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HUMAN CAPITAL OF PODKARPACKIE VOIVODSHIP – A FACTOR OF DEVELOPMENT

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Purpose: The main objective of the article is to determine the level of human capital resources of Podkarpackie voivodeship and the possibilities of using the endogenous resource in terms of regional development of Podkarpackie voivodeship.
Design/methodology/approach: Based on a thorough analysis of the availability of statistical indicators directly or indirectly characterizing the human capital resource at the county level, the following concept of constructing the human capital quality measure was adopted. The first category of direct indicators was named the demographic potential characteristics of regions, due to the dominant role of demographic traits in this group. The second category of indirect indicators describes the socio-economic activity of the population.
Findings: The results of the analysis indicated the existence of a relationship between human capital resources and regional development, on the example of Podkarpackie voivodeship. In Podkarpackie voivodeship there are very large intra-regional variations in the level of human capital quality as determined by a synthesised measure.
Research limitations/implications: Limitations associated with the use of the Human Capital Quality Measure in research are the limited access to some data from official statistics at a more detailed level than NUTS 3, such as municipalities, for example. Future research directions on human capital as a development factor include expanding research to international comparisons to assess how Polish counties compare to other countries. Another good direction would be the application of an interdisciplinary approach, combining economics, sociology, social geography, management sciences, demography, and political and administrative sciences for a comprehensive analysis of human capital quality.
Social implications: An important benefit of using the human capital category in regional development studies is that it can be used to design a regional policy that is more responsive to the real needs of the region's inhabitants.
Originality/value: Such analyses can become an element of the diagnosis of the development strategy of the region and of individual units of the administrative division of the voivodeship - counties or communes. This can be achieved through actions in the field of education, labour market and decentralisation of local policies.
Keywords: human capital, development policy, regional development, Podkarpackie voivodeship.
Category of the paper: Research paper.

1. Introduction

The concept of human capital, despite its frequent use over the past years, remains an ambiguous term. Jacek Tittenbrum pointed out this peculiar paradox, noting that considering the high popularity and numerous sources referring to this concept, the difficulties in providing a clear and unequivocal answer to the question of what human capital is are surprising (Tittenbrum, 2017, p. 18). Stanisław R. Domański states that authors using the term "human capital" employ the method of citing examples and using the term in various contexts. This, on one hand, leaves a fairly large field for the intuitive interpretation of the content of the considered categories, and on the other hand, it can be treated as a peculiar way of defining (Domański, 1993). The concept of human capital emerged in the late 1920s. As Tomasz Bieliński notes, the origins of the term can be traced back to the considerations of the English economist Pigou, who in 1928 was the first to state that "there is such a thing as human capital, which can be invested in like material capital" (Bieliński, 2016, p. 11). The first broader treatment of the issue of human capital was formulated only in the 1960s with the publications of authors such as Theodore William Schultz, Gary S. Becker, and Jacob Mincer. These researchers permanently introduced human capital into economic sciences as a production factor, referring to the capital theory developed by Irving Fisher, according to which all resources used by an organization (firm) can be treated as capital (Wieczorek-Szymańska, 2010, p. 163).

Theodore William Schultz reached an interesting conclusion in the context of seeking a connection between human capital and social development. He stated that much of what we consider consumption is actually investments in human capital (Schultz, 1961, p. 1). These investments primarily include expenditures on education, health, and internal migration for better employment opportunities. Schultz also categorized leisure time spent on developing knowledge and skills, the opportunity costs for students due to the time they allocate to study, and the opportunity costs for employees undergoing training at the workplace. According to Schultz, these investments in enhancing the quality of human capital can increase productivity and impact the real wages of workers. He also argued that investments in human capital can contribute to the income growth of poor individuals and the development of individual countries (Sobczak, 2018, p. 277).

Polish researchers have also explored the issue of human capital. According to Mirosława Marody and Anna Giza-Polesczuk, human capital comprises such community characteristics as age structure, mortality, birth rate, and health status, which together form a broader category of demographic features. Besides demographic characteristics, human capital includes the skills of community members expressed in terms of education level, occupational structure, and the degree of alignment of the occupational structure with the demands of the modern labor market (Giza-Poleszczuk, Marody, 2000). Similarly, Stanisław R. Domański defines human capital as

the sum of knowledge, skills, health, and vital energy contained in society. He points out an important issue, noting that it is a resource given by the genetic traits of a given population once and for all, but can be increased through investments known as human investments (Domański, 1993, p. 19). This observation provides an important premise for communities living in peripheral, underdeveloped regions, indicating that adverse conditions can be overcome through investments in people - human capital.

Andrzej Sadowski reached an interesting conclusion regarding considerations of forms of capital present in society. He states that human resources primarily accumulate human, social, and cultural capital. Human capital includes knowledge (education), professional skills, health status along with the ability to utilize it, knowledge of foreign languages, computer skills, willingness to make contacts, and associated flexibility towards different cultures and lifestyles (Sadowski, 2005, p. 258). In social research, it is also emphasized that the quality of human capital is more than the sum of the characteristics of the population living in a region. It also includes certain social traits, such as the ability to create social bonds, which are influenced by specific investments in people.

Despite its popularity, the theory of human capital is also subject to criticism. An example is the criticism of T.W. Schultz's views, who treated education solely in terms of investment (Jabłoński, 2021, p. 95). Another criticism in the literature is its dehumanization and reduction of human value to a "commodity" (Adamson, 2009).

2. Methodological Assumptions for Constructing the Human Capital Quality Measure

Despite the critical remarks in the literature about the dehumanization of human capital, it can be perceived as a social phenomenon whose level and diversity can be measured using selected indicators. Based on a thorough analysis of the availability of statistical indicators directly or indirectly characterizing the human capital resource at the county level, the following concept of constructing the human capital quality measure was adopted (Kotarski, 2013). Due to the relatively limited set of other indicators directly related to the human capital resource in counties (e.g., characteristics of the health status of the working-age population), the set of indicators was supplemented with those indirectly characterizing the quality of human capital through the statistically observed effects of socio-economic behaviors of the population. This approach allows for combining unchanging demographic characteristics and social traits resulting from inherited collective behaviors.

The first category of direct indicators was named the demographic potential characteristics of regions, due to the dominant role of demographic traits in this group. The second category of indirect indicators describes the socio-economic activity of the population. Within each of these two main categories, several characteristics or behaviors of the population were identified, which describe the demographic potential and socio-economic activity of the population in the counties and can be assigned specific observable statistical measures. Consequently, a certain hierarchical three-level system of indicators was developed, as presented in figure 1.

