

FACTORS AFFECTING THE NEED FOR A SPECIALIZED E-COMMERCE PLATFORM FOR MANAGING AGRICULTURAL ENTITIES

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Abstract: Small holder farmers appear to have much to gain from the use of information technologies in the business, particularly given their spatial dispersion in terms of remoteness and its' small scale turnover. However, the available statistics show a lower rate of usage of information technologies for agriculture business purposes. This article presents an investigation of factors affecting the adoption of e-commerce solutions by small-scale farmers in Lithuania. The aim was to identify the factors that cause the interest of small-scale farmers in e-commerce and to the adaptation of a specialized e-commerce platform for agriculture businesses in Lithuania. The research is novel, as it addresses an unexplored area - the use of e-commerce solutions by farmers in Lithuania. The novelty of this research is based on the idea that small-scale farmers will develop their farms if they start to use the tools from the electronic platforms in their everyday activities. The research was done using questionnaires from 284 respondents (about 0.25 percent of all Lithuanian farmers, according to the 2019 data) from all regions of Lithuania. Data were collected using only online questionnaires in December 2022 and January 2023 years. The results show that there are important factors causing farmers' reluctance to use electronic platforms, such as the farmer's age and experience. The results of the study provide an important contribution to the development of information technology in agriculture, including confirming the need to introduce and develop a specialized e-commerce platform in the agricultural sector.

Keywords: e-commerce, information technologies, small-scale farms, farmers' behaviour

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Introduction

The Fourth Industrial Revolution (Industry 4.0) is affecting almost all sectors in supporting use the digital technologies and innovations in process management, and the agriculture sector is not exception. In the recent past, it was difficult to get information to or from smallholder farmers, on their basic needs and problems such as access to inputs, markets, prices, microfinance or learning (Trendov et al., 2019).

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With the more and more expanding range of Internet services and the creation of Rural Area Information Technology Broadband Network (RAIN) in rural areas in Lithuania. More than 98% of the country's rural population gained access to broadband Internet services as a significant reduction in the price of smart devices has created opportunities to make full use of the tools offered online to increase the efficiency of agricultural entities (Pinkovetskaia et al., 2022; Szczyrba and Dziuba, 2023).

The experience of foreign countries has shown that the adaptation of information technologies in the agricultural sector has created preconditions for the development of: (a) online farm shops, (b) e-shops or e-commercial platforms of suppliers of means of production and equipment, (c) specialized e-commercial platforms of agricultural products and resources set up by third parties (non-farmers and non-suppliers), etc. However, analysis of the situation has shown that specialized e-commerce platforms for agriculture business are rarely found in other countries (Fecke, 2018; Leroux, 2001; Zapata et al., 2016; Wen, 2007, Vasavi et al., 2021). Similar situation is observed in Lithuania. The websites of authorized suppliers of agricultural products and resources, most often represented by the big and medium-scale producers (fertilizers, plant protection products, seeds, spare parts, etc.), can be found in Internet. The secondhand and new agriculture equipment and machinery are often offered on general-purpose websites, next to the household or general advertisements. In such platforms, it is difficult to navigate, find a product or offer own products. There is an objective need to have a specialized e-commerce platform for agriculture business in Lithuania that meets the needs of all entities in the agricultural sector. Agricultural entities need to be able to take advantage of information technology to increase their income and reduce operating costs (Ashokkumar, 2019; Batte, 2007; Henderson, 2004; Zeng et al., 2017; Junsawang. et al., 2022).

The following advantages gain by employing e-commerce platforms can be mentioned (Ashokkumar, 2019; Dharanidharan, 2018; Fecke, 2018; Zeng et al., 2017; Ingaldi nad Ulewicz, 2018, Ingaldi nad Ulewicz, 2019):

1. Access global markets with relatively small investments;
2. Reduced transaction costs,
3. When improving internal business processes, an opportunity to expand the range of marketing tools by combining advertising and sales is created;
4. Time for product search, order placement and delivery is reduced.

Problem: why agriculture small business is slow to use e-commerce solutions and what factors are most influential in the current situation?

The aim of this study was to identify the factors that cause the interest of small-scale farmers in e-commerce and to the adaptation of a specialized e-commerce platform for agriculture businesses in Lithuania.

