

SPATIAL DIFFERENTIATION OF AGRICULTURAL PRODUCTIVE INPUTS IN ZACHODNIOPOMORSKIE VOIVODESHIP

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Abstract. The main purpose of this paper is to assess the differences in levels of productive inputs in the agriculture of Zachodniopomorskie voivodeship. The research was conducted based on 2010 data from the Local Data Bank of the Central Statistical Office of Poland. The differences in levels of productive inputs were assessed with the synthetic indicator covering three groups of resources: land, labor and capital. As shown by the analysis, 37.9% of municipalities are characterized by high and very high levels of productive inputs, while 34% of municipalities demonstrate low and very low levels. The most favorable situation, in terms of the levels of productive inputs, was reported in the northern and western parts of the region. In turn, the worst situation was observed in the central and eastern parts of the region.

Keywords: productive inputs, land, labor, capital, Zachodniopomorskie voivodeship

INTRODUCTION

Agricultural resources enable reaching a specific production volume and have a direct impact on the amount of incomes. The production volume depends both on the amount and the type of resources used (Gołębiewska, 2008). The agricultural production potential is primarily made up of internal components, including the physical productive input resources (land, labor, fixed assets and current assets) and intangible productive inputs (knowledge, information access etc.) (Borecka, 2010).

Land resources consist of natural goods which include air, soils, mineral resources, water and flora and fauna (Jagoda and Klimczak, 2011). As emphasized by Adamowski (1981), land is the basic productive input which, as such, plays two key roles in the agriculture. First, it is the area where various productive inputs are located, such as farm buildings, and where vehicles (e.g. agricultural machines) move. Therefore, it represents the spatial framework for any kind of economic activity. Second, land is the basic space for natural production processes as it includes mineral and organic matter as well as flora and fauna which constitute the specific substrate for crops grown by humans. As a consequence, land is both the physical basis for production processes and the location where they take place.

In addition to land assets, labor resources are also a key category for analyzing the agriculture potential. According to Dolny et al. (1990), labor resources are a category that reflects the working-age population capable of working, which specifically means people who work or seek work. Meanwhile, considered as a productive input, labor is defined as an individual's ability to perform certain actions, including his/her qualifications and motivations (Słownik..., 1995).

In addition to land and labor resources, capital is a productive input traditionally believed to contribute to the agricultural potential of a specific area. As one of the three basic elements of the resource base, capital determines the use efficiency of other (natural

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and human) resources. It is usually defined as a general category which includes various resource types used in the goods and services production process, affecting the growth and development capacity of the economy. In economic terms, capital is composed of “capital goods”: anthropogenic elements of the geographic environment, i.e. physical capital (real property, machinery, installations and appliances) and infrastructure (service, transport, energy supply, communication, water supply and educational facilities and institutions); and of “financial capital”: the subject of a transaction in the form of cash, loan, securities or own contribution (Pakulska, 2009).

PURPOSE, SCOPE AND METHODS OF STUDIES

The main purpose of this study is to assess the diversification of agricultural productive inputs of Zachodniopomorskie voivodeship. The analysis covered 103 entities (52 rural municipalities and 51 urban-rural municipalities). The data for 2010 used as the basis for this study comes from the Agricultural Census (analysis of land and capital resources) and from the Local Data Bank (analysis of labor resources). The diversification level of productive inputs of entities covered by this study was determined based on three resource groups, i.e. land, labor and capital. The selection of features covered by the analysis was based both on substantive reasons and on the availability of data for the entities considered.

