presented.

As it was mentioned in the introduction it is commonly agreed that the government should become involved in promoting the development of the knowledge economy due to several market failures. This idea proclaimed by the economist is implemented by politicians through various policies on different economic levels. The policy objective to support the development of knowledge-based economy by increasing investment in science, research and development, innovation, education, infrastructure supporting the flow of knowledge (codified), and information is one of the most important objectives in most of the countries or communities. At the level of the European Union policy, the Lisbon Strategy (LS), which indicated the goal of creating „the most competitive and dynamic knowledge-based economy by 2010" was the most influential one. Also in the renewed Lisbon Strategy, whose main objective is growth and employment, the priority activities include the promotion of knowledge, innovation and human capital. LS assumptions are reflected in the EU policy-making at various levels in the current programming period 2007-2013. The use of the funds of the regional policy (which accounts to one-third of the EU budget – around EUR 350 billion in the 2007-2012 programming period) is also largely focused on the objectives of the renewed Lisbon Strategy, including support for the knowledge economy in a broad sense. In December 2005, the Council decided that some of the funds allocated to the cohesion policy programs was reserved for investments related to the objectives of the renewed Lisbon Strategy, in particular for research, innovation, information society, human capital and business development (specifically: 60% for less-developed regions and 75 % for the other regions, 1083/2006, p. 25). Countries that joined the EU on 1 May 2004 and after that date are not required to fulfil these requirements but most of them dedicated considerable amount of funds on these issues (Poland among them).

In this paper only funds of intraregional policy in Poland will be discussed. Regional operational programs are designed and managed by the regional authorities. They represent a kind of bridge between the development strategies of regions and the objectives of cohesion policy as outlined in the national and EU level. Due to the volume of funds involved, the Regional Operational Programs (ROPs) can be regarded as the most important policy instrument of intraregional policy in Poland. The funds of regional component of the Human Capital Operational Programme (OPHC) can also be perceived as such an instrument.

One of the most important documents identifying the strategic priorities of the country and the implementation of cohesion policy are the National Strategic Reference Framework (NSRF). Each member country was obliged to prepare such a document,

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based on Community Strategic Guidelines, (this follows from Council Regulation No. 1083/2006 of 11 July 2006). To support the realisation of the objectives of cohesion policy (Convergence and European Territorial Cooperation) in Poland the sum of EUR 67 billion[4] was envisaged in the NSRF from the European Regional Development Fund (ERDF) (52%), European Social Fund (ESF) (15%) and the Cohesion Fund (CF) (33%). These amounts do not include national funds (estimated at EUR 11.9 billion) and private (estimated at EUR 6.4 billion). Table 6 presents the breakdown of the NSRF into specific operational programs with the percentage of funds dedicated for Lisbon strategy goals. The biggest part is planned to be allocated to the Infrastructure and Environment (42%). The second portion of funds will be dedicated to support the realisation of 16 regional operational programs (discussed in this section). The support provided for the human capital accounts to 15% of funds (regional component consists of 60% of that sum) and for innovation – 12%. Poland's NSRF includes a significant commitment to the Lisbon Strategy for jobs and growth (64% directly to support the Lisbon Strategy goals).

In the further analysis of intraregional policy and its support to develop knowledge-based economy, the following assumptions should be made:

- intraregional policy is characterized by the spending (supported with EU funds) within the general framework of regional operational programs and the regional component of the operational program Human Capital;
- policy – related data were based on the indicative breakdown of funds from the EU budget (which does not include the national share), it was subjectively suggested which measures are related to building a knowledge-based economy;
- it is assumed that policy characterized in this way is an independent policy of regional government (of the voivodeships) in compliance with regional development strategies. It should be remembered in this place that there are many restrictions out on local government decisions arising from the EU and national planning procedures and disbursement of EU funds (the guidelines of the capacities of each

Table 6

The breakdown of National Strategic Reference Framework funds in Poland

| OP | Community contribution | | "Earmarking" | |
|---|---|---|---|---|
| | total | % of funds | Lisbon earmarking | in % |
| OP Innovative Economy | 8,254,885,280 | 12.0 | 7,831,882,929 | 95.0 |
| OP Human capital | 9,707,176,000 | 15.0 | 8,036,029,819 | 83.0 |
| OP Infrastructure and Environment | 27,913,683,774 | 42.0 | 18,616,256,995 | 83.0 |
| OP Development of Eastern Poland | 2,273,793,750 | 3.0 | 1,000,013,523 | 44.0 |
| 16 Regional OPs | 16,555,614,188 | 25.0 | 7,026,917,404 | 42.0 |
| NSRF | 66,553,157,091 | 100.0 | 42,511,100,670 | 63.9 |

Source: *European Union Regional Policy* [2008].

