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## **EDUCATION AS A DETERMINANT OF THE IMPLEMENTATION OF INNOVATION IN AGRICULTURE IN THE LIGHT OF EMPIRICAL RESEARCH**

### *WYKSZTAŁCENIE JAKO DETERMINANTA WDRAŻANIA INNOWACJI W ROLNICTWIE W ŚWIETLE BADAŃ EMPIRYCZNYCH*

**Key words: human capital, farmer, education, innovation**

*Słowa kluczowe: kapitał ludzki, rolnik, wykształcenie, innowacje*

*JEL codes: Q10, D82, O15*

**Abstract.** The paper presents the results of empirical research conducted among farmers from different Polish provinces. The study involved 140 farmers, where half of them were young people (so-called young farmers, in the age under 40), and the remaining – older farmers. The attitudes of farmers towards innovation were examined, taking into account some factors of human capital. The study was conducted using the survey method. Based on the obtained results the significant relationship between the level of education and the quality of human capital was indicated. The younger, well-educated farmers are looking for new solutions and willing to implement innovations. Despite the pro-innovative attitudes, implementation of new solutions is very difficult. In the opinion of respondents, the most important barrier to the implementation of innovation is not the lack of knowledge and information about new solutions, but the lack of funds and the high cost of new technologies.

### **Introduction**

Human capital is called a strategic element of social policy, in global, regional as well as local dimension. It is important not only in a large international corporations or learning organizations, but also in small companies [Zdrojewski 2010]. Human capital is defined as the sum of human characteristics such as level of education, possessed the ability to use knowledge, as well as people's health. It is believed that human capital is the most important factor of economic growth of regions. Improving the quality of human capital stimulates the activity of people, cause a willingness to take the risk, as well as to create new solutions and implement them into practice. It may therefore be argued that the development of human capital implies the process of implementing new ideas to life [Wiatrak 2005, Kielbasa 2013].

There is a huge human potential gathered in rural areas in Poland, both intellectual and social. Almost 16% of workers is involved in agriculture, but this share is decreasing every year. In turn, the number of people living in rural areas is increasing (currently 38.8%) [Raport o stanie... 2014], and the village becomes an attractive place to live, despite the still existing deficiencies in infrastructure.

Mieczysław Adamowicz [2005] emphasizes that human capital significantly affects the implementation of innovations or creation new solutions and change management in relation to agriculture and rural development. Investing in human capital development contributes to the formation of pro-innovative attitudes [Kielbasa 2012]. This results in the appearance of the long-term, cumulative benefits not only for the farm or business, but also for the local communities in the form of strengthening the social capital [Spsychalski 2008, Szafraniec 2006]. Sławomir Kalinowski [2008] claims that the human capital development should be analyzed taking into account such factors as: age, education and experience.

Considering the age of farmers the unfavorable demographic structure can be noticed (Fig. 1). Farmers over the age of 45 years-old dominate in the population (62.5%). There is 37.2% of farmers in the mobile productive life stage, and 41.2% in immobile. In addition, nearly 11% of

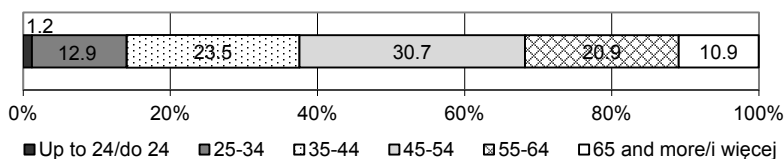


Figure 1. Farmers age structure in Poland in 2010

*Rysunek 1. Struktura wieku rolników w Polsce w 2010 roku*

Source: own study based on [CSO 210]

*Źródło: opracowanie własne na podstawie [GUS 2010]*

farmers despite reaching the post-productive life stage (65 years-old and more for men, and 60 for women), are still engaged in agriculture (Fig. 1).

The level of farmers' education is increasing. According to the Central Statistical Office in Poland, almost a half of farm managers had agricultural education [GUS 2014]. Compared to the latest Agricultural Census the number of farmers with agricultural higher education is increased, but their share is still small (2013 – 2.6%, 2010 – 2.2%). This is confirmed by numerous studies, e.g. those conducted by Bartosz Mickiewicz [2013], which confirms that the level of farmers education is steadily increasing, but is visible mainly in the young generation. Education translates into better production results, contacts with the market and the ability to use EU funds. What's more, the larger the farm, the greater percentage of farmers with a degree in agricultural studies [GUS 2014].