The resources, quality and structure of agricultural land are among the decisive factors for the volume of agricultural production in a geographic area. Therefore, when calculating the level of land resources, the Valuation Index for the Agricultural Production Space (VIAPS), expressed as a score, was used to reflect the quality of land in the geographic area concerned. VIAPS is a synthetic indicator of the diversified impact of specific environmental components (i.e. soil quality, agricultural climate, landscape and water conditions) on the agricultural production potential. Also, as emphasized by Bański (2007), VIAPS level is decisive for the agricultural development of land, and therefore this feature is considered to be a stimulating variable in this study. Meanwhile, the amount of usable land is reflected by the agricultural land area. In the geographic environment, agricultural land performs a number of functions, shaping the broadly defined space of human life and activity. Specific forms of agricultural land play an important

role in developing a harmonious landscape (Głębocki and Świderski, 2007). This is why the research on the level of land resources also takes the following into consideration: area of agricultural land per farm (ha), share of agricultural land in the total area of municipalities (%), share of land under cultivation in the area of agricultural land (%), and share of permanent pasture in the area of agricultural land (%), all of which are also considered to have a stimulating effect. While the share of fallow land in the area of agricultural land (%) was also taken into account in the analysis, it was considered to be an inhibiting variable because of the conviction that fallow land restricts the agricultural production potential.

According to Grela (2010), labor resources of a region may be characterized in quantitative and qualitative terms. The quantitative analysis of regional labor resources primarily covers the socio-demographic features, i.e. age, gender or place of residence. In turn, the qualitative analysis addresses the social and professional characteristics of labor resources, i.e. the education and qualification level and professional activity. Having in mind the availability of data, three features were taken into consideration in the analysis of labor resources. As the population affects the amount of labor resources, this analysis takes into account the migration balance per 1,000 population. Because a positive migration balance means the inflow of population (increased availability of labor), this feature is considered to have a stimulating effect. The second indicator covered is the share of the non-mobile working-age population in the total working-age population (the indicator of ageing labor resources). It enables the assessment of both the current and future situation, and is assumed to have an inhibiting effect. This is consistent with the works of Rosner and Stanny (2014) who found that high levels of the indicator of ageing labor resources mean a relatively lower capacity of the local community to gain new professional qualifications, change their profession and implement innovations. Meanwhile, the third feature, i.e. the share of unemployed people in the working-age population, is one of the basic indicators used to assess the evolution of the labor market (professional activity). Because a high share of unemployed people in the working-age population is undesirable, this indicator is also considered to have an inhibiting effect.

According to Wrona (2006), capital expenditure in the agriculture includes the costs of fertilization, plant

protection products, seeds, breeding material and agricultural mechanization. The author believes that the use of the above and other agro-technical measures allows to maintain a high (plant and animal) production levels also in areas with less favorable natural conditions. The level of capital resources was analyzed with four features being taken into consideration. The first indicator is the livestock density in LSU per 100 ha of agricultural land. According to Godlewska (2005b), the growth of animal production is related to economic development (as the revenues of a society increase, their consumption model evolves: the consumption of meat and meat products increases while that of starch products decreases). Therefore, this feature was assumed to have a stimulating effect. The analysis of capital resources also took account of an economic indicator which reflects the mechanization level, i.e. the number of tractors per 100 ha of agricultural land. According to Bański (1999), mechanization is among the factors that may be decisive for the development potential of the agriculture by increasing labor productivity. Also, higher levels of technical equipment provide significant support for agricultural management and enable higher yields. Mechanization is usually believed to improve the productivity of both labor and land, and therefore is an inherent part of agricultural progress. This is why the above indicator was also considered to be a stimulant variable. Also addressed in the analysis was one of the anthropogenic factors with a significant impact on agricultural productivity, i.e. the fertilization level expressed as the consumption of mineral fertilizers (in kg) per hectare of agricultural land. According to Wrona (2006), to prevent the impoverishment of soils in nutrients as a consequence of the removal of a specific quantity of biomass from the fields each year, the use of natural fertilizers (green manure, dung) or synthetic (mineral, chemical) fertilizer products is necessary. The author believes that both natural and synthetic fertilizers undoubtedly improve the productivity of soil. Therefore, the above indicator was also considered to be a stimulant variable. The analysis also covered the share of farms with an area of up to 1 ha in the total number of farms. Godlewska (2005a) claims that small farms hinder the agricultural development because, due to their size and production level, they do not have enough funds to finance all necessary investments or purchase essential machinery and equipment. Also, their small production scale and, usually, the considerable fragmentation of cultivated land restrict their

capacity to improve labor productivity, make cost savings and diversify their production organization scenarios. Therefore, in order for the agriculture to function properly, it is necessary to develop the most favorable size structure of farms. This is why the above indicator was considered to be a stimulant variable in this analysis.

