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Commercial Farms in Polish Metropolitan Areas: Changes in Production Factors*

Abstract: Both the literature and economic practice increasingly note differences in adaptation processes taking place in farms operating in the immediate proximity of large cities and other commercial farms. In areas where urbanisation and metropolisation processes are ongoing, agriculture not only faces a number of obstacles, but also many opportunities, and as a result processes of structural change are very rapid here. The identification of tendencies to changes in resources of farm production factors may constitute a basis for developing very useful research in Poland aimed at the introduction of appropriate development strategies for urban and peri-urban agriculture. The aim of this paper is to present directions of changes in production factors of commercial farms operating in six selected Polish metropolitan areas (MA). Detailed analyses covered 189 farms in six Polish metropolitan areas. The farms researched from 2004 to 2016 provided continuous data to the Farm Accountancy Data Network (FADN). The comparative material used in the analyses covered 1665 farms outside of metropolitan areas. The analyses of commercial farms' production capacity have shown that farms in MA inner zones (in immediate proximity of the city core) in 2004 possessed larger average resources of land, labour and capital. Between 2004 and 2016, production capacities of farms in the inner and outer zones of the MA evened out to a large extent. However, their average potential was still bigger compared to farms outside of metropolitan areas. Observation of ongoing changes has confirmed that the biggest percentage of farms reducing land, labour and capital resources was in the inner zone, which confirms the existence of barriers to their further development, i.e. limited supply of land and high opportunity cost of labour, among other things. It seems that these farms have to look for alternative development paths, namely they should focus on diversification and the development of non-agricultural services.

Keywords: commercial farms, metropolitan area, production factors, location.

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1. Introduction

The structural changes taking place in the Polish economy significantly impact the transformations in the rural areas. Processes playing the biggest role in the transformations observed in rural areas include: a decreasing proportion of rural inhabitants in the country's overall population (de-ruralisation), reduction of agriculture's impact on the economy and of farmers' impact on society (de-agrarianisation), changes in the social structure of rural areas, modification of tier hierarchies within rural areas (re-stratification) and the adaptation of agricultural production structures to market-economy needs (accommodation) (among others Halamska 2011a; Wilkin 2008). However, these processes vary in intensity across the country. More and more often, analyses of the changes in agriculture highlight the differences between rural areas in the immediate proximity of large cities and those in peripheral areas (Sroka and Musiał 2016).

In formal definitions, the distinction between a city and a rural area was usually based on a dichotomy, i.e. contrasting urban (i.e. non-agricultural) and rural lifestyles. Although this approach has become outdated (Halamska 2011b), it is still very common, also in the minds of many scholars and those in charge of the development of cities and their metropolitan areas. In Poland, agriculture and farms located in such areas are often regarded as an archaic remnant of rural areas, and the activity of the farms as undesirable (Sroka and Musiał 2016). For many decades, agricultural economists have not been interested in research into the agriculture of Polish metropolitan areas, and farms located in such areas are ignored in agricultural policy (Zegar 2018).

Maintaining agriculture, both farmland and farmers, in the face of expanding and intensifying urban pressure has become an issue of increasing public interest. Concerns include loss of potential future food production, provision of a fresh local food supply, preserving open space for environmental and aesthetic reasons, and allowing farmers the choice to remain in farming as a livelihood (Larson, Findeis and Smith 2001; Siegner, Sowerwine and Acey 2018). Research in other metropolitan areas shows that urbanisation presents numerous obstacles to farmers, but access to land may be the most pressing. A limited supply of vacant land has contributed to high land costs in urban and peri-urban areas (Rogus and Dimitri 2015), which hinders the maintenance of the traditional direction of agricultural production. In these areas there is also higher competition for workers, because the attractive labour market encourages the adoption of non-agricultural activities (Wästfelt and Zhang 2016). The phenomena described above thus generate adaptation processes and changes in the resources of production factors.

Until now no scholars have researched both the dynamics and factors of commercial production of farms in Polish metropolitan areas, and in other countries, too, scholars very rarely possess standardised data, basing themselves rather on selective case studies (Pölling et al. 2017a; Sroka, Wąs and Pölling 2016; Van Veenhuizen and Danso, 2007; Wästfelt and Zhang 2016). Identification of tendencies to change in the resources of farm production factors may constitute a basis for developing very useful research in Poland aimed at the introduction of appropriate development strategies of urban and peri-urban agriculture.

