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HUMAN CAPITAL IN THE RURAL AREAS OF EASTERN POLAND – CLASSIFICATION OF SPATIAL UNITS

Abstract: The aim of this paper is to present the spatial diversification of the human capital stock in the rural areas of Eastern Poland, including five voivodeships: Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-Mazurskie. These voivodeships, at the time of Poland's accession to the EU were the least developed regions in the whole Union and thus have been included in the Operational Programme Development of Eastern Poland. The classification of gminas (pl. of: *gmina* – the principal unit of territorial and administrative division in Poland) by the level of human capital has a synthesizing character.

The research has shown that the level of human capital in the rural areas of eastern Poland is not satisfying. These terrains diverge negatively from the average values in Poland. A superior level of human capital is related to a well-developed network of cities, transport infrastructure and non-agricultural function. Thus, the most favourable situation occurs in suburban gminas in areas of restructured economy sections.
Key words: Human capital, rural areas, spatial diversification, classification of spatial units.

Introduction

The turn of the 20th and 21st C. is a period of intense economic and structural changes related mostly to the intensification of the globalisation processes. The developing relations between economies, the growth of liberalisation and the integration of trade markets, the deregulation of capital flow, the reduction of communication and transport costs have changed conditions for business activity. The global economy leads to the globalisation of enterprises' activity, which is expressed *e.g.* in the moving of production to any place in the world [Stempkowicz 2007].

Immaterial development factors, such as the education of a population, the gain in importance in those new circumstances. Human capital, which is understood as a stock

of knowledge, skills and competence accumulated in the society [Łukasiewicz 2009], is the main factor of creating the competitive advantage of regions [Malecki 1987]. Human capital enables the development and functioning of the creative sector in the economy, formed by these types of activity whose significant part of the value added has an immaterial character [Lash, Urry 1994]. Only the creative fields, characterised by ample resources of information, the easiness of carrying it, the ability to gather and accumulate knowledge [Törnqvist 1983], distinguish themselves by a high growth rate. Human capital and creativity are important sources of socio-economic development, therein the emergence of new enterprises and the creation of workplaces [Florida 2005].

Usually metropolises and agglomerations are characterised by an ample stock of human capital and its adequate quality as well as the high share of the creative sector in the regional economies. The situation in rural areas, especially those peripherally located, looks worse in spite of the fact that these terrains are not isolated spatial structures. The process of their transformation takes place in the complex environment, which is formed by the introduced market rules and the appropriate instruments of direct and indirect influence applied within the economic policy [Zioło 2010]. As the cited author indicates, the role of the traditional production factors in the development of rural areas is the decreasing in favour of innovative ideas, adequately prepared by people, thanks to whom the offered products will become more competitive and will have a bigger value added.

In light of the above remarks, the aim of this paper is to present the spatial diversification of the human capital stock in the rural areas of Eastern Poland, including five voivodeships: Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-Mazurskie (Fig. 1). These voivodeships, at the time of Poland's accession to the EU were the least developed regions in the whole Union and thus have been included in the Operational Programme Development of Eastern Poland. Classification of gminas (pl. of: *gmina* – the principal unit of territorial and administrative division in Poland) by the level of human capital has a synthesizing character.

1. Measures and research methods

Five measures describing the educational attainment of the population have been adopted in order to analyse the level of human capital (Tab. 1). Analysis of the adopted measures has shown that they are not equally significant for the researched issues. Thus, the necessity has arisen to define the value of the weights. After the analysis of the information gathered in each measure and the initial statistical elaboration, weights have been assigned to the measures (Tab. 1).

It has been adopted in the paper that the percentage of people with a higher education is the most important measure of human capital. Such an education provides appropriate professional and social competence. The measure is significant due to the possibility of innovation absorption and creation.

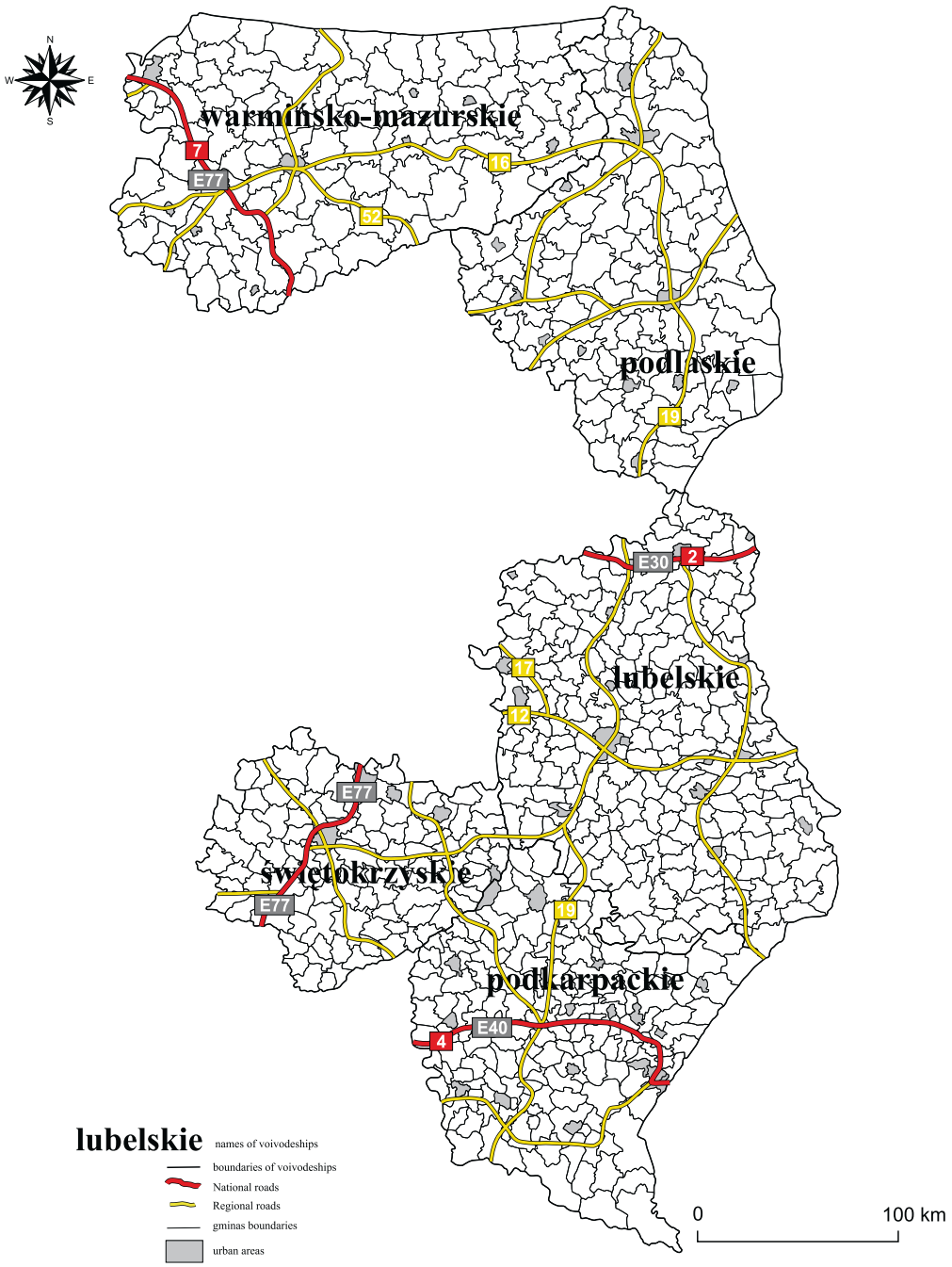

Fig. 1. Administrative division of Eastern Poland

Source: Own elaboration.

