Farmers' Educational Background, and the Implementation of Agricultural Innovations Illustrated with an Example of Land Consolidations

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Abstract: In Poland land consolidation is carried out mainly in the southern part of the country. In three voivodships, namely Lubelskie Voivodship, Podkarpackie Voivodship and Małopolskie Voivodship, in the years 2003-2014 there were numerous land consolidations, over 20,000 ha in each voivodship. In another three voivodships (Warmińsko-Mazurskie, Zachodniopomorskie and Kujawsko-Pomorskie) there are no land consolidations, even though according to scientists from the Polish, every voivodship requires land consolidations processes. What is the reason for that situation? Both domestic and foreign research confirms that farmers with a higher level of education have been managing their farms more effectively. On the other hand, the development of the society's knowledge, education and qualifications is an important factor in the creation of innovations in production. Therefore, are the farmers' level of qualifications and education among the factors which affect the location of agricultural land consolidations? The analysis was carried out for the territory of Poland divided into voivodships (NUTS 2), and for Lubelskie Voivodship divided into municipalities (NUTS 5). The study was divided into the following stages: At the 1st stage of the study, the scope of implementation of agricultural land consolidation in Poland in the years 2004–2013 was determined. At the 2nd stage of the study, results of an analysis of the educational levels of agricultural farm managers in 2010 in selected research units were presented. At the 3rd stage, an analysis of the relationships between the educational level of agricultural farm managers and the implementation of agricultural land consolidations was carried out. In Poland, the level and the area of implemented consolidations is determined by level of agricultural education of agricultural farm managers. Research at the level of both the country and the municipalities of Lubelskie Voivodship confirm the fact that consolidations are more frequently implemented in the areas where agricultural farm managers have a lower educational level.

Keywords: land consolidation, education of farmers, rural areas, agricultural education.

Introduction

The FAO classifies land consolidation impacts at three levels: first, there is the micro-level, where land consolidation aims focus on changing the farm structure and their direct environment so as to enable farmers to become more competitive. Secondly, there is the meso-level, where land consolidation has broader aims for changing rural communities by improving infrastructure (roads, irrigation and drainage systems, water and disposal installations), the natural environment, management of natural resources, landscape and, consequently, the spatial distribution of economic activities. At the macro-level, the focus is on changes which can positively affect the entire country by reducing the disparities between rural and urban areas, by ensuring more efficient and varied use of rural space, by improving the overall competitiveness of the agricultural and rural sector, by building trust between governments and inhabitants of rural areas, and by enhancing the land market (Demetriou, 2014).

According to A. Dacko (2006), the main goal of land consolidation should be to improve the quality of rural life, and not only to increase agricultural production. Land consolidation measures should be initiated to revive the countryside by encouraging continuous economic and political development of the local community, while protecting and rationally managing natural resources. The local community should participate democratically in land consolidation and in defining new forms of land use that make the most of the local potential. This is an activity which is every time different, specific, and having a significant impact on the agricultural space.

Currently in Poland, the choice of a location for the implementation of consolidation work not only depends on the farm land layout and land fragmentation but also on the farmers who apply for the implementation of consolidation work in the particular area. Social acceptance is the key prerequisite for

successful land consolidation. In Poland, land consolidation projects are initiated upon the request of more than 50 % of land owners or owners who have a legal title of more than 50 % of land in a given area.

In recent years, social capital has become an often referred to and even popular category among the factors which determine the development. The assumptions of the National Regional Development Strategy (NRDS) indicated that social capital is considered to be an important factor affecting the social and economic development of the country, and an element characterizing the citizens' living conditions (Kamiński, 2010).

According to M. Kłodziński and W. Dziun (2003), an answer to the question as to why certain municipalities are active and grapple with problems while the other stagnate, is not complicated. This is because the prerequisite for success is not the accumulated material resources but people and their entrepreneurship, a tendency to self-organization and cooperation, and the ability to select a group of leaders enjoying a good reputation and held in high esteem. The driving force behind the development is people, particularly local leaders i.e. commune heads, councilors, teachers, entrepreneurs and non-governmental organization activists. Social capital is the foundation of development, and without it, it is not possible to efficiently use the European Union funds earmarked for the local development of units (Wojewódzka, 2006).