The aim of the paper is to present directions of change in commercial farms' production factors in six selected Polish metropolitan areas. There was also an attempt to assess how these changes are influenced by the location of farms in relation to the cores of metropolitan areas.

2. Urbanisation and metropolisation as processes responsible for changes in agriculture

In recent years, a new global phase in urbanisation development, i.e. metropolisation, has been assuming particular importance. It is one of the most important processes responsible for functional and socio-economic transformations in settlement systems (Piorr, Ravetz and Tosics 2011; Smętkowski, Jałowiecki and Gorzelak 2009). Metropolisation leads to a concentration of specialised, unique and rare global and cross-regional functions in particular cities. The growing strength of the main centre results in changes in its environment (Grochowski 2011; Smętkowski, Jałowiecki and Gorzelak 2009). Metropolisation also leads to transformations in the economy, society, culture and in the way space is used (Noworól 2014; Smętkowski, Jałowiecki and Gorzelak 2009).

In this analysis metropolisation is understood as a special case of the urbanisation process. Large cities have a greater influence on their surroundings than smaller ones, hence it can be assumed that urbanisation which is multiplied by metropolisation processes may have a bigger impact on the changes in agriculture and farms. However, we are not going to determine which of these processes (metropolisation or urbanisation) has a greater influence on the course of transformations in agriculture.

Research conducted in Europe as part of the Plurel programme shows that agriculture and agricultural areas within metropolitan areas are in particular danger of marginalisation and impairment of their productive, social and environmental functions. The research pointed out that urbanisation pressure is leading to significant changes in space, which in turn result in the degradation of peri-urban areas (Piorr, Ravetz and Tosics 2011; Zasada 2011). In the last decades of the 20th century,

especially in peri-urban areas, agricultural areas, which are a basic component of the rural landscape, increasingly began to change their functions from productive and agricultural to residential, commercial, communication, production and investment. As a result, agricultural areas between urbanisation zones became built up, moving the supply zones away from the city centres (Maciejewska 2012; Musiał-Malagó 2014). The irrepressible character of suburbanisation processes has a negative impact on the quality of the space of peri-urban areas, leading to degradation of precious open spaces, agricultural areas and wildlife as well as the natural, cultural, landscape and recreational resources. The consequence is increased pollution of the natural environment and negative changes in the cultural environment (Brzeziński 2010).

Research by Sroka (2018) shows that in Polish metropolitan areas, since the 1970s, and especially after 1990, the process of converting agricultural areas to non-agricultural purposes has been on the rise. Initially, the dynamic growth was limited to cities, which were absorbing the neighbouring areas, but later the process of suburbanisation followed. Between 2010 and 2014, the percentage of agricultural area converted to non-agricultural purposes in Polish metropolitan areas was over twice the average for the country as a whole. The factor that significantly determined the differences in the process of conversion of agricultural areas turned out to be the municipalities' distance from the core of the metropolitan area. The closer to the core, the faster the process of conversion.

Observation of urbanisation processes was also reflected in scholars' approach to the location theory, including location of agricultural production. The foundations of the continuously evolving location theories were laid by D. Ricardo and J. H. von Thünen, who worked on the development of the theory of land rent (Czyżewski and Matuszczak 2016). Although von Thünen's theory is obsolete, its main assumptions about the huge role of the location factor in land-use changes should not be underestimated (O'Kelly and Bryan 1996). The direct approach applies the Thunian model of rural land-use allocation to the problem of urban-rural land conversion (Kellerman 1978). It was also clearly expressed by Sinclair (1967), who noted that non-agricultural uses which bring higher rents "push" agricultural production out of cities. Contemporary research also shows that the way land is used in areas subject to urbanisation processes is determined by economic rents (Sroka et al. 2018). Land is expected to be used for the purpose that brings the greatest utility, taking into account the relative benefits of alternative land uses (Diogo, Koomen and Kuhlman 2015). Adaptations by farmers operating in metropolitan areas are also explained by utility theory (Nogal 2014).When deciding how to use his/her limited resources of land, labour and capital, the owner is guided by the principle of utility maximisation. Utility depends on economic