Main Level	First Level Measure	Second Level Measure	Third Level Measure
Quality of human capital	Demographic potential	Demographic resilience	Demographic burden
			Gross reproduction rate of the population
			General fertility
			Demographic dynamics of the population
			Resources of professionally mobile population
			Professional mobility
			Resources of people with at least secondary education
		Level of functional knowledge	Reading rates
			Prevalence of post-secondary/secondary education
		Health status	Infant mortality
			Mortality due to civilization diseases
			Premature mortality
		Spatial mobility	Net internal migration balance
	Socio-economic activity	Economic activity	Individual business entities (IBE)
			Newly registered IBEs in the REGON register
		Social activity	Number of foundations and associations
			Voter turnout in the 2018 local elections
			Voter turnout in the 2019 parliamentary elections
			Voter turnout in the 2020 presidential elections
			Investment activity of local governments
			Value of EU grants obtained by local governments

Figure 1. Human Capital Quality Measure (HCQM).

The source basis for the study consists of information from the Local Data Bank of the Central Statistical Office (GUS), the results of the 2021 National Census of Population and Housing, the REGON register, statistical data from the Statistical Office in Rzeszów, and the results of local and municipal elections published by the State Electoral Commission. The data cover the years 2010-2022. Since the demographic characteristics describing the quality of human capital exhibit little variability over time, and to reduce the risk of error in assessing the demographic potential of the population related to the occurrence of single-year, often random fluctuations in demo-social parameters, the analysis of statistical material was conducted based

on average values of indicators for the years 2010-2022. The averaging procedure was also applied to parameters characterizing the socio-economic activity of the population.

The study is organized into a hierarchically structured set of variables, where the individual levels of analysis are determined by the degree of aggregation of statistical indicators describing the quality of human capital. The formula for calculating the partial indicator is as follows:

$$p_{mi} = \frac{x_{mi} - \min\{x_{mi}\}m_i}{\max\{x_{mi}\}m - \min\{x_{mi}\}m} * 100$$

$$p_{mi} \in [0,100]$$

where:

x_{mi} – value *i* of the given variable in the given *m* county,

p_{mi} – normalised value *i* of the given variable in the given *m* county.

The calculated measures of the partial indicator for a given county are relative and only show the county's position concerning the minimum and maximum. To allow for comparative analyses, the values of the partial indicators (diagnostic variable values) were normalized by creating synthetic group indicators for each county. This process utilized the taxonomic non-pattern method of variable aggregation, which involves averaging the normalized values of diagnostic variables (Grabiński, 1984).

For each county, group indicator values were obtained as follows:

$$g_{ml} = \frac{\sum_{m=1}^{n} p_{mi}}{n}$$

$$g_{ml} \in [0,100]$$

where:

p_{mi} – normalized value of the *i* variable (partial indicator) in the *m* county,

n – number of partial indicators,

g_{ml} – the *l* value of this group indicator in a given *m* county.

In the final stage of the study, a synthetic assessment of the quality of human capital for each county was made based on the group indicator values, calculating the Human Capital Quality Measure (HCQM). The HCQM is the arithmetic mean of the synthetic group indicators. The calculated synthetic measure values range from 0 to 100, and its interpretation is as follows – the closer the value is to 100, the higher the quality of human capital in the county according to the adopted criteria (group indicators). The HCQM was calculated using the following formula:

$$HCQM = \frac{PD_{mk} + PWF_{mk} + SZ_{mk} + MP_{mk} + AG_{mk} + AS_{mk}}{N}$$

where:
PD_{mk} – Demographic resilience,
PWF_{mk} – poziom wiedzy funkcjonalnej,
SZ_{mk} – Health status,
MP_{mk} – Spatial mobility,
AG_{mk} – Economic activity,
AS_{mk} – Social activity,
N – number of group indicators.

3. Analysis of Human Capital Differentiation

The analysis covered the counties of the Podkarpackie Voivodeship. The selection of indicators and the method of their aggregation into partial and group measures are universal and can be applied to other territorial units, which undoubtedly enhances the cognitive potential of such a method for analyzing human capital differentiation.

Six partial measures - demographic burden, gross reproduction rate of the population, general fertility, demographic dynamics of the population, resources of professionally mobile population, and professional mobility - formed the second-level group measure of demographic resilience. The sum of the values of individual partial indicators allowed for the calculation of an aggregated value, which ranges from 0 to 100.

The most demographically resilient counties were concentrated in the central part of the Podkarpackie Voivodeship. The highest value of the measure was recorded in the Ropczycko-Sędziszowski County, followed by slightly lower values in the Rzeszów County, the city of Rzeszów, and the Łańcucki County. The second group, in terms of the intensity level of the demographic resilience measure, included the counties of Dębicki County, Brzozowski County, Przemyski County, Mielecki County, Przeworski County, Kolbuszowski County, Krośnieński County and Strzyżowski County. The three cities with county rights - Przemyśl, Tarnobrzeg, Krosno and the Stalowa Wola County were in the group of counties with the lowest values of the demographic resilience measure.