Results of numerous studies and economic analyses allow one to draw an unequivocal conclusion that the quality of human capital whose key component is education is one of the main factors determining the development potential of the economy (Kołoszko-Chomentowska, 2008a).

Better educated people not only more readily accept the changing conditions but are also more inclined to search for and implement new solutions (Wiatrak, 2005).

Education is a factor determining a farmer's openness to the changing environmental conditions. Better educated farmers accept changes in the market more readily, and are more willing to respond to emerging challenges (Kołoszko-Chomentowska, 2008b). A higher educational level helps the society achieve a higher living standard.

Education has become the most important factor of social and economic development of rural areas. Modern agriculture, industry, trade and services will not operate efficiently in rural areas without personnel with high professional qualifications (Kłodziński, Rzeczkowska, 2000).
Although education is not tantamount to farmers' level of qualifications, it does prove the quality of human capital in agriculture (Nowak, 2009).

Therefore, are the farmers' level of qualifications and education as well as their age among the factors which affect the location of agricultural land consolidations?

Methodology

The analysis was carried out for the territory of Poland divided into voivodeships (NUTS 2), and for Lubelskie Voivodeship divided into municipalities (NUTS 5). The study was performed in Lubelskie Voivodeship which runs the highest number of land consolidation projects in Poland.

The study was divided into the following stages.

At the 1st stage of the study, the scope of implementation of agricultural land consolidation in Poland in the years 2004–2013 was determined. At the 2nd stage of the study, results of an analysis of the educational levels of agricultural farm managers in 2010 in selected research units were presented. At the 3rd stage, an analysis of the relationships between the educational level of agricultural farm managers and the implementation of agricultural land consolidations was carried out. The final stage of the study is drawing conclusions based on the completed research.

The most complete data on the educational level of agricultural population are provided by agricultural censuses (in Poland, such a census was conducted in 2010). For the purposes of this article, given the availability of data on education, the study involved agricultural farm managers who are most frequently the recipients of consolidation work. According to the Central Statistical Office's definition, an agricultural farm manager is usually the same person as a user, because a person managing an agricultural farm is considered to be a natural person authorised by the owner/user of an agricultural farm to take, supervise or enforce decisions directly associated with production processes

(Characteristics of agricultural farms). The study involved agricultural farm managers conducting agricultural activities in Poland, with a tertiary agricultural education, secondary and post-secondary vocational agricultural education, and basic vocational agricultural education, who have taken an agricultural training course (Gwiaździńska-Goraj, Rudnicki, 2015).The research employed the following methods: analysis and synthesis of the literature, field inventory, and research from the group of spatial-statistical approaches. The study area covered Poland, and in particular the selected region.

Results and discussion

Stage 1: The scope of the implementation of agricultural land consolidations in Poland in the years 2004–2013 and in Lubelskie Voivodeship

name of voivodship	the area of the implemented consolidation in 2004-2013 (ha)	The level of consolidations
Dolnośląskie	10873	the average level
Kujawsko-Pomorskie	0	very low level
Lubelskie	27438	high level
Lubuskie	4242	low level
Łódzkie	3613	low level
Małopolskie	20844	high level
Mazowieckie	3519	low level
Opolskie	1425	low level
Podkarpackie	20205	high level
Podlaskie	10955	the average level
Pomorskie	3396	low level
Śląskie	10208	the average level
Świętokrzyskie	1321	low level
Warmińsko-Mazurskie	0	very low level
Wielkopolskie	126	very low level
Zachodniopomorskie	0	very low level

Figure 1. Implementation of agricultural land consolidation in Poland and Lubelskie Voivodeship in the years 2004–2013.

In Poland, however, the works are implemented with varied intensity (Dudzińska, 2015). From 2004 to 2013, agricultural land consolidations were implemented in Poland over an area of 118 thousand hectares. The highest number of them was implemented in 2013. This probably resulted from the fact that 2013 was the last year of the Rural Development Programme 2007–2013. The highest numbers of consolidations were implemented in Lubelskie, Podkarpackie, and Małopolskie Voivodeships – more than 20,000 ha each. In three other voivodeships, namely Warmińsko-Mazurskie, Zachodniopomorskie and Kujawsko-Pomorskie, no agricultural land consolidations were implemented (Figure 1). In spite of the implementation of consolidations over quite a large area, they only constitute 0.6 % of agricultural land in Poland. In Małopolskie Voivodeship, the contribution amounts to 2.26 % of the area of agricultural land, in Podkarpackie Voivodeship to 2.15 %, in Śląskie Voivodeship to 1.62 % and in Lubelskie Voivodeship to 1.56 %. In the remaining voivodeships, the contribution is lower than 1 % (Dudzińska, Kotlewski, 2016)