agents' preferences for specific objectives and on the degree to which they are achieved. For instance, every farmer has certain objectives that they strive to achieve while engaging in crop production, e.g. increasing profit/income levels, expanding business, and having more leisure time (Diogo, Koomen and Kuhlman 2015). If the labour and capital resources employed do not bring expected the gains (their utility is less than expected), they are used for other purposes. A consequence of such adjustments in metropolitan areas is an increasing proportion of part-time farmers and a bigger proportion of farms conducting non-agricultural activity compared to other regions (Sroka 2016). Farms' adaptations with regard to land as a production factor are of a slightly different nature. This is due to a range of specific qualities of land (i.e. it is not expandable and is immobile) and a relative shortage of land in metropolitan areas (Szymańska 2012). If the utility of land is unsatisfactory, its owners may sell or lease it, or take actions aimed at increasing productiveness. In Western European countries, land is most often leased to other farmers (e.g. almost 60% of farms in the Ruhr Metropolis are leasehold) or has been converted to non-agricultural use (Pölling, Mergenthaler and Lorleberg 2016). Farmers who decide to continue farming use a range of adaptation strategies: a) specialisation and minimisation of costs, b) diversification into non-agricultural activities and services to urban residents, c) differentiation, i.e. distinguishing itself by offering new products and services and d) sharing economy. Research by Pölling, Sroka and Mergenthaler (2017) indicates that over half of the farms in the Ruhr region apply the above strategies, adapting their production profile and sales channels to the urban customer. The authors cited emphasise that in areas under huge urbanisation pressure (cities) only farms that have assumed appropriate strategies can continue to function. The owners of farms that failed to meet market requirements have had to give up farming, making their resources available to other farms or converting them to other purposes.

Summing up, it should be noted that in areas subject to urbanisation pressure there has been a gradual decrease in the number of farms and jobs in agriculture. However, urbanisation also accelerates structural changes and drives processes of adapting agriculture and farms to urban conditions.

The overlap between location, social, economic and environmental factors makes the process of inference much more difficult. However, apart from the environmental attributes of agricultural space, an analysis of the structural changes in metropolitan areas should take into account the size and economic strength of the urban centre (core), its distance from other economic centres, labour market responsiveness and the level of infrastructural development of the area concerned (Wojewodzic 2017). It was decided that the analysis of changes in commercial farms will only take into account the impact of the location factor. This is because

location determines the course of socio-economic processes and is one of the most important factors responsible for changes in agriculture and farms (Sroka 2018).

3. Materials and Methods

Metropolitan areas are still defined in different ways both in the literature and Polish law, which leads to different interpretations of this term. According to Markowski and Marszał (2006), a metropolitan area is a functionally coherent system of a number of settlement units and highly urbanised areas whose main characteristics include the existence of metropolitan functions as well as functional and economic links. A metropolitan area (MA) includes a zone of a significant, constant direct influence and areas with development potential. A metropolitan area within the meaning of the act of 9th October 2015 on metropolitan unions (Journal of Laws 2015.1890) is a spatially coherent influence zone of a city in which the seat of a voivode or voivodeships (the regional parliament of the province) is located, characterised by strong functional links and advanced urbanisation processes and at least 500,000 residents. For the purpose of the research objectives formulated in the project,[1] this paper adopted the definition of MA presented in the Concept of National Spatial Development 2030 (Ministry of Regional Development 2011) according to which it is an area of a large city (over 300 000 residents) and its direct environment that is functionally linked to the city as established in the concept of national spatial development.

The research material presented in this paper covers six selected monocentric metropolitan areas (MA): large – Warsaw MA, medium – Cracow MA, Tricity, Poznań and Wrocław MAs, and small – Lublin MA. They were selected so as to reflect the great diversity of environmental and economic conditions in different parts of Poland. Based on planning documents (urban development plans or studies), the geographical scope of a metropolitan area was defined for each of the selected metropolises and divided into the core (city or cities constituting the metropolitan centre), inner zone of MA (municipalities directly bordering the core) and outer zone of MA (Sroka et al. 2018).

Based on planning documents, the core (central city or cities), inner zone of MA (municipalities in immediate proximity to the core) and outer zone of MA were identified for each selected metropolitan area. The source material used for the analyses was numerical data obtained from the database of the Polish Farm

[1] Urban agriculture as a challenge of sustainable development of metropolitan areas in Poland – socio-economic, environmental and planning aspects. Grant No. 2016/21/D/HS4/00264 under National Centre for Science.