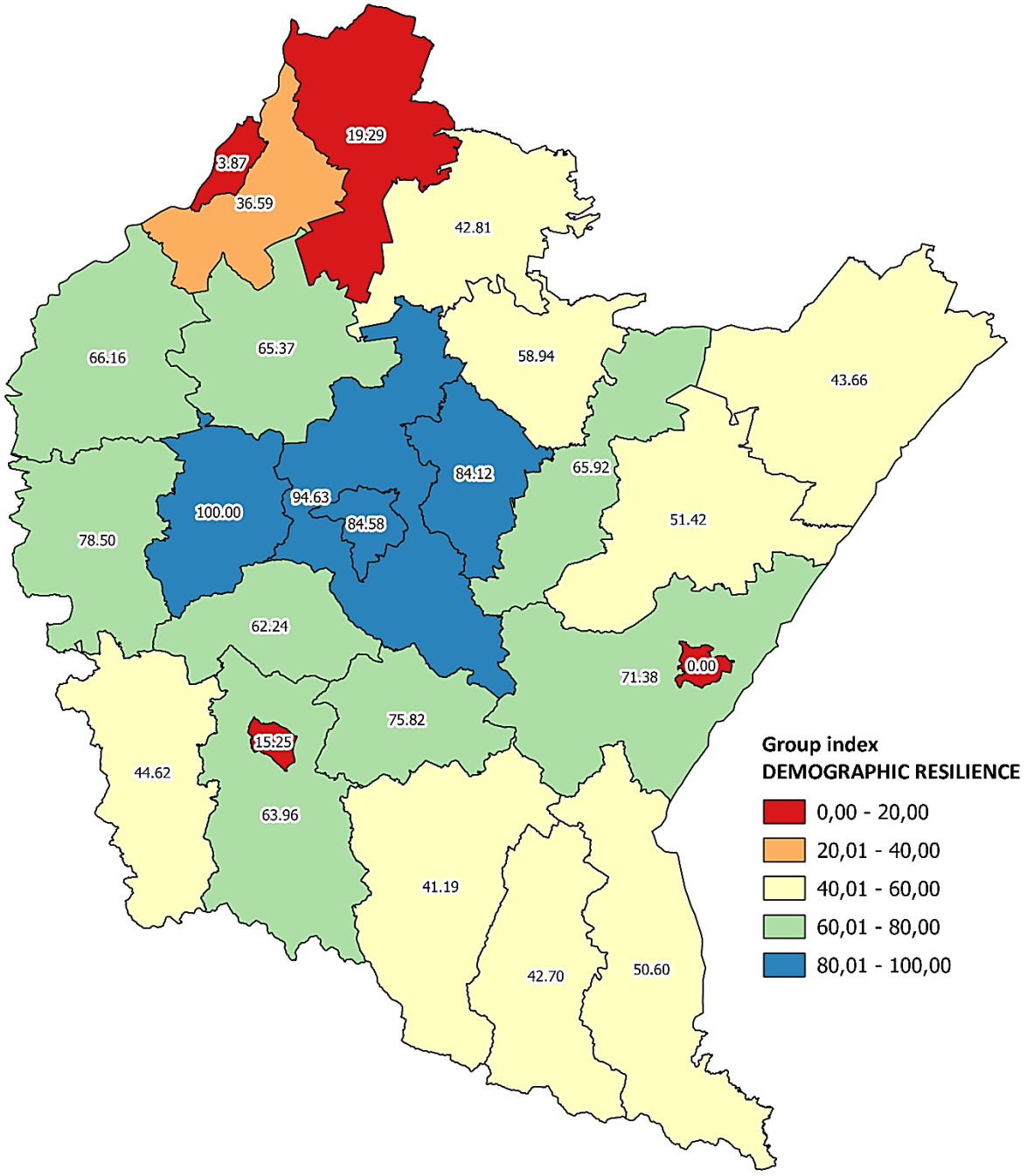


Figure 1. Group Indicator of Demographic Resilience Coefficient.

Source: own study.

Using Pearson's linear correlation coefficient, a strong correlation can be observed between the demographic resilience measure and the level of urbanization ($r = -0.572$; $p = 0.003$). Interpreting the above data, it can be stated that as the level of urbanization increases, the value of the demographic resilience measure in counties decreases. The least urbanized counties have the highest demographic dynamics and the largest resources of young people.

The counties characterized by the relatively highest level of functional knowledge of residents are four cities, county towns - Krosno, Rzeszów, Przemyśl, and Tarnobrzeg. These cities have the best-educated residents, who most frequently use reading rooms and

libraries and have access to the widest range of educational offerings at the post-secondary school level. The relatively lowest level of functional knowledge of residents was observed in the land counties of Krosno, Przemyśl, and Tarnobrzeg, as well as in Przeworski County, Kolbuszowski County, Niżański County, and Brzozowski County. Excluding the land counties surrounding the county towns, most counties with the lowest level of functional knowledge are located in the eastern part of the voivodeship – Strzyżowski County, Brzozowski County, Lubaczowski County, Przeworski County, in the Krosno-Przemyśl subregion. The spatial differentiation of the level of functional knowledge in the Podkarpackie Voivodeship is presented in the following figure.