The simple characteristics listed above were normalized by unitization as per the following formulas (Wysocki and Lira, 2003):

$$z_{ij} = \frac{x_{ij} - \min_i \{x_{ij}\}}{\max_i \{x_{ij}\} - \min_i \{x_{ij}\}} \text{ for variables with a stimulating effect,}$$

$$z_{ij} = \frac{\max_i \{x_{ij}\} - x_{ij}}{\max_i \{x_{ij}\} - \min_i \{x_{ij}\}} \text{ for variables with an inhibiting effect.}$$

The synthetic index value was calculated using the non-model method which consists in averaging the normalized values of simple characteristics used in the analysis as follows:

$$q_i = \frac{\sum_{j=1}^m z_{ij}}{m}, \quad (i = 1, 2, \dots, n); \text{ the values of the synthetic characteristic } q_i \text{ fall into the interval } (0,1).$$

Afterwards, based on the value, arithmetic mean and standard deviation of the synthetic index, the municipalities were grouped into five classes characterized by various levels of diversification of local agricultural resources, i.e. land, labor and capital: class 1: very high level; class 2: high level; class 3: medium level; class 4: low level; class 5: very low level (Ossowska, 2012).

RESULTS OF THE STUDY

The analysis of land resources showed that 33 municipalities (found in class 1 and class 2), located mainly in the northern and south-western part of the region, were in a better than the regional average condition. Because these areas demonstrate favorable natural conditions, such as high quality of soils, these municipalities are primarily active in agriculture as providers of raw materials for food production purposes. Therefore, compared to other municipalities, they reported the highest shares of agricultural land in the total area and of land under cultivation in the area of agricultural land while

having the lowest shares of permanent pasture and fallow land. Their other strength is the large agricultural area per farm which contributes to local agricultural development. In 32 municipalities (found in class 4 and 5), located mainly in the eastern and south-eastern part as well as in the north-western part, the situation was below average. Low levels of land resources in municipalities of the eastern and south-eastern part of the region result from large areas of forests, lakeland and protected areas. Therefore, they reported low shares of agricultural land in the total area and of land under cultivation in the area of agricultural land. Also, because of poorer quality soils, they report higher shares of permanent pasture and fallow land in the area of agricultural land. In turn, municipalities located in the north-western part of the region have a low level of land resources for several reasons, including because their area includes the Szczecin Lagoon and the Szczecin-Świnoujście fairway which significantly limits the agricultural area.

According to a synthetic assessment, the level of labor resources is highly diversified across rural and urban-rural municipalities of Zachodniopomorskie voivodeship. A better-than-average situation is reported by municipalities adjacent to two urban centers in this region, i.e. Szczecin and Koszalin, and by two smaller tourist towns: Kołobrzeg and Darłowo. These municipalities experience an inflow of migrants, primarily because the local economy provides better opportunities for creating and maintaining jobs; and as shown by other authors (Osowska and Poczta, 2009; Stanny, 2013), the economic factors (mainly including employment) are the most common reason for migration. Furthermore, greater mobility is usually characteristic of young people motivated by the desire to improve their working conditions. As a consequence, these regions also report smaller shares of non-mobile working-age population and of registered unemployed people in the total working-age population. Meanwhile, the central areas located outside the impact zone of the region's largest cities have lower-than-average levels of local labor resources. Due to high percentage of registered unemployed people, which exceeds 20% in some municipalities (mainly in the Białogard, Świdwin and Szczecinek districts), these regions suffer from outmigration. As emphasized by Rosner (2012), an additional disadvantage for outmigration regions is that people who highly contribute to the creation of local human and social capital usually have a higher share in the population migrating from rural areas.