Accountancy Data Network (FADN). From the farms participating in the FADN system for a continuous period between 2004 and 2016, those operating in municipalities located in metropolitan areas around the six selected provincial cities were chosen (Table 1). The FADN database did not include farms in MA cores. There were 46 farms in the inner zone of MA, and 143 in the outer zone. The data used in this analysis cannot determine whether the farmland is located entirely in the appropriate zone. However, the FADN database did not include any farms in the core metropolitan areas, and hence these farms often have part of their farmland outside the MA core. What is more, according to the GUS data (2013), this problem is rather not applicable to individual farms. There may thus be a slight probability of distortion of research outcomes as a result of the improper classification of farms to a particular location zone.

Table 1. Number of commercial farms participating in the FADN system for a continuous period between 2004 and 2016

Metropolitan area	Inner zone	Outer zone	MA in total	Outside of MA*
Wrocław MA	7	9	16	126
Lublin MA	5	5	10	280
Cracow MA	9	14	23	129
Warsaw MA	1	46	47	358
Tricity MA	12	35	47	141
Poznań MA	12	34	46	631
In total	46	143	189	1,665

* Number of farms located in the voivodeships in which the metropolitan areas analysed are located

Source: Own study based on FADN data.

The above groups of farms were analysed comparatively against farms in the same voivodeships outside of metropolitan areas in terms of changes in land resources, labour input and the value of a farm's assets (without the land). The discussion presented in this paper uses the terms used in the FADN system.

4. Research findings and discussions

The paper analyses processes in commercial farms as well as records of the basic categories of costs and output according to the FADN system between 2004 and 2016 (Table 2). The analysis has shown that the surface area of farms in metropolitan areas is bigger compared to the average for the regions examined. Although the data

are not representative of all farms, in analysing GUS data Sroka (2014) also noted that in Polish cities the proportion of farms of over 10 ha is above the national average (after excluding farms of less than 1 ha), and structural changes occur there faster. This is because farm owners who are much more likely to find an off-farm job decide to continue farming only if it provides a satisfactory income (Wästfelt and Zhang 2016). Farmers earning an above-average income will thus be most likely to engage in commercial farming. The other land owners will cease farming, resulting in an increasing proportion of abandoned farmland (Sroka, Płonka and Krzyk 2017).

Table 2. Land resources in the farms examined (2004-2016)

Specification	Group size	Total agricultural area [ha]		Percentage of land added by leasing		Percentage of farms that reduced agricultural area in 2004-2016
		2004	2016	2004	2016	
		On average in a farm				
MA inner zone	46	38.4	41.7	33.3	35.9	39.1
MA outer zone	143	29.8	41.8	17.9	24.6	21.7
MA in total	189	31.9	41.8	21.7	27.4	25.9
Outside of MA	1665	27.0	32.9	18.4	19.7	25.1
Individual metropolitan areas*						
Wrocław MA	16	55.1	70.2	35.0	33.3	31.3
Cracow MA	23	25.8	43.9	25.3	30.2	26.1
Warsaw MA	47	20.7	33.8	16.2	28.5	34.0
Tricity MA	47	39.1	43.0	18.0	23.2	23.4
Poznań MA	46	34.3	41.8	22.2	24.8	19.6
Outside of metropolitan areas*						
Dolnośląskie	126	45.6	55.7	27.9	23.5	27.0
Małopolskie	129	14.4	19.3	21.8	26.1	19.4
Mazowieckie	358	20.7	24.7	15.1	17.0	32.4
Pomorskie	141	53.1	61.1	20.6	15.8	20.1
Wielkopolskie	631	26.8	32.1	14.9	18.1	24.2

* Due to the insufficient size of the sample from the FADN database, the Lublin metropolitan area was excluded

Source: Own study based on FADN data.