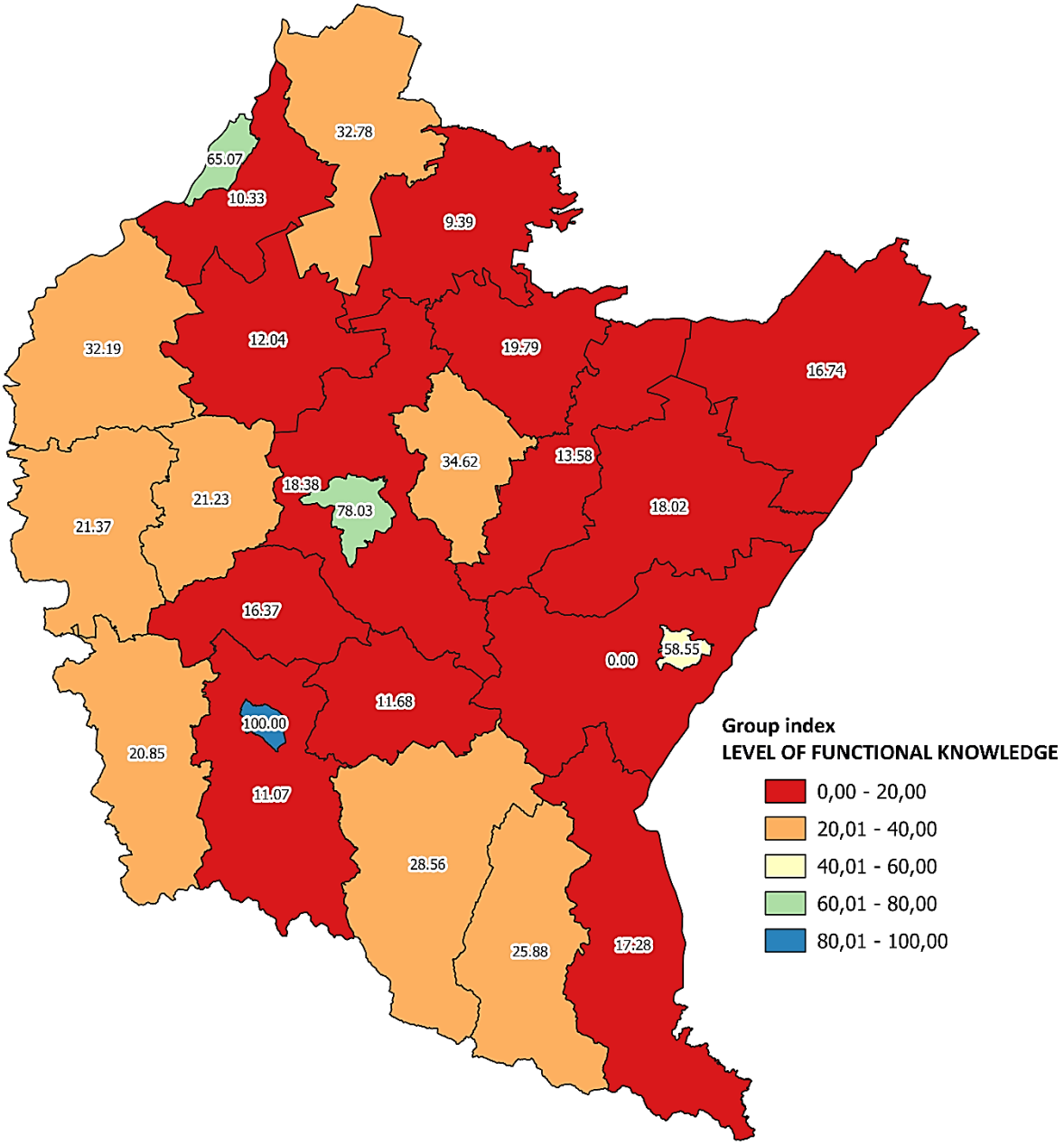
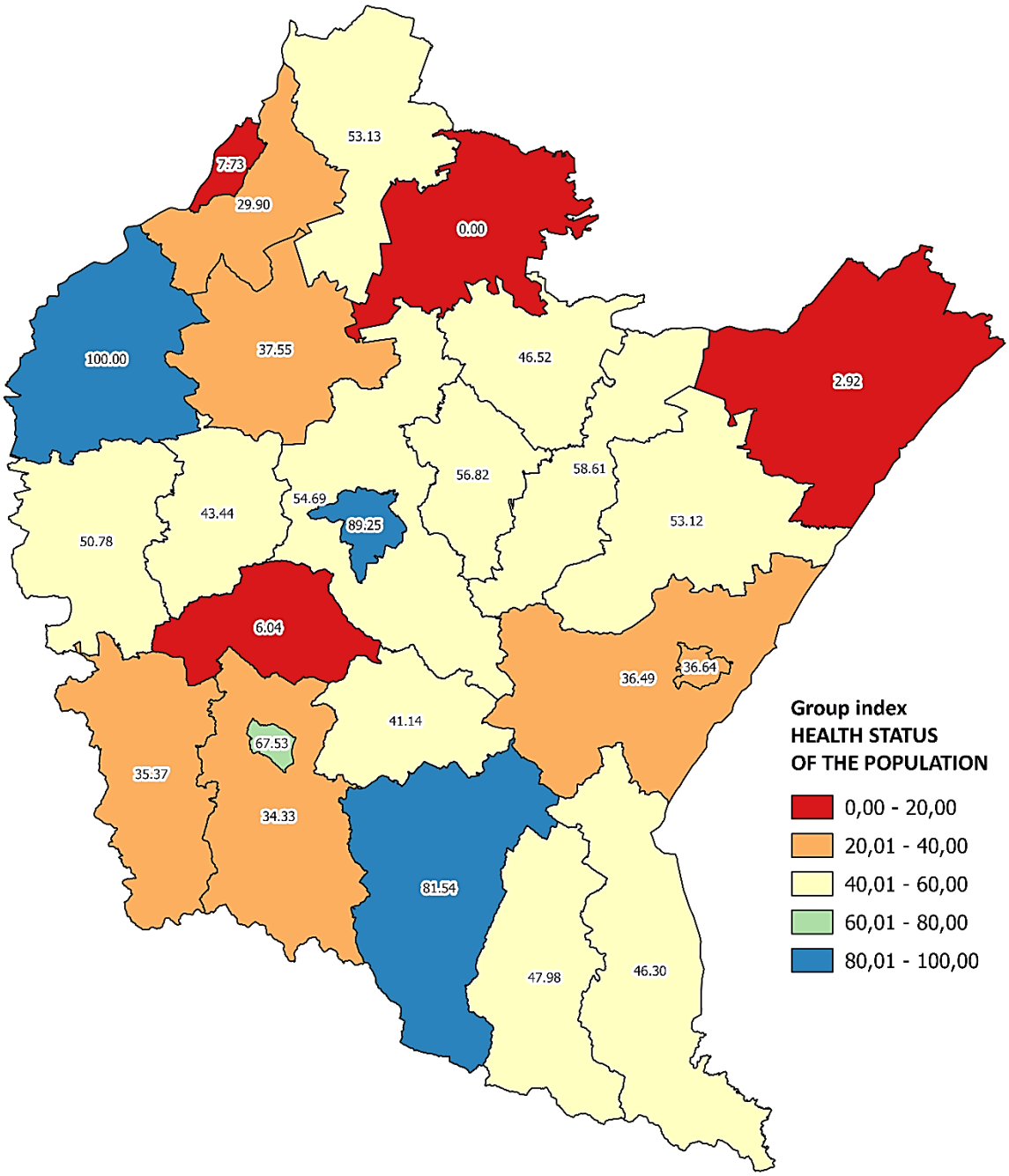


Figure 2. Group index of the functional knowledge level coefficient.

Source: own study.

The counties characterized by the relatively highest health status of residents are Mielecki County, the city of Rzeszów, and Sanocki County. These areas have the lowest risk of death from lifestyle diseases. They also recorded relatively low levels of infant mortality and premature death among men aged 35-49 years. The second group of counties with relatively high health status includes the city of Krosno and the counties of Przeworski County, Łańcucki County, Rzeszowski County, Stalowowolski County, Jarosławski County and Dębicki County. The counties with the lowest health status are Niżański County, Lubaczowski County, Strzyżowski County, and the city of Tarnobrzeg.



Map 3. Group index of the population health status coefficient.

Source: own study.

The percentage of people working in the primary sector (agriculture, forestry, hunting, and fishing) is correlated with the level of the group index of population health status. This relationship is illustrated in the following graph – counties with a low percentage of people working in agriculture, forestry, hunting, and fishing exhibited a higher group index of population health status. Pearson's linear correlation coefficient shows a correlation between the percentage of people working in agriculture, forestry, hunting, and fishing and the level of the group index of population health status ($r = -0.462$; $p = 0.02$). The negative value of the correlation coefficient indicates that as the percentage of people working in these sectors increases, the value of the group index of population health status decreases.