Theoretical Background

Small-scale farmers are seen as a weak economic driver in the agricultural and food supply chain and to ensure their income growth is a critical issue for policymakers (Warren, 2004; Kot, 2023). It is important to help small-scale farmers to enter the market successfully. However, there are many difficulties in solving this issue due the high cost of all transactions, e-commerce support service and Internet infrastructure in rural areas. Historically, two main approaches have been used to help small-scale farmers become more active in digital agriculture market.

-The first is the promotion of collective action through the establishment of farmers' organizations such as agricultural cooperatives (Markelova et al., 2009; Hazell et al., 2010). By working collectively, small-scale farmers create better opportunities to negotiate with buyers and intermediaries, reduce transaction costs and have access to more information on the market situation and support mechanisms.

-The second approach is to encourage the advance contracts between small-scale farmers and agricultural enterprises (Key et al., 1999; Guo et al., 2008). Small-scale farmers organise their production and sell primary products to processing or distribution companies at a pre-agreed price under an advance contract.

In recent years, an increasing number of small-scale farmers have begun selling agricultural products directly to consumers through e-shops, which are integrated in the specialised agriculture platforms supported by the third parties. It is becoming increasingly clear that e-commerce has become a new and effective way of helping farmers, especially the small-scale ones, to enter the market. With e-commerce tools, small-scale farmers get the opportunity to sell most of their products at a higher price than before by removing price pressure from intermediaries and marketing restrictions caused (Zeng et al., 2016).

Many agribusinesses engage in e-commerce by creating and managing their own websites. Some authors provide suggestions for small-scale business based on strategist solutions for quality assurance and success factors in websites development. Information is quite important part of an enterprise's website. For instance, websites provided by agricultural raw material suppliers present additional information, including not only current market price but also crop market forecasts, analysis of market trends, technical information on weed identification, online communication with experts and so on (Doluschitz, 2002; Kurniawati et al., 2020). Determining only the online location of a farm does not seem to be enough (Volpentesta et al., 2007). There is a need to improve the clarity and accuracy of the information, to provide information on technical matters and to update the information on the website in a timely manner (Ernst et al., 2006; Andreopoulos et al. 2008; Bodini et al., 2011). The possibility of direct communicate with the supplier/buyer is also an important aspect of the website functionality. Communication between the two parties is an essential factor in building a relationship based on trust (Ernst and Hooker 2006; Ingaldi, 2021). Website designers should pay full attention to developing customer communication services, especially by allowing their visitors to interact with business representatives or

through “chat rooms” with virtual or real customers trading online (Andreopoulou et al., 2008; Tsekouropoulos et al., 2012). Yu and Chao (2014) provide empirical evidence showing that service quality is the most crucial factor influencing the behavior of Internet users.

There are specialised e-commerce platforms supported by a third-party service provider that ensure the financial transactions between sellers and buyers. Some e-commerce platforms are developed by private companies, while governments partially or fully funded. In 2000, there were 85 e-commerce platforms in the USA and the EU, however, in 2002, only 25 remained active. Fritz et al. (2004) identify best practices for the strategic development of successful platforms that initiate collaboration with other platforms, gain the support of the key market players, improve trading functions and expand value-added services. Yang et al. (2008) and Lu et al. (2011) suggest that local governments should improve the function of online transactions and continuously improve the functional, technological and managerial innovations of the digital public platform. A study by "MarketMaker", a US-based e-commerce platform, suggests that its further development should encourage manufacturers to frequently update their website profiles, especially contact information and attributes as well as product supply/demand announcements (Zapata et al., 2013).