The percentage of people with a secondary and postsecondary education is another measure of human capital. It provides information about the society's ability to absorb (but not create) innovation. This measure is strongly correlated with the previous one (the correlation coefficient amounts to 0.759) but, due to its importance for the analysed phenomena, it has been adopted to the synthetic measure of human capital, however with a lower weight (0.1)[1].

The percentage of councillors with a higher education has been conceded as one of the most important indexes describing the quality of human capital in rural areas. It results from a few reasons. Firstly, the numerous competences of local governments related to the functioning of particular spatial units depend on the councillor's education [Ciok, Rabczyk 2006; Janc 2009]. Secondly, the councillors are selected in a common election – which gives a view of education's importance for the voters and thirdly – this data is current and accessible by gminas [Kamińska 2010].

Another measure – the percentage of farms operated by people with at least a secondary agricultural education – is strongly (negatively) correlated with the percentage of farms operated by people without an agricultural education (- 0.632). However, due to the fact that both the indexes characterise people strongly related with rural areas, not only by living there but also by work, a decision has been made to apply both the indexes in the general formula but to assign a lower weight to them: 0.2 and 0.1.

Table 1

Measures of the human capital and their weights

No.	Measure	Weight
1	The percentage of people with a higher education in the total number of people over 13 years of age	0.3
2	The percentage of people with a secondary education in the total number of people over 13 years of age	0.1
3	The percentage of councillors with a higher education	0.3
4	The percentage of farms operated by people with at least a secondary agricultural education	0.2
5	The percentage of farms operated by people without an agricultural education (destimulating factor)	0.1

Source: Own elaboration.

The taxonomic method of development model (TMD) has been applied in order to make the classification of gminas [Pociecha *at al*. 1988]. It defines the linear hierar-

[1] A similar operation was made in this type of research [Piech 2005; Kamińska 2010, 2011].

chy of the objects on the basis of their distance from the model object. The development model's co-ordinates have been defined on the basis of the maximum values of each feature observed in the whole set (in the rural areas of Eastern Poland).

The following formula has been applied in order to calculate the distance between each gmina and the development model:

$$C_{i0} = \sqrt{\sum_{j=1}^{k} (z_j - z_{0j})^2}$$

where:
C_{i0} – distance between gmina *i* and the development model
z_{ij} – value of *j*-th feature in *i*-th gmina after standardisation
z_{0j} – value of *j*-th feature in the model

The distance values have been adjusted by weight coefficients according to the formula:

$$C_{i0} = \sqrt{\sum_{j=1}^{k} m_i (z_j - z_{0j})^2}$$

where:
m_i – weight coefficient of the *i*-th feature
while:

$$\sum_{j=1}^{k} m_i = 1$$

Synthetic index d_i has been calculated in the further part:

$$d_i = \frac{C_{i0}}{C_o}$$

where:
d_i – measure of the *i*-th *gmina*'s level of development
$C_0 = \bar{C}_0 + 2S_0$
C_{i0} – gmina's distance from the model object $\bar{C}_0$
$\bar{C}_0$ – arithmetic mean of gmina's distance from the model object
S_0 – standard deviation of gmina's distance from the model object

The measure of development level d_i is a positive value from the interval from 0 to 1. 0 describes the model. The closer d_i gets to zero, the higher the level of develop-

ment of the gmina in terms of an adopted criterion. The shorter the distance between d_i and one, the lower level of development. Only in special cases measure d_i exceeds one. It happens when a given gmina drastically diverges from the remaining spatial units.

A classification of gminas has been made, by taking measure d_i as a criterion. Division into five classes, characterised by the diversified level of human capital, have been adopted:

very high – if $d_i \leq \overline{d_i} - 1{,}3Sd_i$

high – if $\overline{d_i} - 1{,}3Sd_i < d_i \leq \overline{d_i} - 0{,}4\ Sd_i$

medium – if $\overline{d_i} - 0{,}43Sd_i < d_i \leq \overline{d_i} + 0{,}4\ Sd_i$

low – if $\overline{d_i} + 0{,}4Sd_i < d_i \leq \overline{d_i} + 1{,}3\ Sd_i$

very low – if $d_i > \overline{d_i} + 1{,}3Sd_i$

Also cartographic methods have been applied in the paper.

2. The adult population's education in the rural areas of Eastern Poland – the spatial diversification of the measures

The percentage of people with a higher education in the rural areas of Eastern Poland amounted to 4.0% and was lower than the analogical index for the rural areas in Poland by 2.0%. The difference between the minimal (0.5%) and maximal (12.5%) value amounted to 12 pp. (Tab. 2).

In general, one can state that (Tabs. 2, 3):

1. The rural population is worse educated than the inhabitants of the cities. It concerns both Poland as a whole and Eastern Poland.

2. The most people with a higher education (in relation to the number of inhabitants) live in the Podkarpackie Voivodeship and the least in the Podlaskie and Warmińsko-Mazurskie Voivodeships.

3. In the four voivodeships of Eastern Poland (the Podkarpackie Voivodeship is an exception), the percentage of people with a higher education has not even reached a half of this measure's average for the voivodeships in general.

4. The biggest spatial disparities occur in the Warmińsko-Mazurskie Voivodeship. The difference between the extreme values amounts to 12 pp.

5. The relative balance between the percentage of inhabitants of the country (in relation to Poland) and the percentage of the rural population with a higher education exists in the Podkarpackie and Świętokrzyskie Voivodeships. The location quotient oscillates around one. The "deficiency" of people with university diplomas in relation to the general number of inhabitants is observed in the remaining regions. The biggest deficiency occurs in the Warmińsko-Mazurskie Voivodeship (location quotient 0.81) and the Podlaskie Voivodeship (0.86).

Table 2

The percentage of people with a higher education in the Eastern Poland voivodeships vs. Poland

Specification	Percentage of people with higher education in relation to the total number of adult inhabitants over 13 years of age			Number of people with higher education per 1000 inhabitants of the country	Percentage of the people with higher education in relation to the total number of inhabitants over 13 years old in the country	
	total	city	the country		minimal value	maximal value
Poland	10,1	13,6	4,2	34	0,5	17,2
Eastern Poland	9,0	14,0	4,0	32	0,5	12,5
There in voivodeships:						
Lubelskie	9,4	15,7	3,8	32	1,3	8,4
Podkarpackie	8,6	14,5	4,4	35	1,9	8,9
Podlaskie	9,3	13,3	3,5	28	1,1	9,6
Świętokrzyskie	9,2	14,9	4,2	35	1,6	7,9
Warmińsko-Mazurskie	8,5	11,7	3,5	28	0,5	12,5

Source: Own elaboration on the basis of data from Central Statistical Office (GUS).

Table 3

Rural population with a higher education in the voivodeships of Eastern Poland *vs.* Poland

Specification	Rural population (thous.)		Percentage of people in relation to Poland		Location quotient
	total	with higher education	living in the country	with higher education	
Lubelskie	1172,4	37,1	8,0	7,4	0,93
Podkarpackie	1253,4	44,4	8,6	8,9	1,04
Podlaskie	496,4	14,5	3,4	2,9	0,86
Świętokrzyskie	702,9	24,5	4,8	4,9	1,02
Warmińsko-Mazurskie	568,8	15,7	3,9	3,1	0,81
Eastern Poland	4193,9	136,2	28,6	27,3	0,95
Poland	14657,3	498,9	100,0	100,0	1,00

Sources: Own calculations on the basis of Regional Data Bank of Central Statistical Office.