Rural areas and farming perform many important functions. One of them is the social function, that has its reference in the people, the inhabitants of rural areas. The changes, that has taken place in Polish rural areas are dependent on people openness, activity, education and skills of rural dwellers. According to Andrzej Wiatrak and his research [2005], changes are not possible without raising their competence and learning throughout the whole life [Kielbasa, Okrajni 2014]. Besides, farm management increasingly requires specialized knowledge and continuous updating. To meet the competition, farmers must be more precise in their actions, to base on academic knowledge or research results [Urban 2008].

Implementation of innovative solutions has become a necessity. Hence, we observe the increasing importance of skills and knowledge acquisition. When the knowledge or information is not updated the information gap may appear. It means the difference between the possessed knowledge or information and the knowledge needed to solve the problem of farm management. When the gap appears farmer or entrepreneur is rapidly losing competitiveness and lags behind other entrepreneurs, and in consequence may be marginalized [Barkley et al. 2004]. Discussing innovation in rural areas and in agriculture, their characteristics must be taken into account, as well as their impact on productivity and the use of natural resources. Studies on the impact of the implementation of innovations and their determinants led Mirosław Struś and Julian Kalinowski [2015]. Based on their research they deduce that innovation is an essential prerequisite for sustainable development, but innovation shouldn't be a value in itself. Due to the nature of resources available to agriculture innovation should implement the assumptions of sustainable development. This objective is hindered by many barriers exogenous and endogenous. The paper is focused on the analysis of selected factors of human capital (age, education) and an analysis of their impact on the speed of implementation of innovation and the perception of barriers to innovation. Due to the limitations, the research focused only on the selected endogenous dilemmas of innovation in agriculture, based on the questionnaire research.

### Material and methods of research

The study was conducted in 2014 on a sample of 70 farmers, and in 2015 on the sample of 70 farmers<sup>1</sup>, chosen randomly. The research sample consisted of 140 farmers from different Polish regions. Sampling was simple, and the aim of the research was to obtain answers to the questions

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prepared in the questionnaire protocol. The study was conducted using the survey method in the presence of the interviewer.

The main aim of the study was to answer the question: what is the big impact of knowledge on attitudes towards innovation in agriculture? The study was focused on one of the element of human capital which was education of the farm managers. The hypothesis assumed that education and the possessed knowledge have a big impact on the farm development and contribute to the creation of pro-innovation attitudes of farmers. Additionally, the analysis of barriers to the implementation of innovations in agriculture has been made, including aspects of social capital. The obtain results were presented in tabular, graphical and descriptive form.

## Results

The study sample consisted of 140 farmers of different age and from different Polish regions. Among them were only men. The average age of respondents was 36 years-old. Half of the farmers were the so-called young farmers, thus they didn't exceed 40 years-old. Distribution of the results shows a large variation of the sample in terms of age (the range  $R = 48$ ), but taking into account the average age and the distribution it may be stated that the tested group had a favourable demographic structure (Fig. 2).

Nearly 23% of farmers had a higher education: agricultural (14.3%) or non-agricultural (8.6%). However, the larger group among the respondents were people with a secondary education: every second farmers, including secondary agricultural education (13.6%). A large group were also people with vocational education (Tab. 1).

The second important element of human capital, analyzed in the sample, was farmers education. This factor was analyzed after dividing the sample into two groups:

- farmers aged up to 40 years-old,
- farmers over the age of 40 years-old.

Figure 2. Distribution of the respondents age (n = 140)

Rysunek 2. Rozkład wieku respondentów (n = 140)