The use of future Internet technologies is expected to have a major impact on the agricultural sector (Carrier et al., 2017; Kaloxylou et al., 2010). In terms of business goals, in particular, the availability of the Internet plays a promising role for farmers (Canavari et al., 2010; Warren, 2004). Farmers can increase farm income and results by using internet possibilities (Chun-Chun et al., 2011) in order to reduce transaction costs (Doluschitz, 2002; Mishra et al., 2009). In this regard, the Internet facilitates access to information on prices and products and interacts with a wider range of suppliers and customers (Henderson et al., 2004; Zapata et al., 2016). Therefore, e-commerce, defined as the use of the Internet for business purposes, is of interest to agricultural entities (Mueller, 2001; Wen, 2007). Leroux et al. (2001) described that there is much optimism in the development of e-commerce in the United States. Similarly, the well-known German farmers' magazine "Top Agrar" reports that experts attribute great importance to e-commerce in agriculture in the future (Top agrar, 2000). "New Media Tracker" provides the first figures on online purchases by German farmers. In 2015, 71% of German farmers bought machines online, while only a small proportion bought fertilizers and plant protection products online (Kleffmann Group, 2016). In this context, the economic barometer of an agricultural processing company provides insights into the intentions of German farmers to use the Internet. Interestingly, approximately 70% of farmers stated that selling and buying using e-commerce is possible in future decision-making (Rentenbank, 2015). Moreover, in 2016, the Internet was used by 95% of German farmers, more than two-thirds of whom were online every day (Kleffmann Group, 2016). It is surprising, however, that so far few German farmers buy raw materials for production online, even though the growing Internet infrastructure is opening up new markets. This problem is also relevant when analyzing the situation in Lithuania.

With regard to the objectives of this research and based on a review of the literature, the following factors influencing the success of e-commerce can be identified:

1. *Impact of e-commerce in lowering costs.* The price of the products sold is of great importance to online purchasing decisions. Reibstein (2002) argued that price affects the customer's decision to shopping online. The first evidence of farmers' behavior in decision to shopping online was provided by Batte and Ernst (2007). They conducted a general analysis of USA farmers' buying behaviour of new agriculture tractors and herbicide. They found out that farmers were willing to shopping online or from the local retailer outside their community if they can expect significantly lower prices. The estimated price advantage in such segment must be around 10% in order to have a significant impact on the intention to buy online. It is necessary to emphasize that e-commerce is also associated with higher risk compared to traditional commerce (Wu et al., 2011), and therefore a lower cost is a fee for the risk borne by the buyer.

2. *Consumers trust in e-commerce.* In addition to cost, trust is also an important factor in the context of shopping online. Lack of trust is often discussed as an important reason why consumers avoid shopping online (Kim et al., 2012). Doney and Cannon (1997) stated the seller is the most important source of trust in the buyer-supplier relationship. Unfortunately, this physical seller is not available in shopping online (Ghobakhloo, 2015). A positive reputation of an online seller reduces the risk perceived by consumers and builds trust. Thus, a seller's reputation may be an important confidence-building factor (Chen et al., 2017). Comprehensive, familiar recommendations can influence the consumer's assessment of the seller's competence and reduce perceived risk.

3. *Quality of e-commerce services.* Kauffman et al. (2010) emphasised that service quality is particularly important in the supplier selection process. The Internet is a relatively low-quality means of service delivery, as the service quality experience is influenced by the direct buyer-supplier relationship, which is quite limited in the case of online commerce. Thus, buyer-supplier interaction is important in an e-commerce environment because there are doubts as to whether ordered products will meet the buyer's expectations (Weathers et al., 2007). For instance, consultation using a variety of communication tools can reduce this uncertainty. In the context of agricultural entities, Balogh et al. (2016) argued that communication is a significant determinant of the buyer-supplier relationship. It was found that the quality of services influences farmers' satisfaction with the relationship (Aji, 2016). In addition, 45% of German farmers stated that the difficulty of obtaining personal advice reduced the attractiveness of shopping online. Briggeman and Whitacre (2008) noted that the more personal the advice offered by the trader is, the more favourable the farmers' willingness to buy online. With the introduction of more interactive media, such as online chat or real-time feedback via videotelephony, sellers could make up for the lack of direct contact (Basso, 2001). Thus, online sellers should strategically consider the choice of means of communication in order to build a trustworthy and sustainable relationship (Nuanphromsakul et al., 2022).

4. *Delivery time for purchases in e-commerce.* The timely delivery plays an important role in e-commerce (San Martín et al., 2011). In this context, Kauffman et al. (2010), Batte, and Ernst (2007) found that delivery punctuality and timeliness are important criteria when consumers choose the shopping online.

More specifically, farmers are approximately 51% less likely to choose an online or local seller if the latter does not meet the deadlines for the prompt delivery of machinery spare parts. However, when examining plant protection products or fertilizers in e-shops, the importance of this factor was not so high. The importance of this criterion is linked to the need to avoid economic losses; when delayed delivery would waste precious time and cause a specific loss to the farm. Failure to meet delivery deadlines can lead to sellers' failing in e-commerce (Briggeman and Whitacre, 2008).