Internal migration is the only available statistical parameter describing spatial mobility at the county level. A net population influx (positive migration balance) was recorded in only three counties in the voivodeship. Interestingly, a higher influx than outflux of population was observed in the rural county surrounding the city with county rights – Rzeszów. The case of Łańcucki County is also noteworthy, as it, along with the rural Rzeszów County and the city of Rzeszów, recorded a positive migration balance. The net influx in this county may be attributed to the good road connection with Rzeszów – the largest city in the region, allowing some people working in Rzeszów to live nearby with quick access and significantly lower costs of housing or land. Considering the high spatial density of Rzeszów (especially before its first expansion in 2006), living in the western part of Łańcucki County (Łańcut or Czarna municipalities) was attractive to many. The county with the highest net influx over outflux of population was the rural Rzeszów County. The migration balance was 3.53 people per 1000 inhabitants, slightly higher than the value for Rzeszów. The situation in Rzeszów fits the trend observed in recent years of a positive migration balance. Since becoming the capital of the voivodeship, Rzeszów has significantly strengthened its position as the main growth center in the region, attracting residents from other Podkarpackie counties. This is reflected in a low unemployment rate, higher regional wage levels, and factors related to quality of life (educational, cultural, entertainment, and shopping opportunities).

Counties with the highest negative migration balance, exceeding 3 people per 1000 inhabitants, are three city counties: Krosno, Przemyśl, and Tarnobrzeg, as well as the counties of Bieszczady and Lubaczowski County. The remaining seventeen counties in the Podkarpackie Voivodeship recorded a net outflux of population, ranging from -2.90 people per 1000 inhabitants in Brzozowski County to -0.52 people per 1000 inhabitants in rural Krośnieński County.

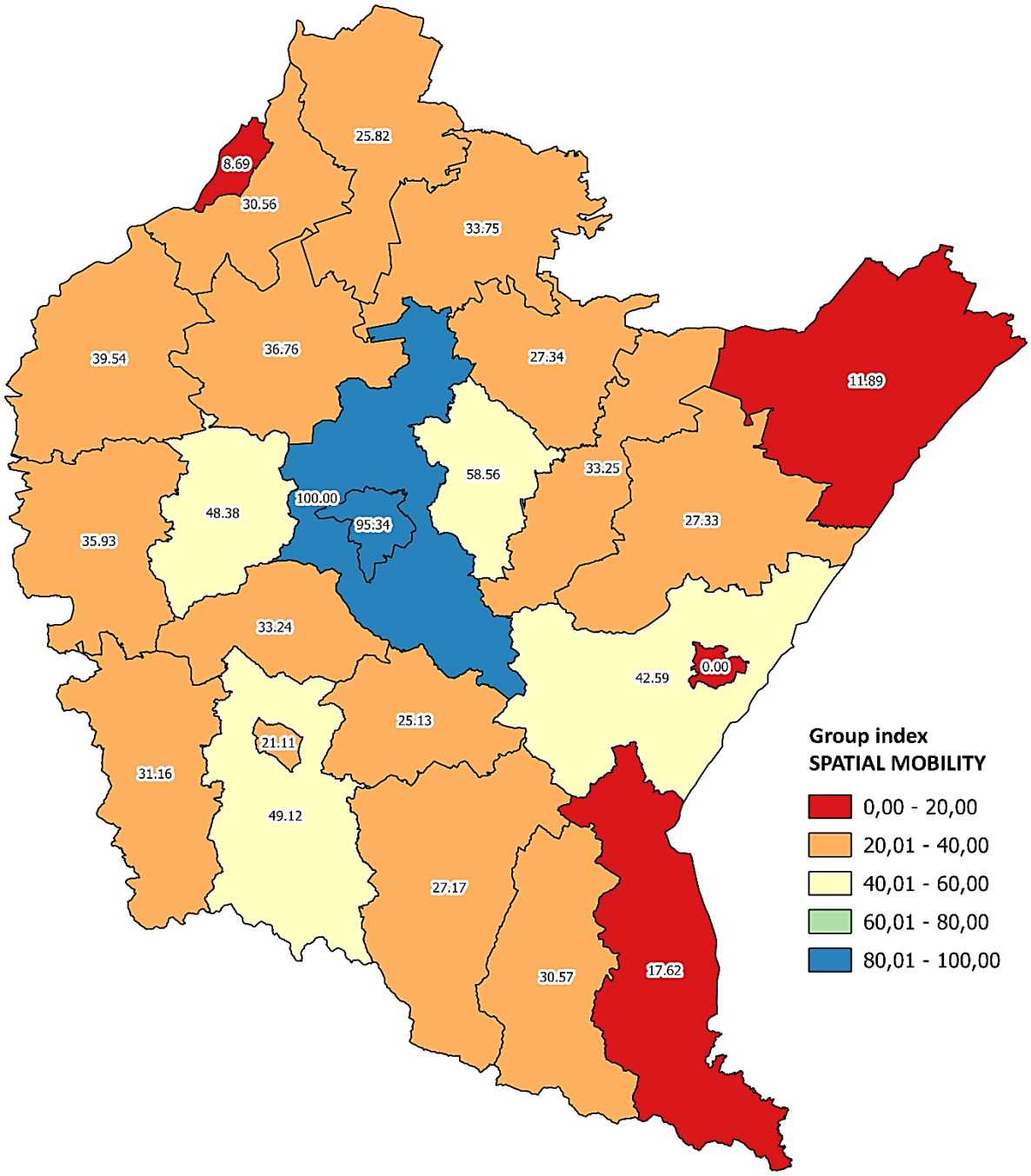


Figure 4. Group index of spatial mobility coefficient.

Source: own study.

The basis for determining the economic activity level of Podkarpackie counties was the ratio of the number of individual business entities per 100 working-age people and the number of newly registered entities per 10,000 working-age people. Including the number of newly registered entities per 10,000 working-age people in the analysis of economic activity levels allowed for a more accurate measure. Relying only on the number of individual business entities per 1000 working-age people does not provide a complete picture. The indicator of newly registered entities helps to supplement the knowledge. The highest levels of entrepreneurship in the Podkarpackie Voivodeship were observed in the city counties – Rzeszów, Krosno,

and Tarnobrzeg, as well as in two counties with a distinctly tourist character – Bieszczadzki County and Leski County. The highest indicator level was recorded in Leski County. Slightly lower values characterized the cities of Rzeszów and Krosno. The high level of individual business entities can largely be attributed to the tourist character of these counties, resulting in a high density of service providers in this sector. In recent years, Bieszczadzki County has seen a dynamic development in tourism. Many hotels, guesthouses, agritourism farms, inns, and restaurants have been established. The lowest density of individual business entities per 1000 working-age people was observed in the eastern counties of the voivodeship: Przemyski County, Lubaczowski County, Przeworski County, and Brzozowski County, as well as in Kolbuszowski County.