The spatial layout of the percentage of people with a higher education indicates that it is highest in the neighbourhood of urban centres, whereas the bigger the city the more extensive the zone of a favourable education structure of the inhabitants (Fig. 2). Moreover, the analysed percentage is higher in the areas characterised by a domination of individual farming and a relatively high unemployment rate (the Podkarpackie and Świętokrzyskie Voivodeships). Thus, one can state that people decide to extend the period of education in those gminas where difficulties occur in the non-agricultural labour market. A similar situation is observed in the areas where education accounts as an important channel of leaving a job in family farming which is perceived by the young people as unattractive (*e.g.* neighbourhood of Suwałki, Hajnówka, Biała Podlaska, Chełm) [Rosner, Stanny 2007]. In turn, in the terrains where the State Agricultural Farms (PGR) and big farms are located (Warmińsko-Mazurskie, the northern part of the Podlaskie Voivodeship) there is a relatively small group of people (below the average for Eastern Poland) who have university diplomas. This is related to the fact that agriculture as a dominating sector has not been "exposed" to a well educated workforce. Even with low qualifications (or without them) one could find a job in the PGR.

The measures of education at secondary and postsecondary levels are better than in the case of higher education (Tab. 4). Every fifth adult inhabitant of the country in Poland and in Eastern Poland holds a secondary or postsecondary school diploma. The share of the rural population with secondary and postsecondary education accounts for 62-70% of the analogical index for each voivodeship.

Table 4

The percentage of people with secondary and postsecondary education in the voivodeships of Eastern Poland *vs*. Poland

Specification	Percentage of people with secondary and postsecondary education in relation to the total number of adult inhabitants over 13 years of age			Number of people with secondary and postsecondary education per 1000 inhabitants of the country	Percentage of the people with secondary and postsecondary education in relation to the total number of inhabitants over 13 years old in the country	
	total	city	the country		minimal value	maximal value
Poland	32,1	38,4	21,7	176	7,5	30,3
Eastern Poland	30,8	40,0	21,7	177	11,1	28,2
There in voivodeships:						
Lubelskie	31,2	41,6	21,9	181	11,7	35,7
Podkarpackie	31,0	41,3	23,8	192	14,9	33,0
Podlaskie	31,3	39,1	20,0	165	11,7	34,9
Świętokrzyskie	30,5	40,8	21,6	178	13,2	31,7
Warmińsko-Mazurskie	29,7	36,9	18,3	146	11,1	28,2

Source: Own elaboration on the basis of data from Central Statistical Office (GUS).

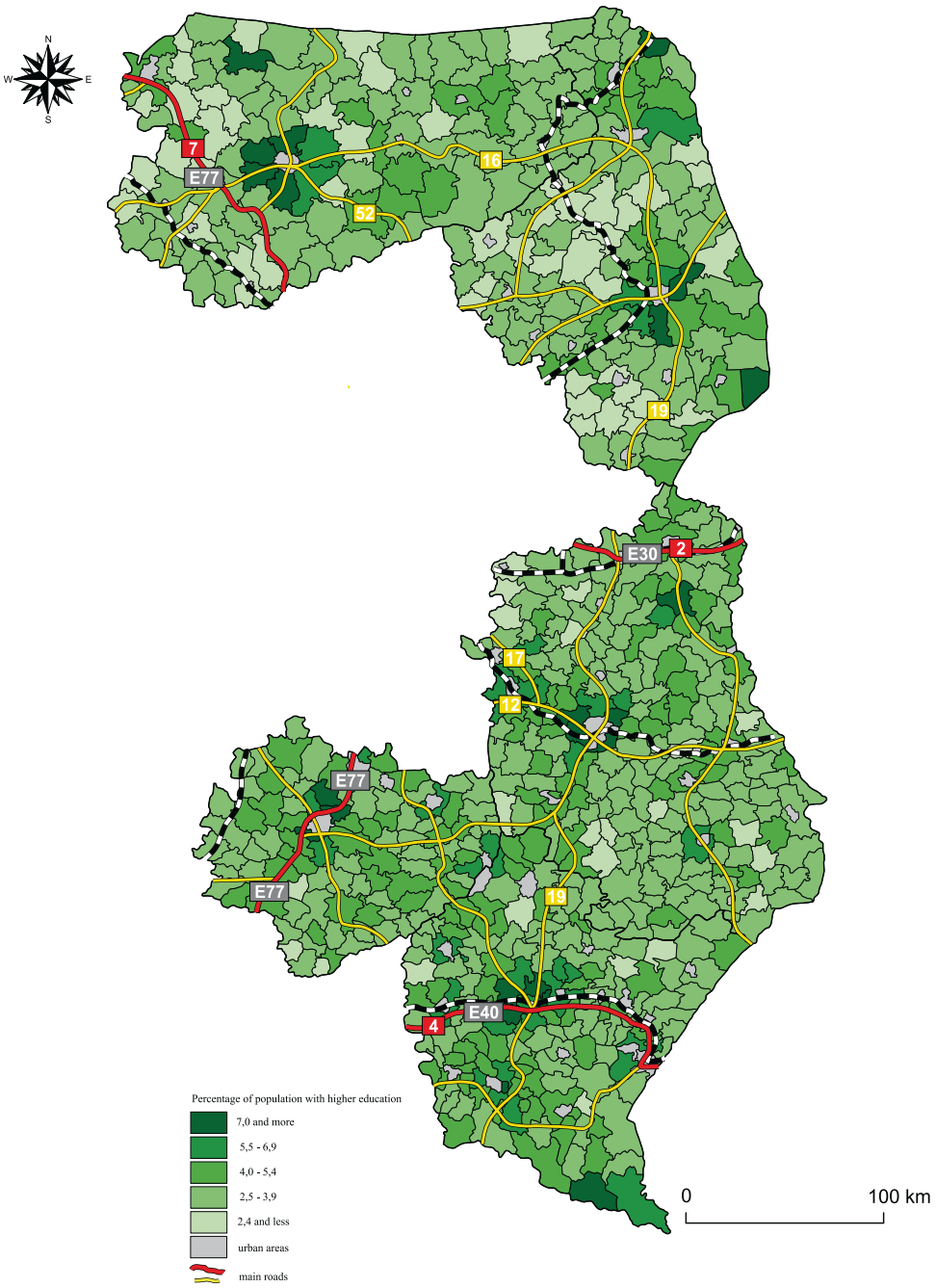

Figure 2. The percentage of people with a higher education among the adult population in the rural areas of Eastern Poland.

Source: Own elaboration. (Figs 2-6).

The most people with a secondary or postsecondary school diploma among the inhabitants of rural areas over the age of 13 have been observed in the Podkarpackie Voivodeship (23.8%), the least in Warmińsko-Mazurskie (18.3%).

The location quotient illustrating the relation between the percentage of people with secondary and postsecondary education and the percentage of the inhabitants of rural areas exceeded one in three voivodeships (Lubelskie, Podkarpackie and Świętokrzyskie) (Tab. 5), which proves a favourable structure of education. Whereas in the rural areas of the Warmińsko-Mazurskie Voivodeship there is a serious deficiency of inhabitants with secondary school diplomas in relation to the number of inhabitants.