5. *Consumers' experience in e-commerce.* Many studies have shown that previous experiences in shopping online can affect the desire to buy goods online again. Perea y Monsuwé et al. (2004) argued that previous experiences might reduce perceived consumers' risk. Mishra et al. (2009) described that part-time working farmers are more likely to use computers and the Internet. They found out that activeness of farmers in e-shopping is positively affected by farmers' competence in ICT, but not in farming experience.

6. *Social and business aspects in e-commerce.* Many studies show that farmers' entrepreneurship and personal attitudes influence the use of ICT (Batte et al., 1990; Batte, 2005). There are several studies related to farmers' behaviour online. One of these studies was conducted by Smith et al. (2004). Among all the aspects, they examined farmers' decisions to buy online. In terms of business characteristics, the most influential variable in the study was farm size. According to Batte and Ernst (2007), the age of the farm operator and the size of the farm did not have a significant effect on the likelihood of buying online. However, the findings on the impact of education and training are mixed. Contrary to their expectations, farmers with secondary education were less willing to buy herbicides from online service providers, and the fact of training after the secondary school was associated with a higher probability of buying machinery parts online. In addition, Briggeman and Whitacre (2008) showed that farmers who buy raw materials online are more educated and that younger farmers are more likely to use e-commerce programs. In their study, Mishra et al. (2009) found that farmers' online shopping activity is not affected by either age or farm size. Education has a major impact in this regard. Taragola and van Lierde (2010) provided evidence that age negatively affects vegetable growers' decision to use e-commerce solutions. Moreover, they found that higher education promotes the use of the Internet for business purposes and that a farmer's entrepreneurship and personal attitudes influence the activeness of e-commerce usage.

Based on literature review the main factors were identified: e-commerce costs, consumers trust, quality of e-commerce services, delivery time, consumers' experience, social and business characteristics (farm holder's age, length of service, holding size, number of employees, number of machinery). The influence of the above-mentioned factors on the activeness in participation in e-commerce platforms of Lithuanian ag-

gricultural entities was analysed empirically. A hypothesis was put forward to evaluate how all these factors together and each separately influence the development of small farms.

Research Methodology

The research was done using questionnaire from 284 respondents (about 0,25 perc. of all Lithuanian farmers according date from 2019) from all regions of Lithuania. Data were collected using only online questionnaires in December 2022 and January 2023 years.

Main characteristics of the respondents is presented in table 1.

Table 1. Main characteristics of the respondents

Nr.	Characteristics	Indicator
1	Number of questionnaires received	284
2	Average age of respondents	45,5 years
3	Distribution of working places in the Lithuania	10 regions
4	Biggest and lowest number of the respondents	Bigest - 131 (live around Kaunas) Lowest - 16 (live around Telšiai)
5	Status of economic entities	Legal person – 11 (4 perc.) Physical person – 273 (96 perc.)
6	Average farming time	17 years
7	The main income comes from (perc.)	Crop production (50), animal production (16), horticulture (10)
8	Average farm area of the respondents	69 ha

Source: Own elaboration

The survey was conducted in direct communication with the respondents or mailed. This empirical study compares well with similar studies and the experience of German, Indonesian, Chinese, Russian, French, and US agricultural entities in using e-commerce platforms (Fecke et al., 2018; Zeng et al., 2017; Dharanidharan 2018). A statistical method - Correlation analysis - was applied to assess the links between the activeness and motivation of farmers (enterprises) in the markets of agricultural products, materials, agricultural machinery, and agricultural services with the factors of the farmer's age, experience, and supply of resources. The aim was to scientifically prove whether a pair of subjects are interdependent or independent. The Pearson correlation coefficient, denoted by the letter “*r*,” was used to reveal the links of the quantitative data. Its mathematical content can be described in simple terms: the covariance of two variables divided by the product of their standard deviations. Excel CORREL function was used to determine *r*.

The indicators of the responders’ age, experience and availability of resources are presented in an interval value. The mean values of the *r* intervals were taken into

account in the calculation of G_i . For the calculation of G_i , the mean values of the intervals r were selected.