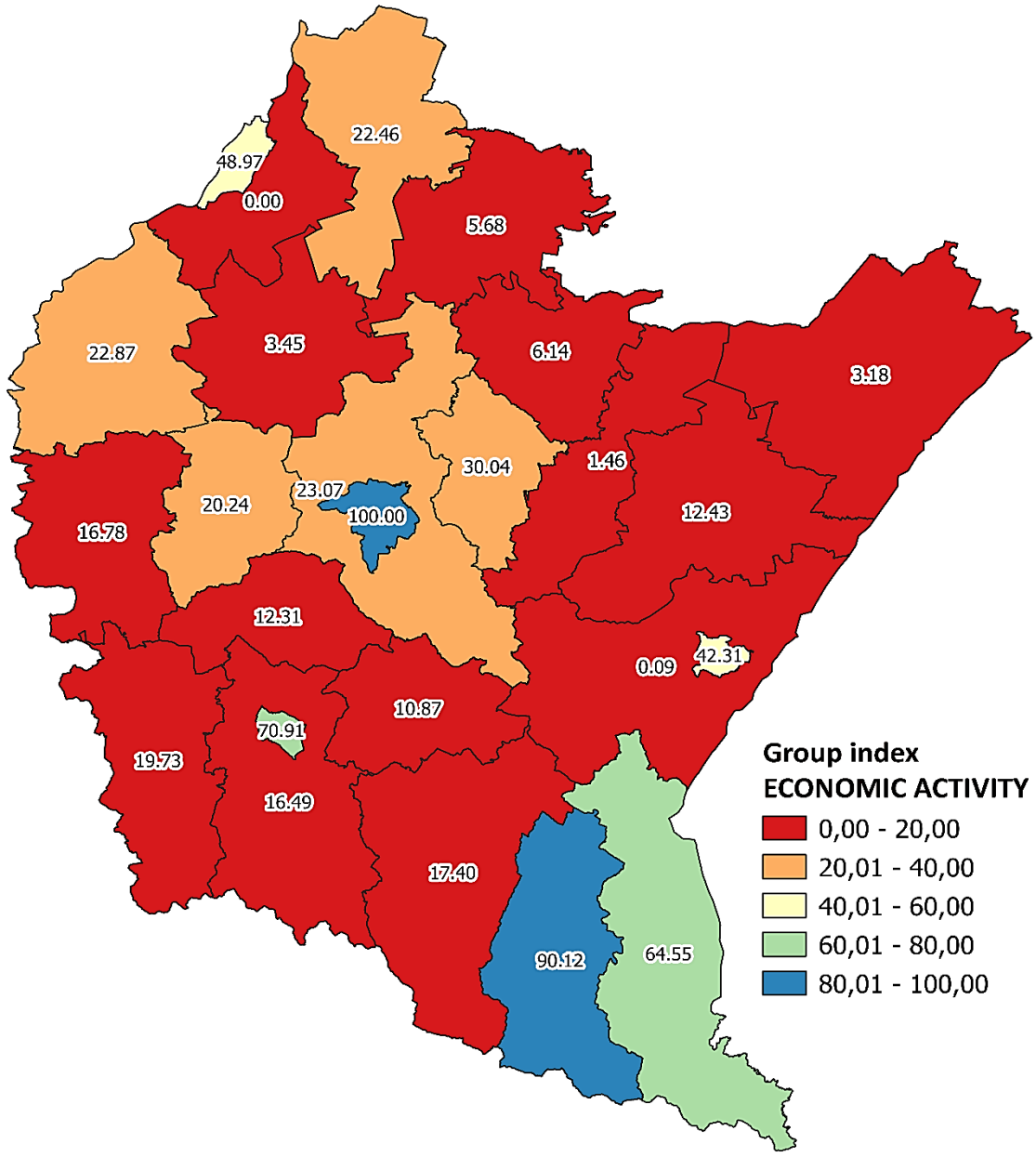


Figure 5. Group index of economic activity coefficient.

Source: own study.

The highest level of social activity is found in counties mainly in the central part of the voivodeship – the city of Rzeszów, rural Rzeszów County, and Łańcucki County, as well as Leski County and the city of Krosno. These five counties can be considered leaders with the highest potential for social activity. The group of counties with a relatively high level of social activity includes Ropczycko-Sędziszowski and Dębicki Counties. The lowest value of the indicator was recorded in Przemyśl. Slightly higher values characterized the counties of Sanocki, Niżański, Tarnobrzeski, Bieszczadzki, and Brzozowski. The group of counties with the lowest level of the indicator also includes Kolbuszowski, Przemyski County, Jasielski, Krośnieński County, Strzyżowski County, Stalowowolski County, and Lubaczowski County.