Table 5

The rural population with secondary and postsecondary education in the voivodeships of Eastern Poland *vs.* Poland

Specification	Rural population (thous.)		Percentage of people in relation to Poland		Location quotient
	total	with higher education	living in the country	with higher education	
Lubelskie	1172,4	37,1	8,0	7,4	0,93
Podkarpackie	1253,4	44,4	8,6	8,9	1,04
Podlaskie	496,4	14,5	3,4	2,9	0,86
Świętokrzyskie	702,9	24,5	4,8	4,9	1,02
Warmińsko-Mazurskie	568,8	15,7	3,9	3,1	0,81
Eastern Poland	4193,9	136,2	28,6	27,3	0,95
Poland	14657,3	498,9	100,0	100,0	1,00

Source: Own elaboration on the basis of Local Data Bank of Central Statistical Office.

The spatial layout of the percentage of the population with secondary or postsecondary education corresponds with the analogical layout of inhabitants with a higher education. The better educated population lives in the immigration areas, i.e. the suburbanisation zones of the voivodeship cities and the subregional centres, whereas the less educated people live in the depopulating areas [Miszczuk, Wesołowska 2012].

The percentage of councillors with a higher education is the last measure providing information about the level of education of the adult population. The councillors who have a university diploma accounted for 1/4 in the rural areas of Eastern Poland in 2011 (Tab. 6). It was a lower index than in Poland as a whole (29.9%) and in the cities (Poland: 35.9%, Eastern Poland: 31%).

The most councillors (in relation to the total number of councillors) with a higher education were observed in the Świętokrzyskie and Warmińsko-Mazurskie Voivodeships.

In the case of the latter region, such a result is surprising. The structure of the population by education in this terrain is the least favourable among all the voivodeships of eastern Poland. This may mean that the inhabitants of the country, despite the deficiencies in their own educational attainment appreciate the meaning of the formal qualifications of their representatives in local government. Whereas in the Lubelskie and Podkarpackie Voivodeships, the councillors with university diplomas accounted for, respectively, 22.4% and 28.2%. Thus, in the terrains characterised by a favourable structure of the adult population's education, the level of councillors' education is not the most important criterion.

Table 6

The percentage of councillors with a higher education in the voivodeships of Eastern Poland *vs.* Poland in 2011

Specification	Percentage of councillors with higher education in relation to their total number			Percentage of councillors with higher education in relation to their total number in the country*		Number of gminy in which there were no councillors with higher education; (percentage of gminy in relation to their total number in the brackets)
	total	city	the country*	Minimal value	Maximal value	
Poland	35,9	68,6	29,9	0	86,7	75 (3,5)
Eastern Poland	31,0	71,9	25,4	0	76,2	41 (5,6)
therein voivodeships:						
Lubelskie	28,1	71,1	22,4	0	60,0	14 (7,3)
Podkarpackie	33,1	68,7	28,2	0	53,3	7 (4,9)
Podlaskie	30,3	70,9	27,9	0	61,9	8 (7,7)
Świętokrzyskie	34,2	78,8	30,8	0	76,2	7(7,2)
Warmińsko-Mazurskie	38,1	74,4	30,6	0	76,2	5 (5)

Source: Own calculation on the basis of data from the Central Statistical Office.

* includes rural and urban-rural gminas

A strong diversification in respect of the analysed measure is visible in each voivodeship. The biggest difference between the extreme values of the percentage of councillors with a higher education occurred in the Warmińsko-Mazurskie and Świętokrzyskie Voivodeships (76.2 pp).

There was not even one councillor with a higher education in 41 gminas (5.6%) in the rural areas of Eastern Poland (in Poland 3.5%). The most territorial units where none of representatives in a gmnia council has a university diploma is located in the Lubelskie (14, *i.e.* 7.3%) and Podlaskie (9, *i.e.* 8.6%) Voivodeships, the least in the Warmińsko-Mazurskie Voivodeship (5, *i.e.* 5.0%).

A relatively high percentage of people with a higher education in the gminy councils occurs in suburban areas, but this rule does not apply to all the gminy neighbouring with the main growth centres (Fig. 3). Rosner and Stanny [2007] think that a good makeup of the council in respect of education occurs in those gminy which are attractive as a place to live, are better communicated with a central city and are popular and attractive in landscape terms.

It is also worth noticing that many gminas located far from cities are characterised by a superior share of the best educated councillors. For example, such a situation occurs in the south-western part of the Lubelskie Voivodeship, the north-western and south-eastern part of the Podkarpackie Voivodeship as well as in the western regions of the Podlaskie Voivodeship.

Whereas, the great majority of gminas characterised by an unfavourable structure of councillors' formal education, is located peripherally in the voivodeships, poviats (plural of: *powiat* – the secondary unit of territorial and administrative division in Poland; translator's note) and far from the main communication routes.

The structure of the councillors by education is strongly correlated with the structure of the population by age. In the areas of advanced ageing processes [comp. Rosner, Stanny 2007, map 34], the level of councillors' education is worse than in the demographically young areas. The electoral preferences of the inhabitants towards the local government result also from the "supply" of candidates to the gmnia council. In general, the older population in Poland is characterised by a lower level of education.

3. The education of farmers in the rural areas of Eastern Poland

The educational attainment of farmers in Eastern Poland, in general, does not differ from the average in Poland. The farms operated by people with specialist, at least secondary education accounted for 6.4% of their total number (in Poland 6.3%).

The most farmers professionally prepared for operating farms live in the Warmińsko-Mazurskie and Podlaskie Voivodeships, with the least in the Podkarpackie Voivodeship (Tab. 7, Fig. 4).

A strong diversification in terms of the analysed measure is observed in each region. The farmers operating large-area farms have a relatively high professional background. The relation between the farmer's education and the level of marketability is also observed. The most farms operated by people with an appropriate background are located in the gminas of the Warmińsko-Mazurskie, Podlaskie, Lubelskie Voivodeships as well as in the eastern and southern part of the Świętokrzyskie Voivodeship. Whereas in the poor terrains of the weakly developed agricultural functions [Bański, Stola 2002] characterised by family farming and a fragmented agrarian structure, the percentage of farms operated by people with a formal education is much lower than on average in Eastern Poland.