[4] Poland was the largest beneficiary of Cohesion policy for this period.

disbursement of funds, the guidelines of the Minister to prepare a regional operational programs, the impact of government on the shape of the regional component of OP HC, and others).

In the last part of this paper the analysis of relationship between the indices characterizing knowledge-based economy and the share of expenditure to support knowledge-based economy in total expenditure under intraregional policy will be carried out.

It occurred to be quite a difficult task to separate expenditures directed to support the knowledge-based economy pillars from total expenditures. The procedure adopted was similar to that of specifying the „Lisbon" expenditure in politics. The category of intervenes defined in COMMISSION REGULATION (EC) No. 1828/2006 was a starting point. Although the Lisbon expenses often are associated with the promotion of knowledge-based economy, not all were taken into further analysis – only those that are designed to support the three pillars of the knowledge-based economy, in accordance with the knowledge economy definition used in this paper. The proposal to assign a category to the pillars of knowledge-based economy is as follows:

| | |
|---|---|
| Education and human capital: | 62, 63, 64, 65, 66, 67, 67, 68, 69, 70, 71, 72, 73, 74, 75 |
| Innovation system: | 1, 2, 3, 4, 5, 6, 7, 8, 9, 80 |
| ICT system: | 10, 11, 12, 13, 14, 15 |

In accordance with the accepted interpretation of expenditure on KBE, voivodeships decided to allocate in the years 2007-2013 on average 55% of intraregional policy funds (EUR 13 billion) and about EUR 360 *per capita* to support the pillars of the knowledge-based economy.

Figure 1 shows the share of intraregional policy expenditures directed to three pillars of KBE. 59% of the total sum is dedicated to the support of Education and human capital. 31% is planned to the innovation system support and the rest (10%) will be spent on fostering ICT system.

In Table 7, the total expenditures of intraregional policies to support the development on knowledge economy and its pillars in regions are compared. Most of

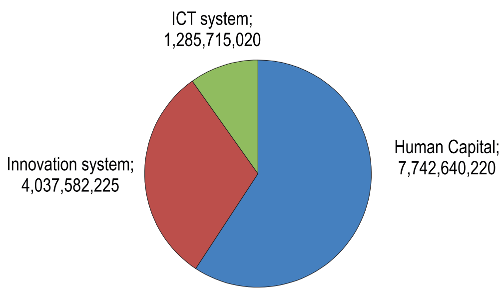


Figure 1. The division of intraregional policy means on three pillars of knowledge based economy
Source: Own elaboration.

the funds are allocated by Mazowieckie Voivodeship – more than EUR 1.6 billion (the largest recipient of funds), the least sum by Lubuskie and Opolskie (respectively EUR 342 million and EUR 348 million). Generally speaking, it seems that provinces, which have a higher rate of GDP in general allocate more funds for this purpose.

Figure 2 illustrates the relationship between the level of development of knowledge-based economy (the index for 2007 and the average for the years 2003-2008), and the share of expenditures of intraregional policies to support the development of knowledge economy pillars. To make reading the results easier, the lines representing average index for 2007 (the horizontal blue line) and the average (arithmetic mean) of expenditures share (the vertical black line) are shown, dividing the charts into four quadrants.

The analysis of the correlation between the share of expenditure on support of the knowledge economy pillars in the total expenditures of intraregional policy and the level knowledge-based economy (the rate for 2007 and the average for the years 2003-2008) suggest that although there is a positive factor, the correlation is not statistically significant (assuming the level of significance of $p < 0.05$). The regions with the highest level of ROW, are usually the regions with higher than average support of knowledge-based economy. More differences concern regions of low ROW. Some of