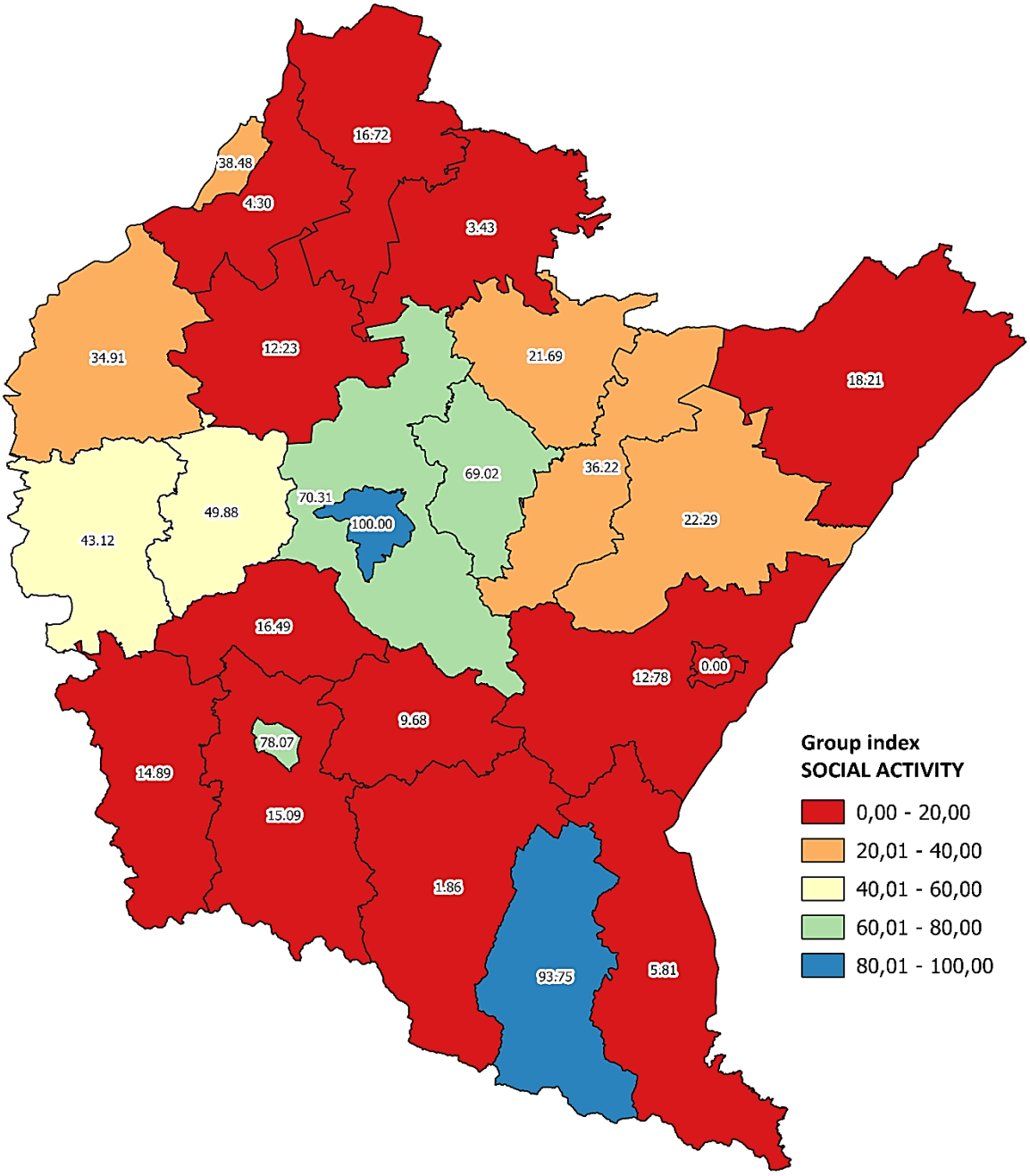


Figure 6. Group index of social activity coefficient.

Source: own study.

For constructing the Human Capital Quality Measure (HCQM), data aggregation was used for six group variables – level 2 indicators. For each group of variables, partial indicators were used. This allowed for the creation of an optimized Human Capital Quality Measure. The county with the highest level of human capital quality was the voivodeship capital – Rzeszów. The region's most populous city, concentrating economic, educational, administrative, and cultural activities, significantly dominates the other counties. The high level of the human capital quality measure also affects the value of the indicator in the rural county, and it is precisely the Rzeszów County that benefits the most from the proximity and position of Rzeszów. Counties with higher-than-average values of the measure included Krosno, Łańcucki County, and Leski County. The counties with the lowest levels of the human capital quality measure were Niżański County, Lubaczowski County, and rural Tarnobrzeg County.

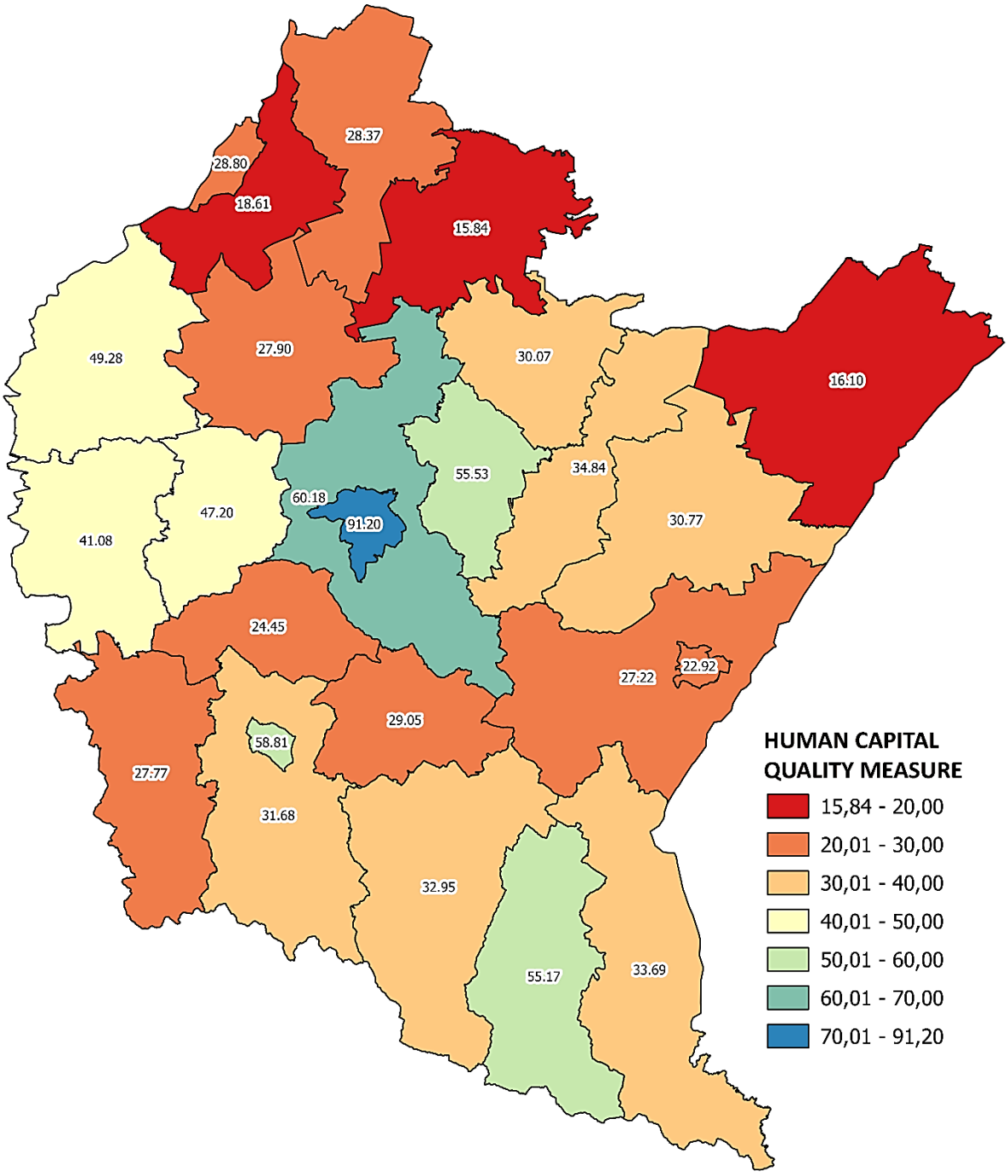


Figure 7. Human Capital Quality Measure.