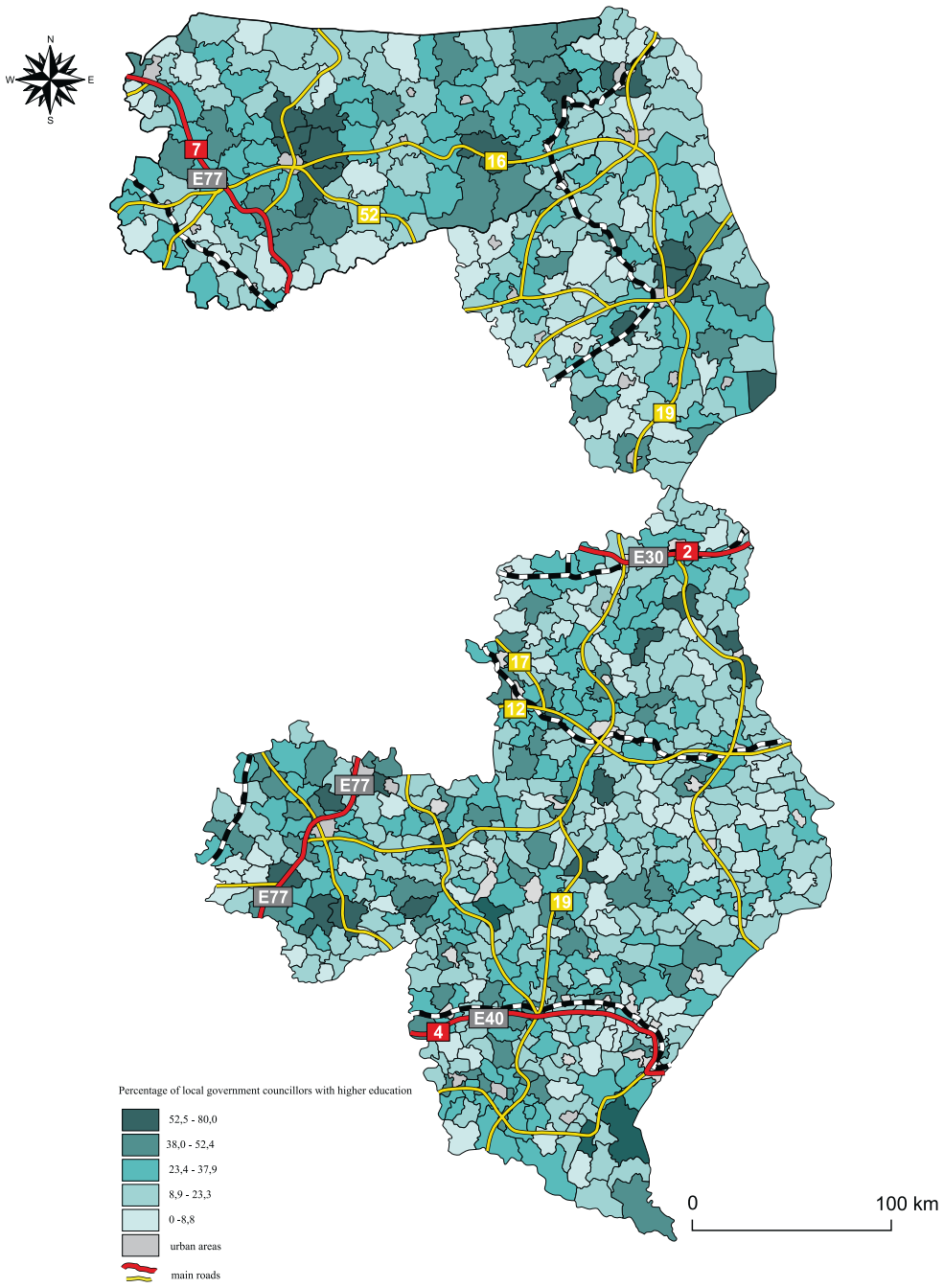

Figure 3. The percentage of councillors with a higher education in the rural areas of Eastern Poland in 2011

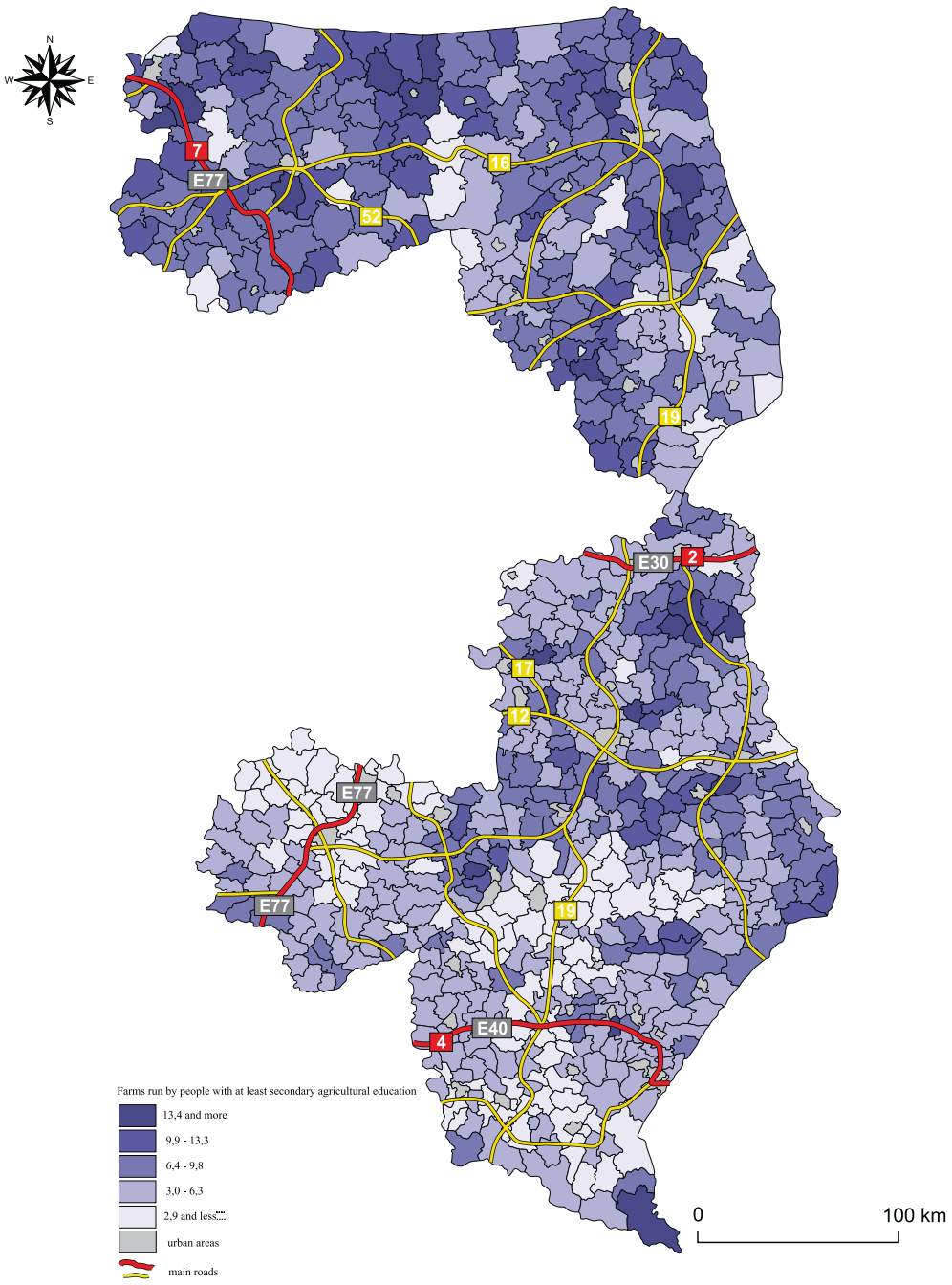

Figure 4. The percentage of farms operated by people with at least a secondary agricultural education in the rural areas of Eastern Poland

Table 7

The farms operated by managers with at least a secondary agricultural education in the rural areas of Eastern Poland

Specification	Total number of farms	Therein percentage of farms operated by managers with at least secondary agricultural education	Percentage of farms operated by managers with at least secondary agricultural education	
			minimal value	maximal value
Poland	2174015	6.3	0	26.7
Eastern Poland	2959745	6.4	0	21.7
Lubelskie	264260	6.6	0	21.7
Podkarpackie	236173	4.0	0	14.1
Podlaskie	96561	8.1	0,9	19.6
Świętokrzyskie	129884	4.8	0	14.3
Warmińsko-Mazurskie	58852	8.8	0	17.8

Source: Own elaboration on the basis of data of Central Statistical Office.