Source: own research  
Źródło: opracowanie własne

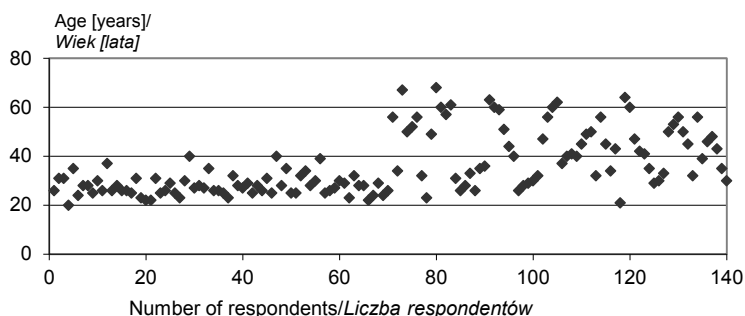


Table 1. The level of education of the farm managers

Tabela 1. Poziom wykształcenia kierujących gospodarstwami

Education/Wykształcenie	Number of respondents/ Liczba respondentów	Share of answers/ Udział odpowiedzi [%]
Higher agricultural/Wyższe rolnicze	20	14.3
Higher non-agricultural/Wyższe nierolnicze	12	8.6
Secondary agricultural/Średnie rolnicze	52	37.1
Secondary non-agricultural/Średnie nierolnicze	19	13.6
Vocational agricultural/Zawodowe rolnicze	16	11.4
Vocational non-agricultural/Zawodowe nierolnicze	19	13.6
Primary school/Podstawowe	2	1.4

Source: own research

Źródło: opracowanie własne

Considering the group of younger farmers it may be concluded that the respondents were well prepared to perform the farmer profession. Every second farmer had a secondary agricultural education, and 20% of them have higher education – agricultural or related (Fig. 3). On the other hand, in the second group structure of education varied greatly (Fig. 3). The group of older farmers was dominated by people with vocational education – usually non-agricultural (44%). 45% of farmers from the second group had agricultural education, while 13% received a higher degree in agriculture (Fig. 4).

The farmers declared that they willingly participate in training to upgrade their skills or those that provide information. Every second respondent pointed to the frequent participation in various training and courses organized in rural areas. The subject of these courses or training were mainly:

- raising funds under the Rural Development Programme (RDP),
- changes in the rules of filling the direct payment applications,
- using the plant protections products,
- cross-compliance requirements.

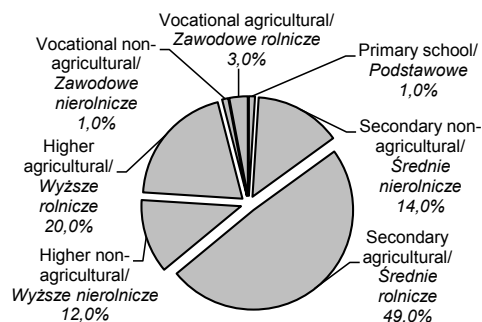


Figure 3. The structure of farmers education in the age group up to 40 years of age

Rysunek 3. Struktura wykształcenia rolników w grupie wiekowej do 40 lat

Source: own research

Źródło: opracowanie własne

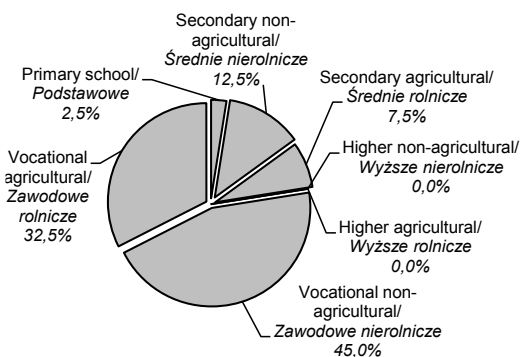


Figure 4. The structure of farmers education in the age group above 40 years of age

Rysunek 4. Struktura wykształcenia rolników w grupie wiekowej powyżej 40 lat

Source: own research

Źródło: opracowanie własne

About 37% of farmers participate in training less often: from time to time in the situation when acquiring new knowledge is a necessity (for instance: filling the direct payment forms, new rules of obtaining funds from RDP). 18 farmers said that they do not participate in training organized in rural areas. In the group of farmers not involved in the process of updating the knowledge were 78 people with vocational education, of which 3/4 non-agricultural.

With regard to the impact of education on the speed of implementation of innovations, almost 3/4 of surveyed farmers confirmed the high correlation between these two variables. Over 15% of the respondents said that the impact is different and depends on factors such as education level, age of the farmer – significantly affects the speed of implementation of innovations, the farm size – determines the legitimacy of changes, etc. In the sample were also farmers who stated that the impact of education on the speed of implementation of innovations is small or irrelevant (10%). Among them, one farmer declared regular participation in training, six occasionally participated in the training, and seven not at all. Among those who have declared that education does not play a significant role in the process of implementation of innovations 65% had vocational education and one person primary.

Respondents also answered the question of what in their opinion is the greatest impediment to the process of implementation of innovations in their farms (Tab. 2).