As shown by the analysis of capital resources level, 31 municipalities (located in the northern and south-western part of Zachodniopomorskie voivodeship) demonstrate above-average levels of capital resources. Because they are mostly engaged in agricultural activities, they report high, favorable levels of mechanization (calculated as the number of tractors per 100 ha of agricultural land) and of mineral fertilizers used per hectare of agricultural land. What is also characteristic of these municipalities is the quite small share of farms with an area of up to 1 ha which could indicate a greater potential for labor productivity improvement, cost savings and diversification of production organization scenarios. In turn, lower-than-average levels of capital resources were recorded in 33 municipalities, located mainly in the eastern part of the region. Because these areas are mostly characterized by a considerable share of forests and protected areas, they demonstrate the lowest mean values of indicators used in this analysis.

By combining three synthetic indicators, i.e. the level of land, labor and capital resources for each unit under consideration (with the non-model method), the aggregated indicator of the level of agricultural productive inputs was calculated. The results of this analysis are as shown in Table 1 which also includes the sub-indicators taken into account for specific resource groups. For the spatial distribution of the aggregated indicator, see Figure 1.

As calculated, the highest levels of productive inputs are demonstrated by class 1, composed of 11 municipalities representing 10.7% of all units covered by this analysis. The municipalities are mainly located in the south-western part of the voivodeship. Note that in class 1, all indicator values under consideration went beyond the average levels for the entire region covered. Class 1 municipalities are characterized by high levels of land resources which is primarily caused by the presence of good and very good soils. Therefore, they also demonstrate a quite high share of agricultural land in their total area and of cultivated land in the agricultural land area, with a smaller share of permanent pasture and fallow land in the agricultural land area. These resources are a favorable basis for agricultural activities performed in these areas. Additionally, because these municipalities are located near the region's largest city (Szczecin), they also report a distinctively high level of labor resources (population inflow and a positive migration balance) and a low