The percentage of farms operated by people without a professional background demonstrates the different spatial layout. In the rural areas of Eastern Poland, such farms accounted for 58% of their total number (Tab. 8) and it was by 0.5 pp higher than the analogical percentage in Poland.

Relatively, the biggest number of farms operated by people without a formal agricultural education is located in the Podkarpackie and Świętokrzyskie Voivodeships, thus in the areas characterised by small-scale and semi-subsistence farming [Bański, Stola 2002] (Tab. 8, Fig. 5).

Table 8

The farms operated by people without an agricultural education in the rural areas of Eastern Poland in 2002

Specification	Number of farms		Percentage of farms operated by people without agricultural education		
	total	Operated by people without agricultural education	total	minimal value	maximum value
Poland	2174015	1255022	57.7	0.0	100.0
Eastern Poland	2959745	1255027	58.2	27.8	100.0
Lubelskie	264260	146418	55.4	33.7	98.0
Podkarpackie	236173	160804	68.1	46.4	86.4
Podlaskie	96561	45346	47.0	27.8	83.7
Świętokrzyskie	129884	83285	64.1	38.7	89.7
Warmińsko-Mazurskie	58852	31863	54.1	37.4	100.0

Source: Own calculations on the basis of data from Central Statistical Office.

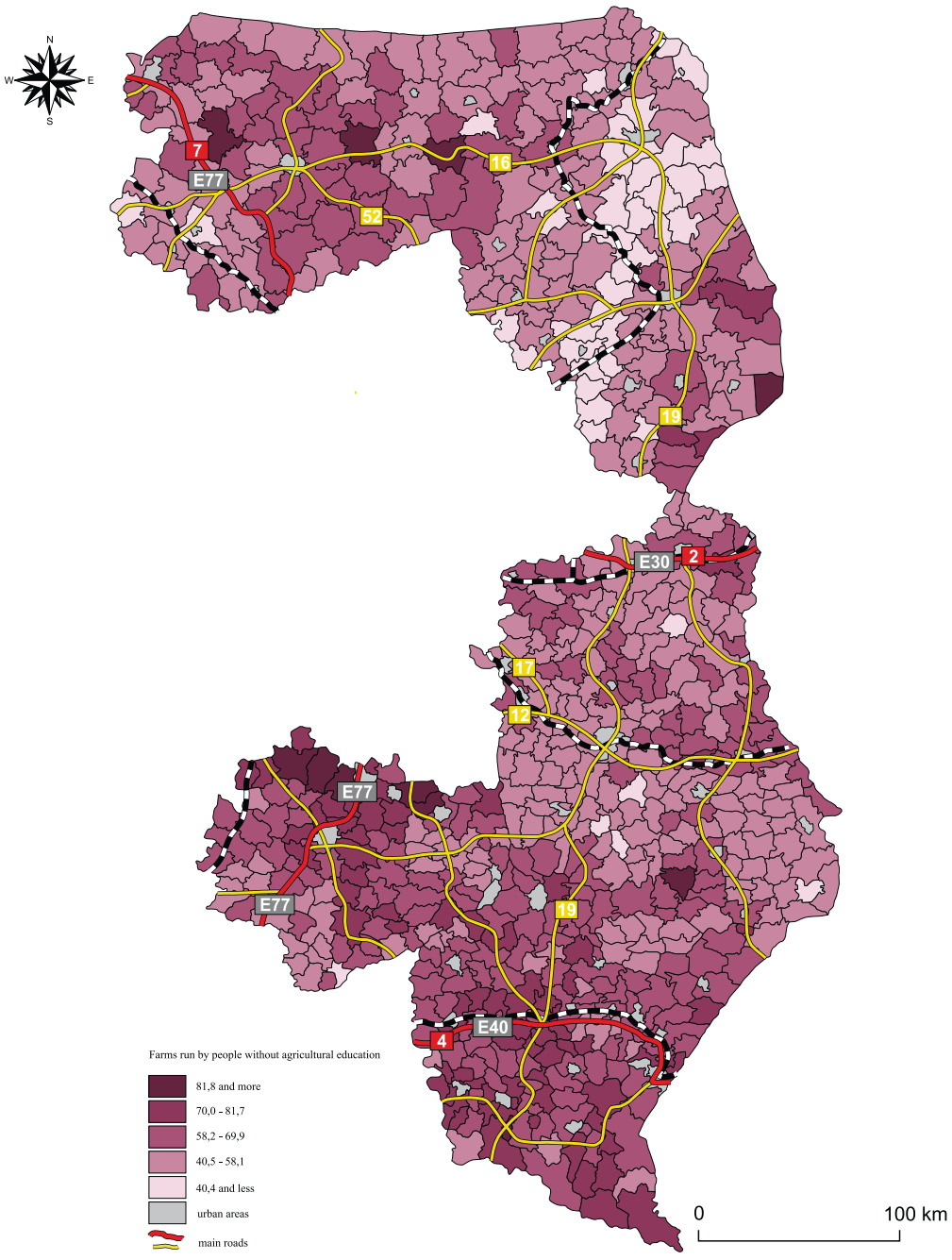

Figure 5. The percentage of farms operated by people with at least a secondary agricultural education in the rural areas of Eastern Poland

Whereas, the least number of farms operated by people without an agricultural education have been observed in the Podlaskie, Warmińsko-Mazurskie and Lubelskie Voivodeships.

A strong diversification in terms of the analysed measure is observed in each region. The extreme values in the Warmińsko-Mazurskie Voivodeship amount to 37.4% and 100%, in the Lubelskie Voivodeship 33.7% and 98%, in the Podlaskie Voivodeship 27.8% and 83.7%.

The highest percentages of farms operated by people without an agricultural education by gminas occur in the suburban gminas, where people depart from agriculture as a dominating sector of the economy and the non-agricultural functions develop. The range of an urban centre's influence is quite considerable and includes at least the gminas located in the first ring.

4. Human capital in the rural areas of Eastern Poland – a synthetic approach

The taxonomic measure of the level of human capital d_i for the rural areas in Eastern Poland oscillated between 0.288 and 1.0. Taking the value of d_i as a criterion, the gminas have been grouped into five classes.

The first class (a very high level of human capital) includes 66 territorial units (10.3%) which are inhabited by 14.3% of the rural population of Eastern Poland (Tab. 9).

Table 9

The taxonomic measure di of the level of human capital in the rural areas of Eastern Poland

Classes (d_i measure)	Number of gminas	Number of inhabitants	% of gminas	% of inhabitants
very high (d_i<0,681)	66	589900	10.3	14.3
high (0,681-0,767)	102	745942	16.0	18.1
medium (0,768-0,845)	216	1373833	33.9	33.3
low (0,846-0,932)	223	1265540	35.0	30.7
very low (d_i>0,932)	31	146346	4.9	3.6
total	638	4121561	100.0	100.0

Source: Own elaboration.

The most gminas in this group are from the Podkarpackie (20) and Lubelskie (18) Voivodeships, whereas the least are from the Podlaskie (9) and Warmińsko-Mazurskie (9) Voivodeships (Tab. 10, Fig. 6). These are mostly suburban areas, the gminas located in the first ring of the regional and over-local urban centres. As research has

shown [Bański, Stola 2002], these terrains are characterised by well-developed non-agricultural functions and account for the areas of transformation success [Heffner, Stanny 2007].