If a farm has a large surface area or increases it, it is perceived as a sign of its development and adaptation to changing external conditions. However,

in municipalities close to the metropolis core, the possibilities for increasing a farm's area are limited. This phenomenon is mainly determined by the decreasing supply of farmland (this land is converted to non-agricultural use), and its high prices, which are the result of strong competition between various land users (Rogus and Dimitri 2015). The research shows that in the MA inner zone the average area of the farms examined grew by only 3.3 ha, while in the other farms in metropolitan areas it grew by 12 ha, i.e. by over 40%. Although in 2004 farms in inner zones had a relatively large area and relatively large capital (Table 4), over the last 12 years they have been unable to acquire additional land, either through purchase or through leasing. Moreover, as much as 39.1% of farm owners decided to reduce their farm's area, and capital value (Table 4) grew much more slowly compared to other farms. Similar processes are noticed by Rogus and Dimitri (2015), who analyse changes in the agriculture of metropolitan areas in the US. Those farms are also shrinking; however, by manufacturing high added-value products, including vegetables and animal products such as eggs they are adapting to urban conditions on a larger scale than other farms.

It thus seems that for some farms in Polish MAs the possibility of development by expansion has been exhausted and that such farms will also increase the significance of high added-value production and services in future, or there will be divestment and transfer of resources to other activities. Cases from other countries, including Germany, Italy and Spain, show that farms in peri-urban areas are more likely to diversify, increasing the importance of services to local inhabitants in income generation (Pölling et al. 2017). This is also confirmed by domestic research (Sroka 2016).

A detailed analysis has shown that the average area of farms recorded an increase in all the zones examined. The commercial farms that increased their area mainly acquired land from farms that were not linked to the market or had ceased agricultural activity (Wojewodzic 2017). Analysis of changes in the average surface area of farms located in outer zones has shown that changes there are much faster compared to the average for the regions examined. In 2004, the average surface area of such farms was close to the average for the voivodeship, while in the following years it grew by over 40%, i.e. twice as fast as in farms outside of metropolitan areas. In outer zone, owners of small and inefficient farms are more willing to reduce or abandon agricultural production and to make their land available to farms with greater development potential. This, among other things, is due to problems with combining agricultural and non-agricultural activity and lower expectations as to potential economic rents when converting land to non-agricultural purposes. The further away farmland is from the centres of development, the smaller is the price of a land and the easier it is to buy or lease land (Kuethe, Ifft and Morehart 2011).

What is more, land is less likely to be converted to non-agricultural use than it is in the inner zones (Sroka 2018), which is probably the result of a lower demand for building land and for use in other economic activities. This is why in MA outer zones, the surface area of commercial farms grew faster compared to those in inner zones.

Low supply of land, combined with a certain percentage of land owners ceasing agricultural activity, resulted in an increase in the average share of leased land in all the groups of farms. Farms most dependent on leasing were those closer to MA centres, which can be explained by higher land prices and lesser willingness of land owners to sell their land. Similar relationships were also observed in other countries (Larson, Findeis and Smith 2001; Pölling et al. 2017). The sale of land mainly involves plots suitable for building and infrastructure. Consequently, between 2004 and 2016 the biggest percentage of farms cutting their surface areas was recorded in MA inner zones. Such farms accounted for around 40%. In four out of five metropolitan areas, the percentage of commercial farms cutting their surface areas was higher than in other parts of the voivodeship. An exception was Poznań metropolitan area.

Farming families may also improve their living conditions through diversification of income sources and aiming to increase the added value of the products produced by the farm (Zasada 2011). An increase in the degree of product-processing and shortening of distribution chains allows farmers to earn higher incomes, and is often combined with initiatives leading to diversification into non-agricultural activities. Farmers' engagement in non-agricultural activity may in time lead to a relocation of resources from farming to more profitable non-agricultural activity, and even to ceasing farming or the liquidation of a farm (Wojewodzic 2017).

The development of agricultural production technology and rise in the technical level of the equipment used by the labour force facilitate reduced labour input. Changes are particularly noticeable at the level of relative indicators describing labour input per unit of surface area. Observation of changes in labour input has shown that it is highly stable in commercial farms (Table 3) employing an average of around two people. As expected, the number of annual work units (AWU) employed on farms in the immediate proximity of large cities decreased faster, which was affected, among other things, by a high proportion of farms reducing land resources, more effective use of work and pressure from the urban labour market, which offers attractive and diversified paid work opportunities (Wästfelt and Zhang 2016). However, the opposite trend is noticed by Zasada et al. (2013), who highlight that the increase in farm work resources in European metropolitan areas is mainly the result of the intensification of production in farms specialising in vegetable growing. It should be noted that labour resources in farms in Polish metropolitan areas are a few times higher than in Western Europe (Sroka and Pölling 2015), hence their reduction should be interpreted as the streamlining of a production process.