In Lubelskie Voivodeship, 13 consolidation measures (7,970 ha) were conducted in the years 2004–2006, and 39 consolidation measures (27,502 ha) in the years 2007–2013. Lubelskie Voivodeship comprises 191 rural municipalities, and land consolidation projects covered 31 municipalities. The highest number of four consolidation measures were carried out in the municipalities of Chełm and Urszulin each. The municipalities of Łuków, Ostrówek and Wojsławice performed three consolidation measures each.

The implemented consolidation objects feature various sizes, from 74 ha in the case of objects Łuszczów and Łuszczów kol. in the municipality of Uchanie to 2,101 ha for object Potok in municipality Potok

Górny. The largest area of consolidated land concerned measures implemented in the period 2004–2013 in municipalities of Potok Górny and Urszulin, and amounted to 4,202 and 3,863 ha, respectively.

Stage 2: Analysis of the educational levels of agricultural farm managers in 2002 and 2010 in selected research units.

POLAND, BY VOIVODESHIPS (NUTS 2)

Table 8

The structure of agricultural educational levels of agricultural farm managers in Poland, by voivodeships

name of voivodship	Percentage of managers with educational level (%)								synthetic indicator of general education
	tertiary	post-secondary	secondary vocational	general secondary	a total of people with secondary	basic vocational	primary and post-primary	incomplete primary education, and without education	
Polska 2010 r.	10,30	1,40	24,00	6,10	31,50	38,60	17,50	2,10	2,30
Dolnośląskie	11,90	1,50	28,50	7,20	37,20	35,80	13,30	1,80	2,44
Kujawsko-pomorskie	9,70	1,00	23,90	4,60	29,50	42,70	17,00	1,00	2,30
Lubelskie	11,40	1,90	25,90	6,10	33,90	34,60	17,80	2,20	2,34
Lubuskie	12,10	1,50	28,30	6,40	36,20	34,30	15,10	2,30	2,41
Łódzkie	9,50	1,20	22,80	6,00	30,00	39,30	19,30	1,80	2,26
Małopolskie	8,20	1,40	21,10	6,00	28,50	42,00	18,80	2,60	2,21
Mazowieckie	10,50	1,30	23,80	6,10	31,20	39,40	16,80	2,00	2,31
Opolskie	9,20	1,50	24,40	4,90	30,80	46,10	12,50	1,30	2,34
Podkarpackie	9,60	1,70	22,70	7,00	31,40	36,50	19,40	3,00	2,25
Podlaskie	11,90	1,60	25,50	6,30	33,40	31,80	21,00	2,00	2,32
Pomorskie	11,20	0,90	21,40	6,10	28,40	41,70	16,80	1,90	2,30
Śląskie	10,40	1,20	25,00	6,60	32,80	41,90	13,20	1,70	2,37
Świętokrzyskie	10,10	1,60	22,70	6,50	30,80	37,40	19,00	2,70	2,27
Warmińsko-mazurskie	13,50	1,50	23,80	5,70	31,00	33,00	21,00	1,70	2,34
Wielkopolskie	9,00	0,80	25,20	4,40	30,40	45,30	14,30	1,00	2,32
Zachodniopomorskie	15,60	1,40	25,50	7,10	34,00	32,20	15,80	2,40	2,45
min	8,20	0,80	21,10	4,40	28,40	31,80	12,50	1,00	2,21
max	15,60	1,90	28,50	7,20	37,20	46,10	21,00	3,00	2,45

The study used a synthetic indicator of the general education, whose values fall within the range of 1–4 points. (1 point – primary and junior high school education; 2 points – basic education; 3 points – secondary education; 4 points – tertiary education).