Also some gminas of specific restructured fields of the economy such as Lutowiska and Cisna in the Podkarpackie Voivodeship, Nałęczów (Lubelskie), Krościenko Wyżne (Podkarpackie), Dywity, Stawiwuda (Warmińsko-Mazurskie) are characterised by a very high level of human capital. These are local centres of success [Bański 2008].

Table 10

The number of gminas in each TMD class in the voivodeships of Eastern Poland

Classes	Number of gminas in voivodeships:					
	Lubelskie	Podkarpackie	Podlaskie	Świętokrzyske	Warmińsko-Mazurskie	total
very high	18	20	9	10	9	66
high	32	26	14	20	10	102
medium	71	51	28	29	37	216
low	61	42	45	35	40	223
very low	11	4	9	3	4	31
total	193	143	105	97	100	638

Source: Own calculations.

Also, some areas of competitive agriculture are included in the first class (*e.g.* Obrazów, Samborzec in Świętokrzyskie Voivodeship). The agricultural function is a dominating field of the economy here and the farming has a large-area and marketable character.

A high level of human capital in the analysed class is determined, mostly, by a superior share of the people with a higher and secondary education. The location of these units against cities and the high accessibility of secondary and high schools influenced the positive measures related to the adult population's education.

There are 102 gminas (16.3%) inhabited by 18.1% of the Eastern Poland population in the second class (a high level of human capital). The most spatial units of this class are included administratively in the Lubelskie (32), Podkarpackie (26) and Świętokrzyskie (20) Voivodeships. In spatial layout, they neighbour with the areas included in the first class and create a dense strip stretching usually along the regional communication routes (e.g. route no 19). These areas are usually characterised by a positive migration balance and a relatively "young" population [Miszczuk, Wesołowska 2012]. These are the gminas of an urban-rural type or the areas neighbouring with them.

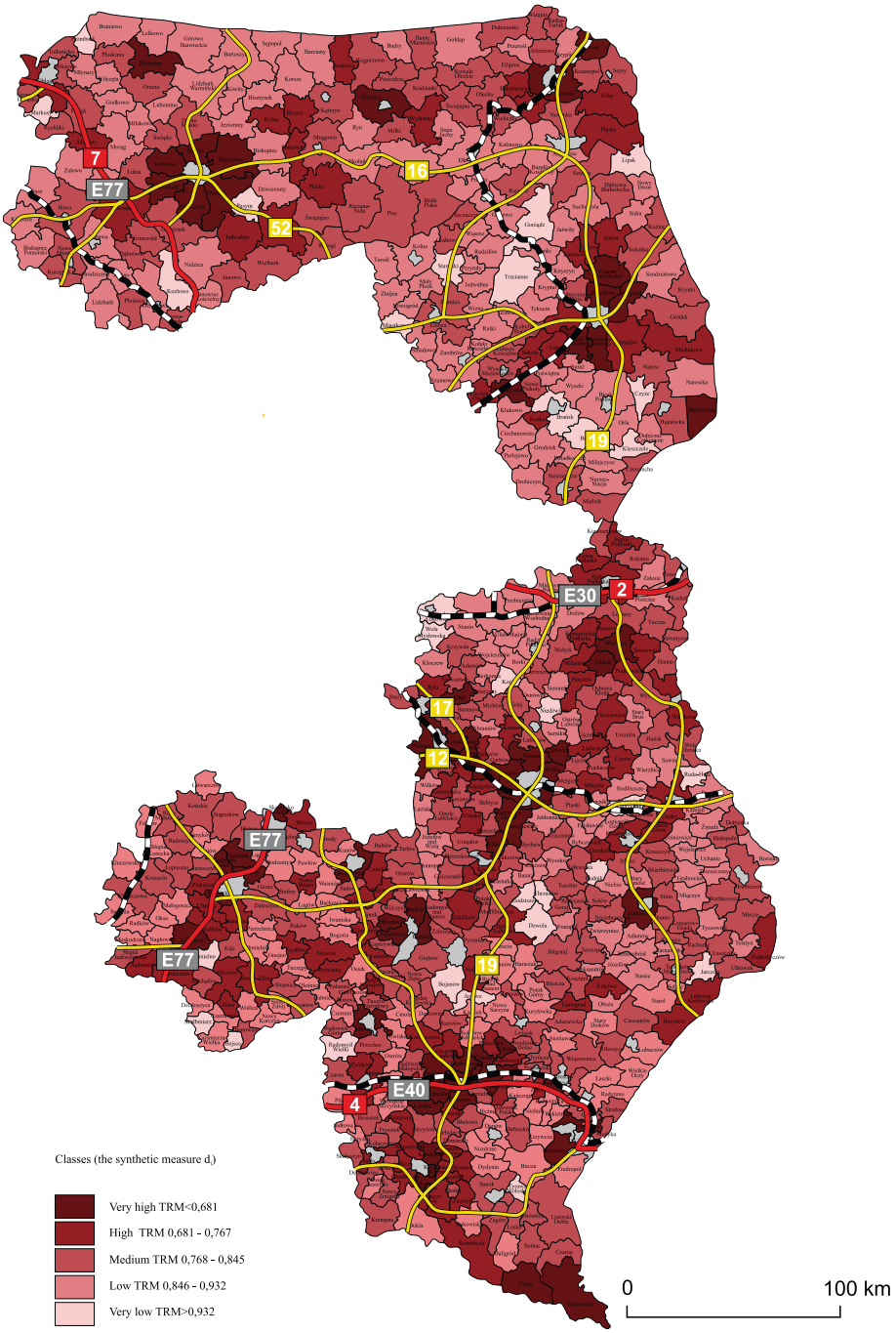

Figure 6. The level of human capital in the rural areas of Eastern Poland – the synthetic measure di

Some areas of well-developed non-agricultural functions, usually health resorts, tourist and industrial centres (*e.g.* Horyniec-Zdrój in Podkarpackie Voivodeship, Busko-Zdrój in Świętokrzyskie, Kazimierz Dolny in Lubelskie, Iwonicz-Zdrój, Rymanów in Podkarpackie) are included in this class. The development of the functions generally related to spa tourism favours the accumulation of human capital.

A high level of human capital is a characteristic also for some areas of competitive agriculture (areas in the eastern and southern part of the Świętokrzyskie Voiv., the western part of the Podlaskie Voiv.) [comp. Bański 2008].

The superior measures describing the secondary education of the inhabitants and the professional background of the farmers are observed in the classes of the high level of human capital.

216 gminas (35%), inhabited by 30.7% of the inhabitants of rural areas in Eastern Poland, have been classified into another class – of a medium level of human capital. The spatial units from the Lublin Voiv. (71) and the Podkarpackie Voiv. (51) dominate in this group. According to the functional classification of rural areas [Bańki, Stola 2002], one can find here the mostly eminently agricultural gminas as well as those with a domination of the agricultural or forestry functions, located in the neighbourhood of cities (usually in the second ring), along communication routes, in the peripheries of voivodeships and in the intermediate areas between the core and peripheries.

The gminas which belong to the class of a medium level of human capital are characterised by the superior measures describing the farmer's professional education and the level of councillors' formal education. The percentages of the inhabitants with a secondary education do not diverge from the average values in eastern Poland. The percentage of people with high school diplomas is below the average.