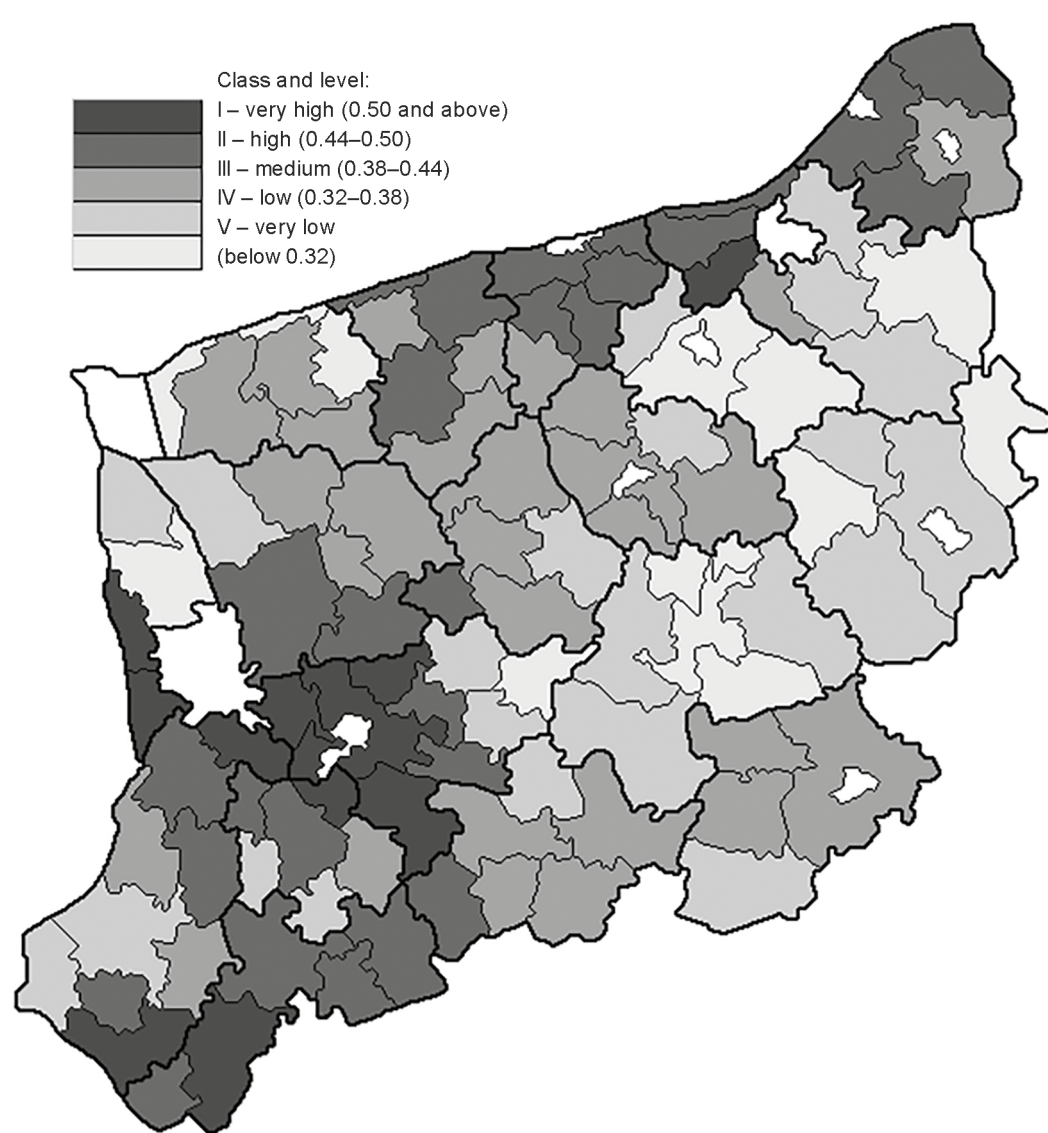


Fig. 1. Differences in levels of productive inputs (land, capital, labor) in Zachodniopomorskie voivodeship

Source: own elaboration based on calculations.

share of registered unemployed people. What is also characteristic of these areas is the high level of capital resources resulting from the high density of livestock per 100 ha of agricultural land, high mechanization levels (large number of tractors per 100 ha of agricultural land), high levels of (mineral) fertilizer use and a low share of farms with an area of up to 1 ha in the total number of farms.

The next (2nd) class included 28 municipalities, i.e. 27.2% of all units in the region covered by this analysis. Just as in the case of class 1, class 2 areas are located in the south-western and northern part of the voivodeship. Because they are located in the vicinity of class 1 municipalities, class 2 areas also demonstrate a highly similar (high) level of natural resources, largely conditioned by the presence of good quality soils. Also, compared to

Table 1. Indicators of land, labor and capital resources by classes of rural and urban-rural municipalities of Zachodniopomorskie voivodeship

Specification	Class					Total
	I	II	III	IV	V	
Number of municipalities	11	28	29	22	13	103.00
Share of municipalities	10.68	27.18	28.16	21.36	12.62	100.00
Average value of the synthetic indicator	0.53	0.45	0.40	0.34	0.28	0.40
Level of land resources	0.57	0.54	0.50	0.43	0.35	0.48
Area of agricultural land per farm (ha of agricultural land)	28.06	22.51	24.31	19.72	17.92	22.43
Valuation Index for the Agricultural Production Space (score)	76.18	71.48	66.76	64.09	57.78	67.35
Share of agricultural land in total area (%)	52.28	54.40	42.81	37.52	30.95	44.35
Share of cultivated land in agricultural land area (%)	75.40	72.28	72.72	58.50	50.14	67.00
Share of permanent pasture in agricultural land area (%)	16.19	17.84	15.75	20.12	18.36	17.63
Share of fallow land in agricultural land area (%)	2.34	3.10	2.94	5.09	6.68	3.85
Labor resources level	0.53	0.42	0.33	0.31	0.23	0.36
Migration balance per 1,000 population	10.48	0.77	−1.71	−1.91	−5.48	−0.25
Share of unemployed in the working-age population (%)	9.45	10.22	13.49	14.12	15.63	12.58
Share of non-mobile working-age population in total working-age population (%)	36.92	38.79	39.07	39.11	40.34	38.93
Capital resources level	0.47	0.40	0.37	0.29	0.25	0.36
Livestock density (LSU/100 ha of agricultural land)	76.48	22.05	23.71	22.99	23.89	28.76
Tractors per 100 ha of agricultural land (units/100 ha of agricultural land)	3.91	3.98	3.48	3.18	2.57	3.48
Use of mineral fertilizers per 1 ha of agricultural land (kg/ha of agricultural land)	185.96	140.52	127.83	80.82	36.48	115.92
Share of farms of up to 1 ha in the total number of farms (%)	18.98	23.60	27.31	35.86	33.79	28.06