In the opinion of farmers, the biggest barrier in the process of implementation new solutions in agriculture is the high cost of innovation. New technology, processes of their implementation

Table 2. Barriers of implementing innovations in the opinion of farmers

*Tabela 2. Bariery wdrażania innowacji w opinii rolników*

Specification/ <i>Wyszczególnienie</i>	Number of indications/ <i>Liczba wskazań</i>	Share/ <i>Udział [%]</i>
High cost of new technology/ <i>Wysokie koszty nowej technologii</i>	48	31.6
The lack of financial resources for innovation/ <i>Brak środków finansowych na innowacje</i>	34	22.4
The problem with the sale of agricultural raw materials and unstable agricultural markets/ <i>Problem ze sprzedażą produktów rolnych i z niestabilnym rynkiem</i>	26	17.1
The lack of sufficient knowledge and information/ <i>Brak wystarczającej wiedzy i informacji</i>	21	13.8
Bureaucracy/ <i>Biurokracja</i>	17	11.2
Concerns about whether innovation will bring the expected results, the fear of risk and changes, reluctance to implement changes/ <i>Obawy, czy innowacja przyniesie oczekiwanych rezultatów, strach przed ryzykiem i zmianami, niechęć do wprowadzania zmian</i>	4	2.6
I don't know/ <i>Nie wiem</i>	2	1.3

Source: own research

*Źródło: opracowanie własne*

and the *know-how* are very expensive. The second barrier is the insufficient amount of free funds for investment processes and difficulty in obtaining cheap loans. Farmers also pointed to the instability of the markets, which makes investment risky and might not produce the expected results. Almost 14% of the farmers mentioned the lack of sufficient knowledge or shortage of information of innovations as a significant barrier.

### Summary and conclusions

Farmers who participated in the study confirmed the great importance of knowledge in the process of acquisition and implementation of agricultural knowledge. The obtained data allowed to confirm the research hypothesis, which assumed that education and possessed knowledge have a big impact on the farm development and contribute to the creation of pro-innovation attitudes of farmers.

The empirical studies indicate a significant relationship between the level of education and the quality of human capital. The appropriate level of qualification and the ability to search for information may decide not only of the economic success of farms or agricultural enterprises, but also become an important factor of social development in rural areas. It was confirmed by 74.2% of the examined farmers. Certainly their opinion was determined by their education (high level of education), and the young age (average age: 36). On the base of the survey the following conclusions were drawn:

1. Age and education influence the farmer responses to a large extend. They confirmed that there is a relationship between the age and education and the approach towards innovation. Young, well-educated people are more willing to take the risk and are interested in innovation. Hence, they should be of a particular assistance in the agricultural policy of Poland and the EU.
2. The measures implemented under the RDP contributed to the changes, including the changes of the demographic structure of farmers. Introduced criteria for receiving the funds (age – the so-called young farmers, and education) is particularly dedicated to the younger group of farmers. The demographic structure is still unfavourable but improvement can be seen in the future.
3. Implementation of innovations and comparing the competition require not only the knowledge and information of new technologies, but above all the financial resources. New technologies are becoming more and more expensive. Therefore, agricultural policy should provide the means of supporting pro-innovative activities of farmers.

Social and economic activation of farmers and rural residents require further investment, and thus financial aid for the construction or improvement of the social infrastructure. The most important are training and advisory assistance for farmers. Especially in the fields of: new technologies and techniques of production, information technology in agriculture, market analysis, searching for market niches, as well as the marketing of agricultural products.

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### Streszczenie

Przedstawiono wyniki badań empirycznych prowadzonych wśród rolników z całej Polski. W badaniu wzięło udział 140 rolników, z czego połowę stanowili młodzi rolnicy (w wieku do 40. roku życia), a pozostała część to starsi rolnicy. Zbadano postawy rolników względem innowacji, z uwzględnieniem wybranych czynników kapitału ludzkiego. Badania przeprowadzono przy użyciu ankiety uczestniczącej z kwestionariuszem pytań. Na podstawie pozyskanych wyników można wskazać na istotny związek między poziomem wykształcenia i edukacją a jakością kapitału ludzkiego. Młodzi, lepiej wykształceni rolnicy poszukują nowych rozwiązań i chętnie wdrażają innowacje. Mimo proinnowacyjnych postaw wdrażanie nowych rozwiązań jest bardzo trudne. W opinii badanych najpoważniejszą barierą wdrażania innowacji nie był brak wiedzy i informacji o nowych rozwiązaniach, a brak środków finansowych oraz koszt nowych technologii.

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