Only 2 % of agricultural farm managers have not completed primary education, or are not educated. 82.1 % of farmers have post-primary education. The group of farmers has the highest percentage of people with basic education (38.6 %) (Table 1). Secondary school graduates account for 30 % of agricultural farm users. In 2010, more than 10 % of agricultural farm users held a university diploma.
On a regional basis, the differences between the farmers' educational level in particular voivodeships are not very large, and similar to the average structure for the country. The fewest managers with tertiary education are found in Małopolskie Voivodeship, and most of such managers are found in Zachodniopomorskie Voivodeship. Most agricultural farm managers with secondary education are found in Dolnośląskie Voivodeship, and the fewest such managers are found in Pomorskie Voivodeship. The synthetic indicator of general education is the lowest in Małopolskie Voivodeship, and the highest in Zachodniopomorskie Voivodeship.

In addition to general education, vocational skills also play an important role in achieving success in running an agricultural farm. At the same time, farmers with agricultural education obtain better production and economic results and, consequently, higher income than farmers with no vocational skills (Spatial differentiation of agriculture).

Table 2

Agricultural education of agricultural farm managers in 2010

name of voivodship	Percentage of farmers without agricultural education (%)	Percentage of farmers with agricultural education received at school (%)	Percentage of farmers who have completed an agricultural training course (%)
Polska 2010 r.	59,0	52,1	47,9
Dolnośląskie	56,6	47,5	52,5
Kujawsko-Pomorskie	44,1	67,0	33,0
Lubelskie	59,3	46,1	53,9
Lubuskie	59,1	56,5	43,5
Łódzkie	54,8	54,1	45,9
Małopolskie	67,8	42,8	57,2
Mazowieckie	55,5	58,2	41,8
Opolskie	52,7	52,0	48,0
Podkarpackie	70,0	37,5	62,5
Podlaskie	52,5	57,8	42,2
Pomorskie	49,1	60,7	39,3
Śląskie	68,5	40,9	59,1
Świętokrzyskie	67,3	41,0	59,0
Warmińsko-mazurskie	54,1	55,9	44,1
Wielkopolskie	45,9	65,2	34,8
Zachodniopomorskie	53,7	55,9	44,1

The highest percentage of farmers with agricultural vocational education are found in municipalities of the Wielkopolska region, and in Kujawsko-Pomorskie and Pomorskie Voivodeships (Table 2). Having analyzed farmers' vocational education preparing them for work at a farm, it can be observed that out of 41 % of farmers with vocational qualification, 52 % were educated at schools, which implies that they have completed an agricultural school at a post-primary level. The other 48 % of farmers have obtained their vocational qualifications outside the school i.e. by only receiving an agricultural training (Głębocki, 2014).

LUBELSKIE VOIVODESHIP DIVIDED INTO MUNICIPALITIES (NUTS 5)