Source: own elaboration based on the Bank Danych Lokalnych (n.d.).

class 1 municipalities, they demonstrate a comparable level of labor resources but differ much more significantly in the level of capital resources. The biggest differences between the two classes exist when it comes to livestock density per 100 ha of agricultural land.

Class 3 proved to be the most numerous with 29 municipalities, representing 28.2% of all entities covered by this study. Because of their number, the municipalities grouped in this class are located throughout the voivodeship, with the largest clusters being found in the north-western, central and southern part. The general synthetic measures show an average level of productive

inputs (land, labor and capital). However, when analyzed, specific sub-indicators turn out to be usually lower (in the case of those with a stimulating effect) or higher (in the case of those with an inhibiting effect) than the general level recorded in the region. These municipalities reported a negative migration balance, which suggests outmigration and contributes to lower levels of labor resources. In class 3 municipalities, the lower levels of land and capital resources are mainly affected by the below-average quality of soils and by the resulting lower share of agricultural land, as well as by low levels of fertilizer use and mechanization. The advantageous

position of this class is the consequence, on one hand, of the involvement of some municipalities in tourist activities (Kamień Pomorski, Gryfice, Kołobrzeg and Wałcz districts) and, on the other, of the historical background related to the operation of national agricultural holdings (Łobez and Świdwin districts).

Class 4 was composed of 22 municipalities, representing 21.4% of entities covered by the analysis, located primarily in the central and eastern part of the voivodeship and demonstrating a low level of productive inputs. In this group, the values of the analyzed synthetic indicators for the three resources turned out to be slightly below the regional average. Because of poorer quality soils, these areas are characterized by a lower share of agricultural land and cultivated land and by a higher share of permanent pasture and fallow land in the area of agricultural land. Also, this class demonstrates low levels of labor resources. This is primarily caused by the quite high share of unemployed people in the working-age population which results in outmigration. Furthermore, because of the low density of livestock per 100 ha of agricultural land, small number of tractors, low use of mineral fertilizers and a quite high share of farms with an area of up to 1 ha, this class is also characterized by low levels of capital resources.

Class 5, demonstrating the lowest levels of productive inputs, consists of 13 municipalities representing 12.6% of all entities taken into consideration. They are located in Stargard, Białogard, Szczecinek, Koszalin, Kamień Pomorski, Police and Drawsko districts. In this group, the values of synthetic indicators for the three resources covered by the analysis turned out to be the most disadvantageous compared to other classes. The unfavorable situation of these areas is primarily conditioned by low-quality soils which, combined with low use levels of mineral fertilizers and poor mechanization, significantly reduce the farms' production potential. The consequence are the increasing unemployment rates and the outmigration to suburban areas in search of better opportunities and living conditions.

SUMMARY

In accordance with the main objective of this study, the differences in levels of productive inputs (land, labor and capital) in rural municipalities and urban-rural municipalities of Zachodniopomorskie voivodeship were assessed.

In summary, the analysis shows that 37.9% of municipalities surveyed demonstrated high or very high levels of productive inputs while low or very low levels were reported for 34% of municipalities. As regards the levels of productive inputs, the situation of northern and western parts of the region is definitely better than average. The main reason for this are the developed agricultural and tourist functions and the impact of the voivodeship's largest urban centers (Szczecin and Koszalin) located in this area (note that suburban areas may be the location of supporting facilities or bedroom communities). In turn, the central and eastern parts of the region demonstrate below-average conditions. In this part of the voivodeship, the municipalities are outside the influence of large cities and are not involved in agricultural or tourist functions. Moreover, especially the eastern part is characterized by a large share of forests, protected areas and lakeland, which explains the lower population density in this part of the voivodeship.

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