According to the relationship between the correlation coefficient and its error (denoted by r), which is a criterion of the statistical reliability of the correlation relationship (denoted by t), it is estimated whether this relationship is statistically significant, reliable or not at a certain chosen degree of accuracy (usually 5%, that corresponds to a probability of 95%, denoted by $\alpha = 0.05$). It is not limited to five per cent accuracy in this article. Slightly lower, namely 6, 7, and 8% were adjusted (94, 93, and 92% probabilities).

In the correlation analysis, the statistically significant dependence is recognized for the pair of subjects whose reliability index t exceeds its theoretical value. Then its probability p_value is less than the selected accuracy α as well. The following formula was used for reliability t : $t = r \cdot \sqrt{1 - r^2} / \sqrt{n - 2}$, (...). Where n is the sample size, which in each case of the links under study is different. The value in the formula after the multiple sign is the error of the coefficient r . The Excel function $T.DIST.2T(t; n - 2)$ was used to calculate the probability p_value .

To evaluate the causal regularities (regression tendencies), the square of the correlation coefficient, the so-called coefficient of determination R^2 , was used in the paper, which is useful for deciding on the degree of causality “at a glance”. Its quantity expresses the degree of variation of the active feature determined by the active feature that intensifies as it approaches the value of one. The statistical significance of the determination is evaluated by the F test, and its probability p_value corresponds to the probability of t statistics discussed above, therefore we will not examine it in the work.

The work is not limited to the identification of statistically significant dependencies. A one-proportion z_test was used to explain what other more detailed answers (e.g. at the regional level, in terms of farm specialization, etc.) can be obtained from this. Its essence is to substantiate the significance of the *share* of the *number* of respondents in a certain group from the total number of cases. The reliability of the z_test is based on the aforementioned p_value (the selected accuracy is described above), and all necessary calculations were performed with a probability e-calculator. Using the z criterion, essential proportions of the distribution of respondents according to various characteristics were identified. Minor options are omitted. For instance, Vilnius County was overlooked because part of its respondents “did not pass” the z_test .

Research Results

The founded study results will be discussed further in response to three main questions: (1) *What is the activeness of the markets for agricultural and food products, buying materials and agricultural machinery in cyberspace?*; (2) *What socio-economic factors determine responders' decisions and motivation in digital agricultural market?*; (3) *what are the specific decisions of respondents to participate in the digital agricultural products, materials and machinery market and*

(4) how socio-economics factors influence to the the e-active farmers' decisions?

(1) What is the activeness of the markets for agricultural and food products, materials and agricultural machinery in cyberspace?

The activeness of agricultural markets is the basis for the economic success of its participants. The number of sellers and buyers in agricultural markets is an important argument for the activeness of markets and their activation is accelerated by the employment of their digital space. Therefore, it is important to find out at the outset how many agricultural market participants are active, how much they employ, their decisions and motivations for farmers' participation in those markets and what the farmer's productive, socio-economic "baggage" is that determines decisions and motivations.