Table 3. Labour input in the farms examined (2004-2016)

Specification	Overall labour input [AWU]		Percentage of contract work		Percentage of farms that reduced labour input between 2004 and 2016
	2004	2016	2004	2016	
	On average in a farm				
MA inner zone	2.3	2.1	12.9	12.0	63.0
MA outer zone	2.0	2.0	7.1	6.0	50.3
MA in total	2.1	2.0	8.5	7.5	53.4
Outside of MA	2.0	2.0	7.9	8.3	49.0
Individual metropolitan areas*					
Wrocław MA	2.3	1.6	16.7	7.2	81.3
Cracow MA	2.3	2.7	11.0	16.2	26.1
Warsaw MA	2.1	2.1	6.3	7.3	44.7
Tricity MA	1.9	1.9	8.0	4.7	57.4
Poznań MA	2.0	1.8	7.3	5.2	58.7
Outside of metropolitan areas					
Dolnośląskie	2.2	1.8	6.4	6.6	66.7
Małopolskie	2.0	2.4	9.5	11.6	33.3
Mazowieckie	1.9	2.0	6.7	8.4	45.3
Pomorskie	2.3	2.3	12.0	13.0	52.8
Wielkopolskie	2.1	2.1	8.0	7.2	50.4

* Due to the insufficient size of the sample from the FADN database, the Lublin metropolitan area was excluded

Source: Own study based on FADN data.

Between 2004 and 2016, the proportion of contract work in labour input was significantly higher in farms in MA inner zones, which was mostly due to a higher proportion of farmers engaged in an intensive production of fruit and vegetables. Similar observations are also made by Pölling (2016), who analyses German urban and peri-urban farms dedicated to vegetable growing, and by Heimlich and Barnard (1992) who describe farms in the US metropolitan areas. Due to the relatively higher labour-market responsiveness in MA cores, peri-urban municipalities, which are usually well connected with the core, recorded a higher percentage of farms reducing labour input (Bertoni and Cavicchioli 2016). The values of the indicators observed would have been even higher if not for the reverse trends in farms in Cracow MA (vegetable production), where both average labour input and the proportion of contract work grew.

The process of intensification of agriculture takes place in stages: the stages of labour and capital-intensive intensification based on the moveable factors of production are followed by the process of mechanisation. Poland's accession to the European Union's structures and the mobilisation of instruments facilitating modernisation of farms not only intensified investment processes – mainly in the area of machinery purchase – but also contributed to boosting the processes of land and capital concentration in entities of a larger economic size (Kisiel and Babuchowska 2013; Mikołajczyk 2017). At the same time, the process of polarisation of farms became increasingly visible. Some farms were unable to invest and were forced by the market into divestment or condemned to slow decapitalisation. Of the commercial farms analysed, almost one third recorded a decrease in nominal value of capital. This rose to 43.5% for such farms in MA inner zones, and even to 58.7% when adjusted for inflation.

Data showing changes in the capital of commercial farms also confirm intensification of polarisation processes. If between 2004 and 2016 the average value of a farm's capital in MA zone I, MA zone II and outside of metropolitan areas grew by 46.7%, 63.5% and 54.8% respectively (Table 4), and a large number of farms recorded a narrowed reproduction in that period, then the increase in capital in developing farms was much higher than the average values presented. Heimlich and Barnard (1992) notice sharp polarisation in analysing north-eastern metropolitan areas in the US. Farms using different adjustment strategies invested three times as much as other farms, which led to a traditional agricultural production (e.g. crops). Hence, Heimlich and Barnard stress that the higher investments were made by farms with intensive farming.

The investment process requires raising significant financial resources. In recent years, part of the investment in agriculture has partially been financed from public funds, mainly the rural development programme (RDP) 2007–2013. However, even in such cases farmers often had to rely on commercial credit, resulting in increased debt for such farms (Grzelak 2015). Observation of changes in debt levels of commercial farms has shown an increase in average debt among farms operating in MA outer zones and at the same time a decrease in the average level of liabilities for farms in MA inner zones. A relatively small and diminishing debt of farms from the MA zone I is the result of a slight increase in asset values. These farms rarely invest, which may threaten their further development. It should be noted that 43.5% of farms in this zone (10 percentage points more than those in the outer zone) noted a decrease in asset values. For comparison, Heimlich and Barnard (1992) state that farms in metropolitan areas of the US are characterised by lower debt ratios than those elsewhere. However, the low debt ratio is mainly the consequence of high value of farm assets in metropolitan areas (the high value

of land increases the asset values); this happens because the debt in absolute values was at the same level in both groups of farms. Comparing the debt ratio of farms in Polish metropolitan areas with the data for all farms in the FADN, it should be noted that the former are more indebted than the latter (Gałecka and Pyra 2016). Thus, farms in the MA outer zones showed a faster increase in their land resources and the value of their remaining assets, hence having a slightly higher debt.