Table 7

The expenditures on the pillars of the knowledge based economy in each voivodeship (in EUR)

| Voivodeship | E&HC | % | IS | % | ICT | % | Total |
|---|---|---|---|---|---|---|---|
| Dolnośląskie | 572,709,558 | 57 | 308,454,516 | 31 | 120,050,314 | 12 | 1,001,214,388 |
| Kujawsko-Pomorskie | 451,715,328 | 59 | 255,992,827 | 33 | 57,060,229 | 7 | 764,768,384 |
| Lubelskie | 562,942,528 | 61 | 291,273,653 | 31 | 72,441,739 | 8 | 926,657,920 |
| Lubuskie | 209,613,286 | 61 | 94,630,216 | 28 | 37,320,713 | 11 | 341,564,215 |
| Łódzkie | 529,287,139 | 65 | 220,754,009 | 27 | 70,446,664 | 9 | 820,487,812 |
| Małopolskie | 648,141,682 | 62 | 324,478,129 | 31 | 75,032,884 | 7 | 1 047 652 695 |
| Mazowieckie | 974,249,455 | 60 | 439,409,605 | 27 | 205,127,627 | 13 | 1 618 786 687 |
| Opolskie | 189,690,378 | 53 | 142,516,494 | 40 | 25,628,689 | 7 | 357,835,561 |
| Podkarpackie | 488,925,646 | 58 | 266,116,324 | 31 | 94,804,434 | 11 | 849,846,404 |
| Podlaskie | 275,816,596 | 56 | 162,910,358 | 33 | 50,896,631 | 10 | 489,623,585 |
| Pomorskie | 398,768,436 | 63 | 189,592,806 | 30 | 40,270,492 | 6 | 628,631,734 |
| Śląskie | 802,788,173 | 58 | 384,038,005 | 28 | 200,867,100 | 14 | 1 387,693,278 |
| Świętokrzyskie | 326,338,069 | 60 | 184,609,295 | 34 | 29,025,782 | 5 | 539,973,146 |
| Warmińsko-Mazurskie | 332,964,090 | 53 | 238,273,077 | 38 | 62,192,522 | 10 | 633,429,689 |
| Wielkopolskie | 662,718,276 | 62 | 298,735,106 | 28 | 102,549,200 | 10 | 1,064,002,582 |
| Zachodniopomorskie | 315,971,582 | 53 | 235,797,803 | 40 | 42,000,000 | 7 | 593,769,385 |
| Total | 7,742,640,220 | 59 | 4,037,582,225 | 31 | 1,285,715,020 | 10 | 13,065,937,465 |

Source: Own elaboration.

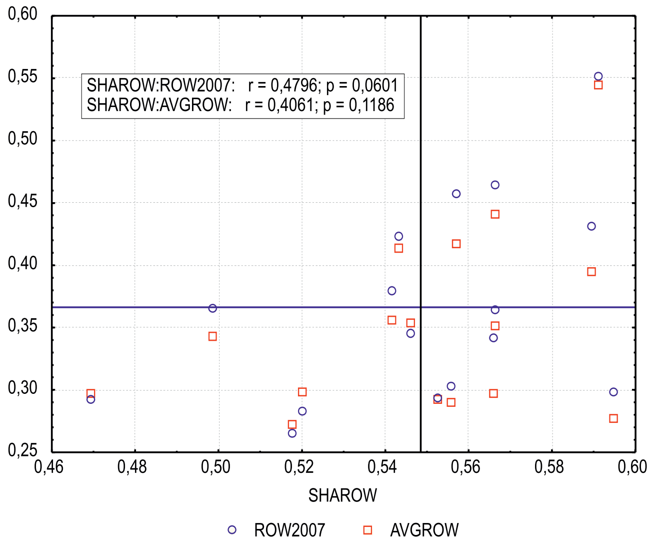


Figure 2. The relationship between the level of ROW development and share of expenditures to support the pillars of the KBE in total expenditures intraregional policy

Source: Own elaboration.

them opted for a relatively large support pillars of a knowledge-based economy with intraregional policy measures (*e.g.*, Opolskie, Lubelskie, Lubuskie), and some (such as Warmińsko-Mazurskie, or Pomorskie) are the regions with the lowest share of expenditures for this purpose.

## Conclusions

There are quite huge differences in the level of development of knowledge-based economies in Polish regions. The analysis based on hard statistical data does not identify a single standard policy in the allocation of these resources to support the development of knowledge-based economy pillars. You can not explicitly specify that the poorer regions are looking at investing in knowledge as a key engine of growth.

The proposed method of classification of the regions of knowledge can be used to organize regional authorities' mindset about the support of the knowledge-based economy. This is particularly important in view of the upcoming programming period, which will implement the Europe 2020 Strategy, in particular the „smart growth" pillar, based on knowledge and innovation. Currently in both scientific and political discussions, it is stressed that policies to promote knowledge and innovation should be diversified and adapted to meet the specific conditions and potential of the region [*ESPON* 2012]. At the same time the "one size fits all" approach is criticised (such as that all regions should target 3% spending on R&D).

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