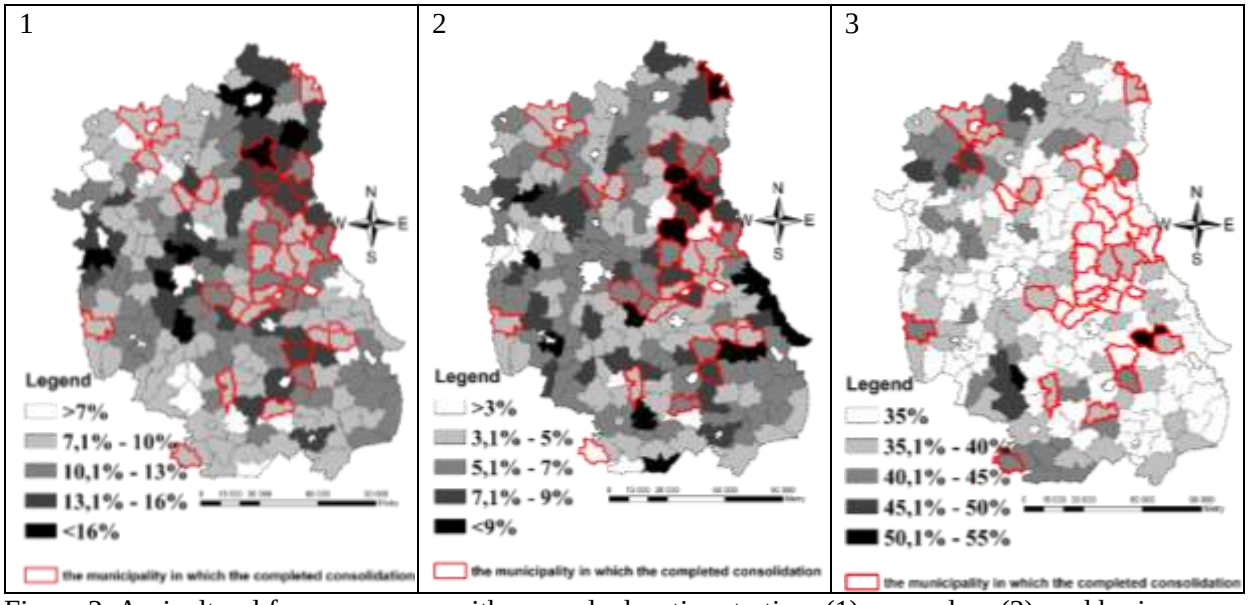

Figure 2. Agricultural farm managers with general education: tertiary (1), secondary (2), and basic vocational (3) in 2010.

The highest percentage of farmers with tertiary education is found in 7 municipalities of Lubelskie Voivodeship. An analysis of the secondary educational level of farm managers, the highest percentage

of such farmers is found in 15 municipalities. Within more than 50 % of municipalities, over 35 % of managers have vocational education (Figure 2), and most frequently these are people without agricultural education (Figure 3).

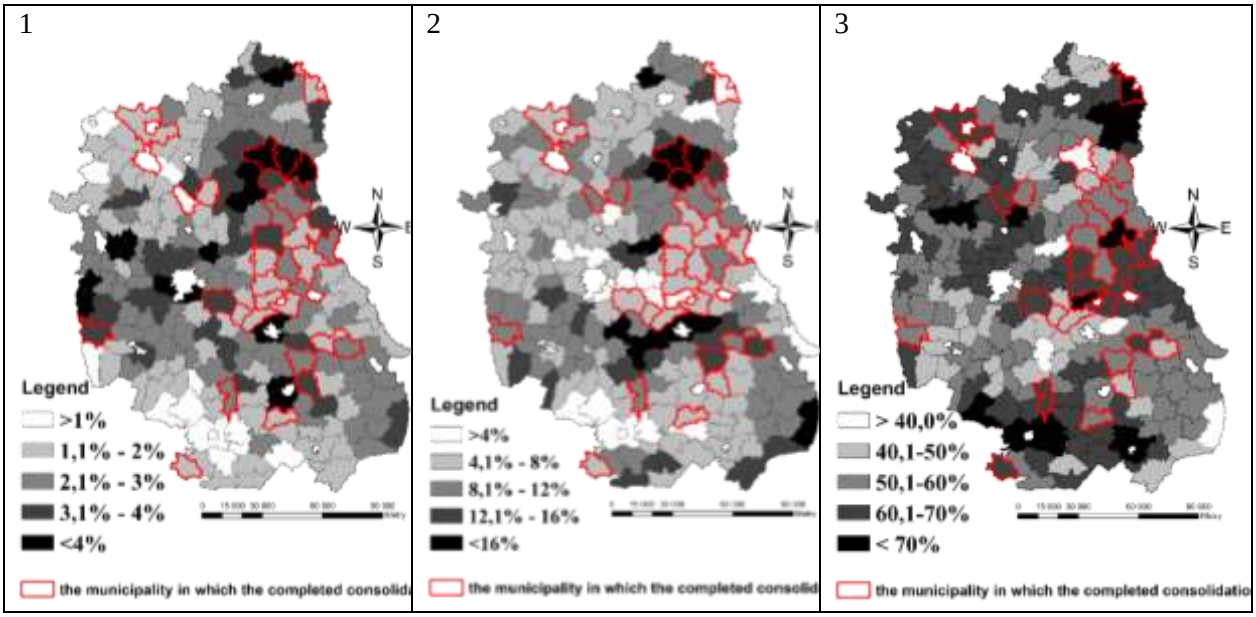

Figure 3. Agricultural farm managers with agricultural education: tertiary (1) and secondary (2), and without agricultural education (3) in 2010.

Stage 3: Analysis of the relationships between the educational level of agricultural farm managers and the implementation of agricultural land consolidations.

POLAND, BY VOIVODESHIPS (NUTS 2)

At this stage, a coefficient of correlation between the educational levels (general and agricultural) of agricultural farm managers, and the area and level of implemented consolidations was determined (Tables 3, 4).