Source: own study.

4. Conclusions

In the Podkarpackie Voivodeship, there are very significant intra-regional disparities in the quality of human capital, as determined by a synthesized measure, ranging from just under 16 points in the case of Niżański County to over 91 points in Rzeszów. It is notable, however,

that these disparities are not concentrated in specific parts of the voivodeship. The strongest position of Rzeszów is not surprising, as it serves as the administrative, economic, and educational center of the region as the voivodeship capital and largest city. In relation to Rzeszów, all group indicators comprising the synthetic Human Capital Quality Measure achieved the highest or one of the highest values in the voivodeship. Favorable socio-economic conditions contribute to ensuring high-quality human capital, both in terms of developing existing human resources and attracting individuals with high potential from other parts of the voivodeship (and to some extent from neighboring voivodeships). In this context, the role of Rzeszów as the main growth pole in the Podkarpackie Voivodeship, strongly influencing its surroundings, is noticeable (Piróg, 2019). The impact of Rzeszów on its surroundings as a growth pole and the associated processes of developmental diffusion can also explain the high level of human capital in nearby counties: Rzeszowski County and Łańcucki County (Piróg, 2019, pp. 13, 60-62). These counties, compared to others in the voivodeship, stand out in terms of the high values achieved in group indicators: demographic resilience, spatial mobility, and social activity. Based on the analyses conducted, an interesting picture emerges concerning Krosno, which also recorded a relatively high level of human capital quality. The city's good result was mainly due to the values achieved in the indicators for the level of functional knowledge (first position among counties in the voivodeship), health status of the population (fourth position), economic activity (third position), and social activity (third position). The high level of the Human Capital Quality Measure achieved for Krosno, similar to Rzeszów (although to a much lesser extent), can be explained by its relatively high level of socio-economic development and influence on its surroundings (Piróg, 2019, p. 29). Additionally, a distinguishing development factor for Krosno, indicating a high level of human capital for years, is the high level of entrepreneurship measured by the number of registered enterprises per capita (Klimczak, Miller, Wojnicka-Sycz, Sycz, Piróg, 2017, p. 38; Piróg, Błachut, Kotarski, Mularz, 2022). The example of Lesko County shows that a high level of human capital quality can also exist in areas with low levels of physical, financial, intellectual, socio-economic, or administrative capital, as determined in other analyses (Piróg, Wojnicka-Sycz, Walentynowicz, Sycz, 2021, pp. 30-56), although this can be considered rather an exception likely not only on a voivodeship scale, requiring more in-depth case study analyses. The high level of human capital quality in Lesko County compared to other counties in the Podkarpackie Voivodeship was primarily due to high values in economic and social activity indicators (second place in both categories among counties in the voivodeship, with only Rzeszów achieving higher values). The very high value of the economic activity indicator is due to the high number of registered enterprises per capita, mainly in the tourism sector. The high level of human capital is also indirectly reflected in the level of income achieved. In the Podkarpackie Voivodeship, a higher average level of wages relative to the national average in 2022 was achieved only in Rzeszów and Mielec County (Piróg, Kotarski, Błachut, Mularz, 2023, p. 104).

An element connecting counties with the lowest level of human capital quality (i.e., Niżański, Lubaczowski, and Tarnobrzeski) is their peripheral location within the Podkarpackie Voivodeship, although this peripherality varies: Niżański County borders the Lublin Voivodeship, Lubaczowski County borders the Lublin Voivodeship and Ukraine, and Tarnobrzeski County borders the Świętokrzyskie Voivodeship, with the Vistula River acting as an additional natural barrier between Tarnobrzeski County and the Świętokrzyskie Voivodeship.

It is also noticeable that two city counties, Tarnobrzeg and Przemyśl, which were also the capitals of voivodeships before the administrative reform implemented in 1999, have a relatively low synthetic Human Capital Quality Measure value. This can be seen as a worrying phenomenon indicating the declining potential of these cities in various areas of socio-economic development, including human capital.

Although the analysis covered only the Podkarpackie Voivodeship, the methodology used to measure human capital quality can be considered universal enough (due to the availability of data from public statistics) to be successfully applied to comparative analyses at the level of other voivodeships, as well as at the interregional and national levels.

In summary, it is important to remember the limitations associated with using the Human Capital Quality Measure in research. The first and most significant barrier is the limited access to some public statistics data at a more detailed level than NUTS 3, such as municipalities. Another limitation is that not all interesting data in the context of human capital may be publicly available or may be subject to usage restrictions.

It is worth emphasizing that a significant benefit of using the category of human capital in regional development research is its potential to design regional policies that better meet the real needs of the region's inhabitants. Such analyses can become part of the development strategy diagnosis for the region and individual administrative units of the voivodeship – counties or municipalities. This can be achieved through education, labor market, and local policy decentralization activities. The potential for greater use of local human capital resources should become a goal of local development policy. New analytical areas that could enrich the set of indicators should also be identified. Such an area is undoubtedly modern technologies and digitization and their impact on human capital development.

Future research directions on human capital as a development factor include expanding research to international comparisons to assess how Polish counties compare to other countries. Another good direction would be the application of an interdisciplinary approach, combining economics, sociology, social geography, management sciences, demography, and political and administrative sciences for a comprehensive analysis of human capital quality. Interdisciplinary analyses could include, for example, assessing the impact of various public policies on the quality of human capital at different levels of territorial division of the state. Future research directions may also include the use of advanced data analysis techniques and big data to better understand the complexity and dynamics of human capital, as well as creating predictive models that can forecast future changes in human capital quality based on current data and trends.

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