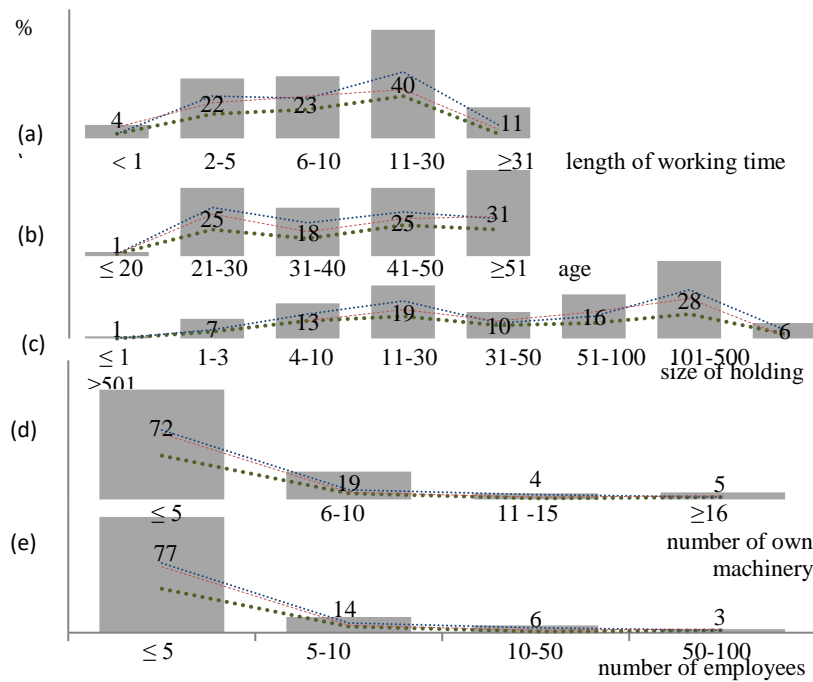


Figure 1: Respondents' distribution by: (a) length of working time, years; (b) age; (c) size of holding; (d) number of own machinery; (e) number of employees; and participants in digital agricultural markets by buying agricultural machinery (- - -); buying materials (...); selling agricultural products (●●●), per cent

The distribution of the survey participants, namely 273 farmers and 11 representatives of agricultural companies, by groups with regard to age, work experience and amount of resources is presented in Figure 1, where the columns show the overall percentage distribution of respondents, dotted lines indicate the percentage of participants in digital agricultural markets (*e-active farmers*) concerning the total number of respondents. Here, participation in digital agricultural markets is

understood as the use of internet sources to sell agricultural products, buy materials and agricultural machinery.

When assessing the e-active agricultural market participants based on Fig. 1, it is not difficult to observe that about two-thirds of respondents in each group are e-active in buying materials, half or more than half in buying agricultural machinery and about a third in selling agricultural products. Thus, farmers, whether small-scale, medium or large (according to the size of the holding, employees and machinery), young, mature or elderly, and with more or less farming experience, tend to trust and use e-service when buying materials and less often when buying agricultural machinery and even less frequently when selling agricultural products.

(2) *What socio-economic factors determine responders' decisions and motivation in digital agricultural market?*

The study determined the Pearson correlation coefficient r and its statistical significance p_value for all possible pairs of decisions and motivations of responders in regard to socio-economic factors: age of farmers, farming experience and size of holding (see Figure 2).

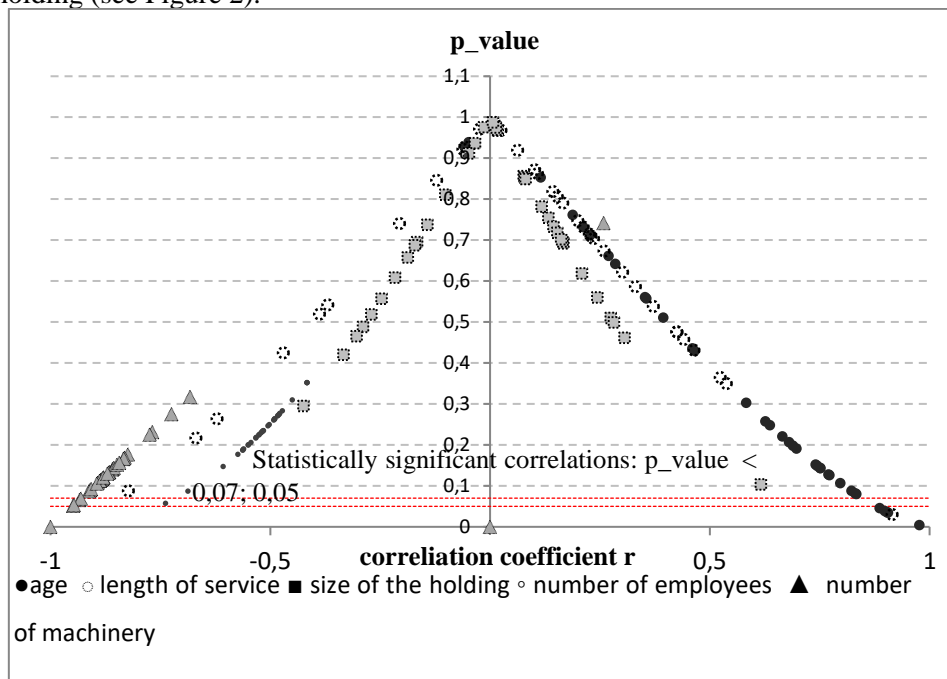


Figure 2: Respondents' decisions and motivation related with their socio-economic factors (Pearson r and p_value regarding e-active farmers)