Table 3

Correlation matrix – general educational level of managers

Variable	The area of the implemented consolidation in 2004-2013 (ha)	The level of consolidations
higher education studies	-0,213	-0,314
secondary education	0,174	0,167
basic vocational	-0,198	-0,126
synthetic indicator of general education	-0,247	-0,292

Table 4

Correlation matrix – agricultural educational level of managers

Variable	The area of the implemented consolidation in 2004-2013 (ha)	The level of consolidations
Percentage of farmers without agricultural education (%)	0,577	0,693
Percentage of farmers with agricultural education received at school (%)	-0,632	-0,743
Percentage of farmers who have completed an agricultural training course (%)	0,632	0,743

A relationship was found between the area and level of the implemented agricultural land consolidations and the educational level of agricultural farm managers. No relationships were found between the level and area of consolidations and the general educational level of agricultural farm managers.

LUBELSKIE VOIVODESHIP DIVIDED INTO MUNICIPALITIES (NUTS 5)

In order to determine the relationships between the educational level of agricultural farm managers and the implementation of agricultural land consolidations, an average educational level was adopted for the municipalities of Lubelskie Voivodeship, and for municipalities in which consolidation work has been conducted (Figures 4, 5). Educational levels were set for general and agricultural education. In order to draw conclusions, a level of the synthetic indicator was adopted for particular types of education. The synthetic indicator has a value falling within the range of 1–5 points (1 point – the lowest level of the tested education, 5 points – the highest level of education). The obtained values of the synthetic indicator are presented in brackets in the diagram 4 and 5. The horizontal axis shows the percentage of managers in the total number of farm managers.

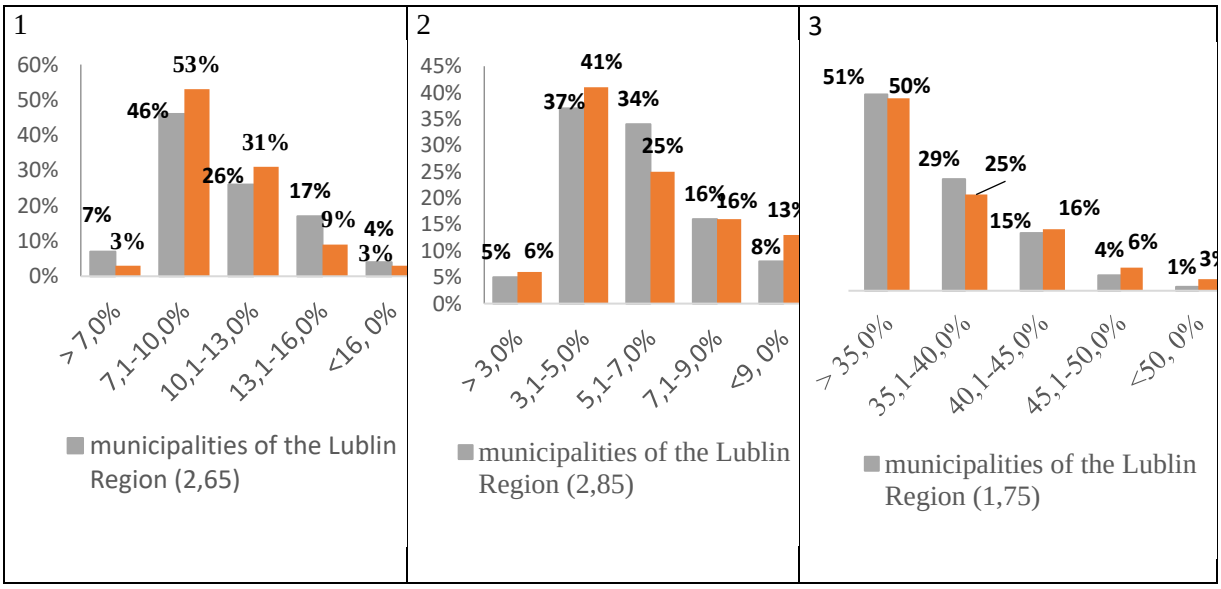

Figure 4. Agricultural farm managers with general education: tertiary (1), secondary (2), and basic vocational (3) in 2010.