Table 4. Capital[2] in the farms examined

Specification	Average value of a farm's capital [in thousand PLN]		Value of liabilities to overall capital value ratio [%]		Percentage of farms with falling overall capital value between 2004 and 2016	
	2004	2016	2004	2016		
	on average in a farm				nominally	in real terms*
MA inner zone	477.8	700.9	12.3	6.9	43.5	58.7
MA outer zone	399.9	653.8	10.7	14.7	32.2	49.7
MA in total	418.9	665.3	11.1	12.8	34.9	51.9
Outside of MA	379.3	587.3	10.1	10.0	40.4	54.4
Individual metropolitan areas**						
Wrocław MA	364.1	571.6	9.4	25.6	37.5	43.8
Cracow MA	334.5	768.4	9.9	7.2	34.8	52.2
Warsaw MA	435.4	566.8	11.1	5.3	38.3	53.2
Tricity MA	398.5	724.2	11.2	11.8	31.9	51.1
Poznań MA	515.7	712.4	12.0	19.8	41.3	58.7
Outside of metropolitan areas**						
Dolnośląskie	374.2	583.5	11.4	17.9	47.6	53.2
Małopolskie	333.6	447.1	6.8	3.9	52.7	65.1
Mazowieckie	321.3	524.9	8.2	6.9	35.2	46.6
Pomorskie	517.1	1019.7	11.4	19.2	25.7	38.2
Wielkopolskie	442.8	623.7	11.1	10.6	43.6	59.3

* Adjusted for inflation, the consumer price index for 2004–2016 was assumed at 125.73 (http://stat.gov.pl/wskazniki-makroekonomiczne); ** Due to the insufficient size of the sample from the FADN database, the Lublin metropolitan area was excluded.

Source: Own study based on FADN data.

[2] A farm's capital is made up of the value of its: animals, permanent crops, land improvement devices, buildings, machinery and equipment and working capital. It does not include amounts or other rights that can be separated from the value of land (SE 510).

5. Conclusions

In commercial farms one can see processes of accommodation, i.e. adaptation of agricultural production structures to the requirements of the market economy, as well as a polarisation among farms, where one can see processes of land and capital concentration or, alternatively, a reduction in resources. However, the scale and pace of changes in the resources of factors of production vary, and one of the factors determining the scale of processes observed is the location of farms relative to the core of a metropolitan area. Research confirmed that in Polish metropolitan areas there is also a considerably higher rate of change in the resources of production factors, which is already seen in many West European countries and the US.

One in four of the farms examined had reduced the surface area of its land, and for the MA inner zone farms this figure was almost 40%. Despite a significant proportion of farms reducing land resources, the average surface area of a farm recorded an increase in all of the groups analysed. An increase was also recorded in the proportion of land that had been added to a farm by leasing, which in farms located in the MA inner zone accounted for over a third of the surface area of the commercial farms examined. The slower rate of increase in the surface area of farms located closer to the cores of metropolitan areas indicates that the possibility of developing farms by expansion is becoming exhausted. Similar trends are evident in European metropolitan areas, where the diminishing resources of farmland and also the development of infrastructure hinder an increase in farming area. As the literature review shows, a chance for further development may be diversification of activity, including adapting it to the needs of inhabitants of metropolitan areas (various services). In future, farms close to cities that do not take advantage of new adjustment strategies of development (e.g. diversification, differentiation, participation) will also be doomed to cease farming.

Mechanisation of agricultural production results in both an increase in the capital employed in agricultural production and a reduction of labour input per unit of surface area. However, the reduction of labour input in the different groups of farms is not very significant, as there is a simultaneous increase in the surface area of land used. As a rule, the closer to the core of a MA, the bigger the percentage of farms reducing labour input, which can be explained by the more attractive wage rates offered in non-agricultural economic sectors, which are well-developed in large cities. In regions with favourable soil conditions, where there is intensive horticultural production (e.g. north-eastern Cracow MA) or fruit-farming (e.g. south-western Warsaw MA), demand for work in agriculture may increase.