The arrangement of points (p_value ; r) in the Scatter diagram illustrates the targeting of farmers' e-activeness in e-commerce and motivation in relation to the factors and their dependence on them. It can be said that the age of the respondents usually determines the factors directly influencing activeness and motivation: as the farmer

grows older, the tendency to behave in one way or another (as indicated in a certain formulation of behaviour) reinforces. Work experience and the size of the holding perform in much the same way, i.e. in both directions. The amount of self-propelled machinery and the number of farmworkers regularly reduce the tendency to behave one way or another. However, according to the methodology, it is important to take into account what remains below the horizontal lines, which indicate a level of significance corresponding to the 7% and 5% accuracy chosen by the researchers. The diagram clearly shows that the most common essential factors are the age of the farmer and the stock of self-propelled machinery. Work experience and the number of employees are unitary cases of causality. At the same time, the size of the holding plays almost no role in the commercial activity of farmers in digital agricultural markets (one square is on the 10% accuracy limit).

(3) What are the specific decisions of respondents to participate in the digital agricultural products, materials and machinery market.

Table 2 presents the correlation correspondences of respondents' participation in digital agriculture market (selling agricultural products, purchasing materials and machinery and making collective purchases) with the respondents' age, length of service and size of resources, based on Pearson's *r* and *p_value*.

Table 2. Pearson *r* and *p_value* are detailed when an e-active farmer is under the influence of socio-economic factors

Pearson <i>r</i> and <i>p_value</i> depend on:	In the sale of agricultural products			When buying materials			When buying agricultural machinery			In the case of collective purchasing		
	a	b	c	a	b	c	a	b	c	a	b	c
age	0.47 0.43	0.75 0.14	0.83 * 0.08	0.23 0.71	0.63 0.26	0.91 * 0.03	- 0.06 0.93	0.75 0.14	0.90 * 0.04	0.19 0.76	- 0.05 0.94	0.90* 0.04
length of service	-0.39 0.52	0.06 0.92	0.33 0.59	- 0.37 0.54	0.21 0.73	0.37 0.54	- 0.82 * 0.08	0.03 0.97	0.42 0.48	- 0.67 0.22	- 0.47 0.42	0.26 0.67
holding size	-0.29 0.49	0.02 0.97	0.17 0.69	- 0.33 0.42	0.21 0.62	0.08 0.86	- 0.30 0.47	-0.05 0.91	- 0.28 0.50	- 0.42 0.29	- 0.27 0.52	0.15 0.72
number of employees	-0.56 0.19	-0.48 0.27	- 0.52 0.23	- 0.57 0.18	- 0.49 0.26	- 0.52 0.25	- 0.56 0.19	-0.47 0.28	- 0.53 0.22	- 0.74 * 0.06	- 0.54 0.21	-0.49 0.26
number of machinery	-0.77 0.23	-0.86 0.14	- 0.89 0.11	- 0.89 0.11	- 0.88 0.12	- 0.83 0.17	- 0.87 0.13	- 0.91 * 0.08	- 0.82 0.18	0.00 0.99	- 0.95 * 0.05	-0.83 0.17

Note: Remarks: a - yes, regularly, b - yes, sometimes, c - I do not use (in answer to the question "Do you use e-commerce solutions to participate in digital agricultural products, materials and agricultural machinery market?")

* Correlation significant at the 0.001 level (two-sided).

The results in the table show that the examined dependencies are mostly insignificant ($p_value > 0.07$). At the discretion of the researchers, a confidence limit of 0.08, or 8%, was also assigned to the situation: "statistically significant" with a 92% probability. Thus, what is marked with a red asterisk in the table is considered to be a statistically significant dependence.

(4) How socio-economics factors influence to the the e-active farmers' decisions?

Further, the statistically significant regularities of *e-active farmers' decision* (to use / not to use e-commerce solutions when selling products, purchasing materials, machinery) in interaction with socio-economic factors, see Figure 3, as well as the corresponding reasons, are described. In the text below, Pearson r and p_value in parentheses next to the respective dependencies are indicated.