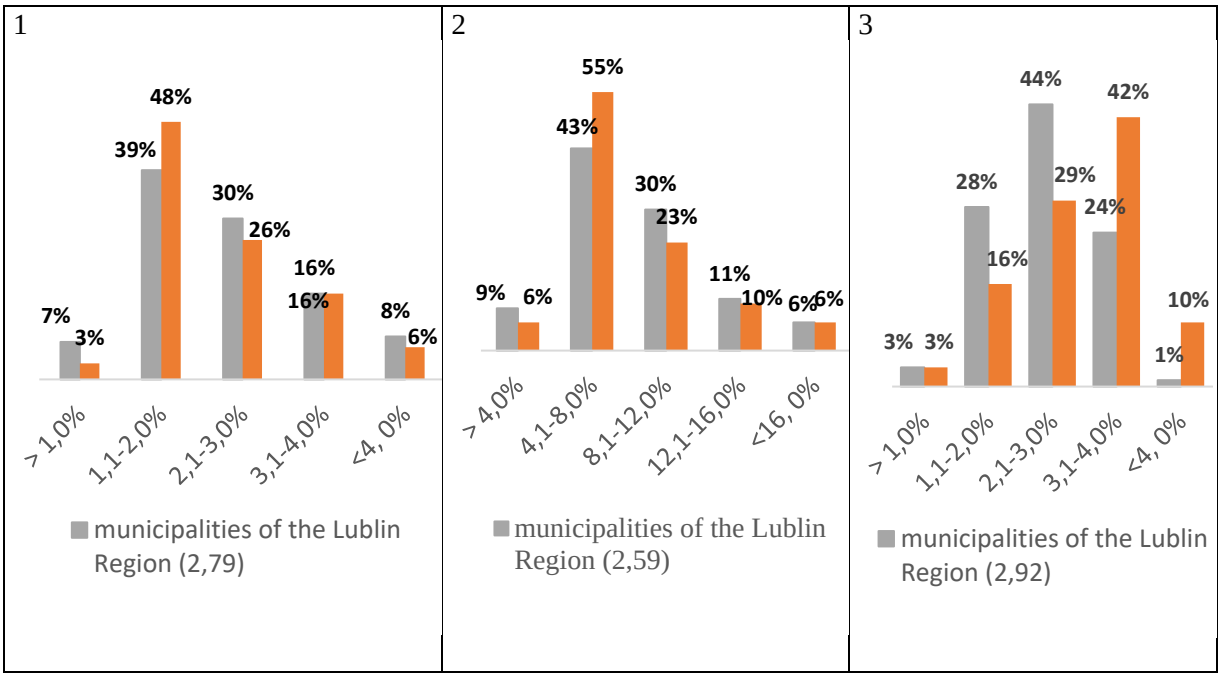

Figure 5. Agricultural farm managers with agricultural education: tertiary (1) and secondary (2), and without agricultural education (3) in 2010.

Agricultural farm managers in the municipalities in which consolidations have been implemented were characterized by a lower synthetic indicator of tertiary general and tertiary agricultural education than

the average in municipalities for the voivodeship under study. Municipalities with implemented consolidation objects were characterized by a higher percentage of farmers with general vocational education and without agricultural education.

Conclusions

- In Poland, the level and the area of implemented consolidations is determined by level of agricultural education of agricultural farm managers.
- A negative, rather strong correlation between the tertiary educational level of agricultural farm managers and the level and the area of implemented consolidations was obtained, which may indicate an inverse relationship between these variables.
- Research at the level of both the country and the municipalities of Lubelskie Voivodeship confirm the fact that consolidations are more frequently implemented in the areas where agricultural farm managers have a lower educational level.
- Results of the study allow the authors to draw a conclusion that the study needs to be extended to include an analysis of factors determining the farmers' behaviours understood e.g. in terms of social activity.