The development of a farm requires an extended increase in assets. In real terms, an increase in the value of capital was recorded in less than half of the farms examined.

Nevertheless, the average value of the capital employed significantly increased in all of the groups of farms analysed, which confirms the occurrence of polarisation, i.e. division of the farms into those reducing their potential and those increasing it significantly. Farms reducing the value of capital employed predominated among those in the immediate proximity of the cores of metropolitan areas. This results from the fact that farm owners have already started the process of relocation of resources from farms that do not provide sufficient income. It is important that the resources freed, especially land resources, should be passed on to other farms.

The examples described highlight a need to conduct of further research aimed at outlining agricultural development strategies for metropolitan areas that will be suited to Polish conditions. It should be noted that examples from other countries with a higher level of urbanisation show that in metropolitan areas only farms which have adjusted to local conditions and taken advantage of the opportunities appearing, namely the huge absorption capacity of urban consumer market, have been able to survive and develop. Thus urban consumers in Western Europe (and also in the future in Poland) need high quality food products, often niche ones, and a wide range of services, including in recreation, education, conservation etc.

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Towarowe gospodarstwa rolne na obszarach metropolitalnych w Polsce: zmiany zasobów czynników produkcji

Streszczenie: Zarówno w literaturze, jak i praktyce gospodarczej coraz częściej dostrzega się różnice w przebiegu procesów dostosowawczych zachodzących w gospodarstwach rolnych prowadzących swą działalność bezpośrednio w sąsiedztwie wielkich miast a pozostałymi gospodarstwami towarowymi. Na obszarach podlegających procesom urbanizacji i metropolizacji rolnictwo napotyka szereg barier, ale i szans rozwoju, stąd procesy zmian strukturalnych przebiegają tutaj szybciej. Identyfikacja tendencji zmian zasobów czynników produkcji gospodarstw może stanowić podstawę do rozwijania bardzo potrzebnych w Polsce badań mających na celu wypracowanie odpowiednich strategii rozwoju miejskiego i podmiejskiego rolnictwa. Celem opracowania jest zaprezentowanie kierunków zmian w potencjale produkcyjnym (czynnikach produkcji) towarowych gospodarstw rolnych prowadzących swą działalność w sześciu wybranych polskich obszarach metropolitalnych. Szczegółowym analizom poddano 189 gospodarstw rolnych zlokalizowanych w 6 polskich obszarach metropolitalnych (OM). Gospodarstwa te w okresie 2004–2016 prowadziły nieprzerwanie rachunkowość rolną w ramach systemu FADN. Materiał porównawczy dla prowadzonych analiz stanowiło 1665 gospodarstw prowadzących działalność rolniczą poza obszarami metropolitalnymi. W wyniku przeprowadzonych analiz potencjału produkcyjnego towarowych gospodarstw rolnych stwierdzono, że podmioty prowadzące swą działalność w wewnętrznych strefach OM (w gminach bezpośrednio graniczących z rdzeniem OM) dysponowały w 2004 r. większymi średnimi zasobami ziemi, pracy i kapitału. W okresie 2004–2016 doszło do znacznego wyrównania się potencjału produkcyjnego gospodarstw prowadzących swą działalność w wewnętrznej i zewnętrznej strefie OM. Jednocześnie w dalszym ciągu dysponowały one średnio większym potencjałem niż gospodarstwa prowadzące swą działalność poza obszarami metropolitalnymi. Obserwacja zachodzących zmian potwierdziła, że wśród gospodarstw strefy wewnętrznej był największy odsetek podmiotów zmniejszających zasoby ziemi, pracy i kapitału, co potwierdza występowanie barier ich dalszego rozwoju, tj. m.in. ograniczona podaż ziemi i wysoki koszt alternatywny pracy. Wydaje się, iż podmioty te muszą szukać alternatywnych ścieżek rozwoju, w tym koncentrować się na dywersyfikacji działalności i rozwijaniu usług pozarolniczych.

Słowa kluczowe: gospodarstwa towarowe, obszar metropolitalny, czynniki produkcji, lokalizacja.