Whereas, 254 gminas (39.9%), inhabited by 34.3% of the rural population of Eastern Poland, have been qualified into the class of a low and very low level of human capital. The great majority of them are located in the Lubelskie and Podlaskie Voivodeships. These are the areas of domination of the agricultural functions, located upon the traditional regional borders of: the Lubelskie and Mazowieckie regions, the Podlaskie and Mazowieckie Voivodeships, along the Polish-Russian border and punctually at the eastern border of Poland. All the measures adopted for analysis are lower (in the case of destimulating factors, higher) than the average for a given area.

5. The level of human capital in the rural areas of Eastern Poland *vs.* the country

The comparison of the level of human capital in the rural areas of Eastern Poland with the remaining rural terrains in the country results unfavourably for the analysed

area. The average measure of development in Eastern Poland amounts to 0.848[2] and is much higher (thus unfavourable) than in Central (0.835) and Western Poland (0.837) (Fig. 7). There are much less areas (than in other regions) characterised by a very high and high (the first and second classes) level of human capital in Eastern Poland. They account for less than 20% of the total number of spatial units in Eastern Poland, while such gminas in Central Poland account for almost ¼ of their total number (Fig. 8). At the same time in Eastern Poland most gminas are of a low and very low human capital stock. They account for almost 40% of the total number of the territorial units of this region, while in the western part of country, the gminas of such a class account for approximately 1/3.

The presented data unequivocally show that the rural areas of Eastern Poland are characterised by a low level of human capital stock. It is related to the migration processes taking place in the peripheral areas and the society's ageing processes connected with them. The economic structure of these areas and the poorly developed network of the cities are factors which impede the accumulation of human capital.

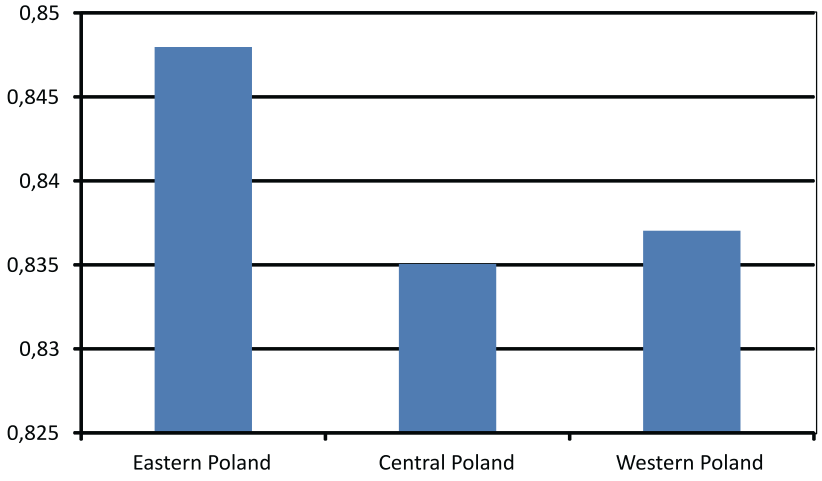

Figure 7. The average measure of development d_i in the rural areas in Eastern Poland *vs.* Poland

Source: Own elaboration. Central Poland includes: the Kujawsko-Pomorskie, Łódzkie, Małopolskie, Mazowieckie, Opolskie, Pomorskie and Śląskie Voivodeships. Western Poland includes: the Zachodniopomorskie, Wielkopolskie, Lubuskie and Dolnośląskie Voivodeships.

[2] This measure has been calculated on the basis of the distance from the model, while the model is described by the maximum values of each feature for Poland.

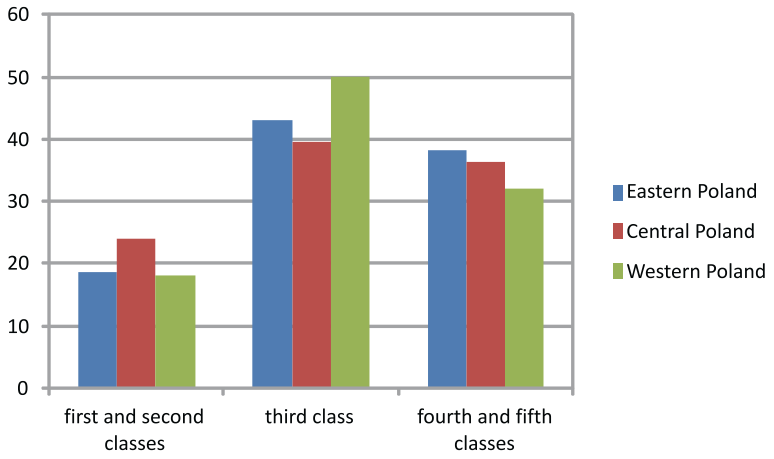

Fig. 8. The percentage of the gminas in Eastern Poland in each class of human capital *vs*. Poland
Source: Own elaboration.

Summary

The contemporary development challenges resulting from the globalisation and integration processes are related to the competitiveness of the regions. A diagnosis of the situation shows that the very low level of Eastern Poland's cohesion in economic, social and spatial dimensions is a basic source of the development problems. The Improving of the economic cohesion signifies the necessity for maintaining the GDP growth rate at a much higher level than 2.5% per year [Szlachta 2007]. The preservation of the social cohesion is related to the radical growth of the employment rate at least to the level of the average for the EU *i.e*. 63%. Whereas the spatial cohesion requires an investment related to transport and communication. The realisation of the described aspects of the cohesion is possible provided that the human capital stock is high, but Eastern Poland's high cohesion may also be a factor which will attract a highly qualified workforce.

Meanwhile, the presented research has shown that the level of human capital in the rural areas of Eastern Poland is not satisfying. These terrains diverge negatively from the average values in Poland.

The superior level of human capital is related to the well-developed network of cities, the transport infrastructure and the non-agricultural function. Thus, the most favourable situation occurs in the suburban gminas in the areas of the restructured economy sections.

The area of Eastern Poland in terms of the level of human capital can be divided

into two subregions: the northern subregion, including the Warmińsko-Mazurskie and Podlaskie Voiv. and southern subregion: the Lubelskie, Podkarpackie and Świętokrzyskie Voivodeships. The southern region with family and fragmented farming is characterised by a higher level of human capital than the northern region with large-area farms. It is mostly related to the network of cities. The more dense and the bigger the urban centres, the higher the level of human capital. In the northern subregion, one city falls on ap. 500 km^2, while in the southern subregion on every 350-370 km^2.

Also, the situation in the labour market is a very important factor influencing the level of human capital. The high unemployment rate in the southern subregion is an impulse for extending the period of education, which results in superior indexes of the population's education. The parents eagerly invest in their children's education. The surpluses in the labour market have not stimulated an improvement of the population's education in the northern subregion, where the state sector dominates in agriculture.

The researches have shown that the border of the state is not a strong barrier to the accumulation of human capital. Only one gmina included in the fifth class (with the lowest level of human capital) is located upon the state border and three gminas represent the first class. The majority of the areas stretching along the border of the state are characterised by a medium level of human capital stock. The worst situation is observed at the border with Kaliningrad Oblast.

Whereas, internal borders (between voivodeships, poviats) account for a factor which facilitates the drainage of the best educated people. It is mostly along these borders that the areas of the lowest level of human capital are located.

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