Bibliography

1. Dacko A. (2006). Tworzenie warunków do rozwoju terenów wiejskich poprzez scalanie gruntów – aspekt teoretyczny (Creating Conditions for Development of Rural Areas trough Land Consolidation – Theoretical Aspect). *Infrastruktura i Ekologia Terenów Wiejskich,* Vol. 2(2), pp. 29 – 39.
2. Demetriou D. (2014). *The Development of an Integrated Planning and Decision Support System (IPDSS) for Land Consolidation*. Switzerland: Springer International Publishing.
3. Dudzińska M. (2015). Potencjał uwarunkowań przestrzennych gospodarstw w gminach województwa dolnośląskiego, w których zrealizowano scalenia gruntów rolnych (The Potential of Spatial Parameters of Farms in Rural Areas and the Land Consolidation Measures: Case Studies in Lower Silesia). *Acta Scientiarum Poonorum Administratio Locorum,* Vol. 14(4), pp. 7 – 20. (in Polish)
4. Dudzińska M., Kotlewski L. (2016). Relations Between the Process of Land Consolidation and Socio-Economic Conditions in Municipalities in Lower Silesia. *Acta Geobalcanica*, Vol 2(1), pp. 45 – 53. DOI: http://dx.doi.org/10.18509/AGB.2016.05
5. Głębocki B. (2014). *Zróżnicowanie przestrzenne rolnictwa. Powszechny Spis Rolny 2010 (Spatial Differentiation of Agriculture. Agricultural Census 2010).* Warszawa: Główny Urząd Statystyczny. (in Polish)
6. Gwiaździńska-Goraj M., Rudnicki R. (2015). Struktura wykształcenia rolniczego kierowników gospodarstw rolnych w Polsce. Analiza czasowa i przestrzenna zjawiska (The Structure of Agricultural Education Managers' Farms in Poland. Analysis of Temporal and Spatial Distribution and Selected its Conditions). *Acta Scientiarum Poonorum Administratio Locorum,* Vol. 14(3), pp. 7 – 19. (in Polish)
7. Kamiński R. (2010). Rola kapitału społecznego i instytucjonalnego w procesie rozwoju obszarów wiejskich (The Role of Social and Institutional Capital in the Development of Rural Areas). In M. Stanny, M. Drygas (red.) *Przestrzenne społeczno-ekonomiczne zróżnicowanie obszarów wiejskich w Polsce*. Warszawa: Wyd. IRWiR PAN, pp. 157 – 179. (in Polish)
8. Kłodziński M., Dziun W. (2003). *Aktywizacja wiejskich obszarów problemowych (Stimulating Activity in Rural "Problem" Areas*). Szczecin, Warszawa: IRWiR PAN, KROWiOGŻ AR, pp. 17 – 18. (in Polish)
9. Kłodziński M., Rzeczkowska M. (2000). Rozwój przedsiębiorczości wiejskiej w krajach Unii Europejskiej – wskazówki dla Polski (The Development of Rural Entrepreneurship in Countries of European Union - Tips for Polish). In *Rozwój przedsiębiorczości w warunkach integracji z Unią Europejską*. Warszawa: PAN, Akademia Rolnicza w Szczecinie. (in Polish)
10. Kołoszko-Chomentowska Z. (2008a). Kwestia czynnika ludzkiego w rolnictwie (Human Factor Issue in Agriculture) *Acta Scientiarum Poonorum Oeconomia,* Vol. 7(4), pp. 87 – 95. (in Polish)
11. Kołoszko-Chomentowska Z. (2008 b). Wykształcenie ludności rolniczej jako determinanta rozwoju rolnictwa (Socio-Cultural Development's Conditions of Direct Sale of Agricultural Products). *Zeszyty Naukowe SGGW Ekonomika i Organizacja Gospodarki Żywnościowej,* Vol. 67, pp. 79 – 85. (in Polish)

12. Nowak A. (2009). Kwalifikacje rolników czynnikiem rozwoju gospodarstw rolnych (Farmers Qualifications as the Factor Influencing Rural Farms Development). *Acta Scientiarum Polonorum Oeconomia*, Vol. 8(3), pp. 107 – 116. (in Polish)
13. Wiatrak A. P. (2005). Kapitał ludzki w procesie zmian rolnictwa polskiego (Human Capital in the Process of Changes in Polish Agriculture)., In Proceedings of the International Scientific Conference about Agriculture and Food Economy in the year after the Polish accession to the European Union, *Problemy rolnictwa światowego,* Vol. 13, Warszawa: Warsaw Agricultural University, pp. 394 – 402. (in Polish)
14. Wojewódzka A. 2006. Znaczenie kapitału społecznego w rozwoju lokalnym (The Importance of Social Capital in Local Development). In M. Adamowicz (red.) *Samorządy i społeczności lokalne w zrównoważonym rozwoju obszarów wiejskich*. Warszawa: SGGW, pp. 167 – 174. (in Polish)