Feature to be analysed is age of the farmer:

-More frequent decision not to use e-commerce solutions is typical to older respondents: when selling agricultural products (0.83; 0.08); when buying agricultural materials, i.e. fertilizers, pesticides, fuel, spare parts (0.91; 0.03); when buying agricultural machinery, implements (0.90; 0.04); participate in collective purchases (0.90; 0.04). These dependencies are presented in Fig. 3 as trend lines a_1 , a_2 , a_3 , and a_4 , respectively.

-Older respondents are more likely to cite the fact that existing traditional marketplaces are sufficient and therefore do not need digital space as a reason for not using e-commerce tools in collective purchases (0.89; 0.04).

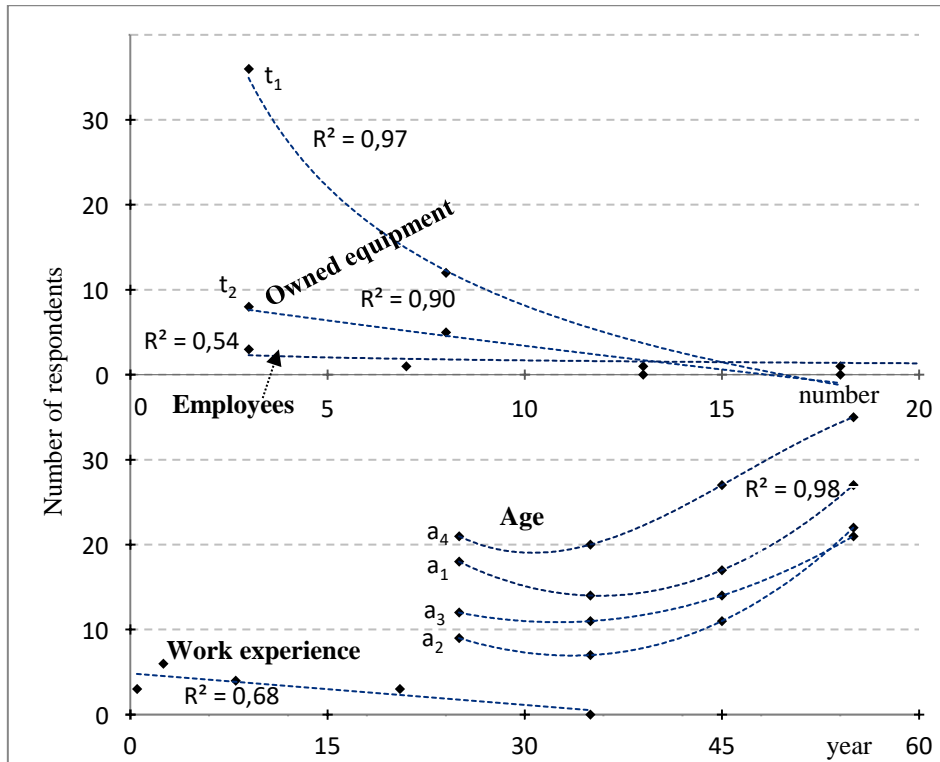


Figure 3: Statistically significant patterns of e-active farmers' decisions in digital agricultural market

Feature to be analysed is farmer's length of service:

- More frequent decision to use e-commerce solutions regularly is typical for respondents with less work experience when purchasing agricultural machinery and implements (-0.82; 0.08). Or the same fact can be interpreted oppositely: respondents with a longer working experience are less likely to use e-commerce services when purchasing agricultural machinery, see the trend line “Length of service” in Fig. 3;
- The reason for this situation is considered by farmers to be the lack of specialized websites (0.92; 0.03).

Feature to be analysed is the size of the farmer's agricultural holding:

- Why do not larger farm holders use e-commerce opportunities more often when purchasing agricultural machinery? According to the respondents, “Lack of skills for this” is cited as a reason (0.62; 0.084).

Feature to be analysed is the average number of employees on the farm:

- More frequent need to use e-commerce in collective purchases is typical for farms with fewer employees (-0.74; 0.06); The lower price, which is usually lower for collective purchases is of particular importance to small-scale farms.

- Why farms that employ fewer workers more often do not use e-commerce opportunities when purchasing agricultural machinery? It is said that there are no skills for this, as argued by the surveyed respondents (-0.69; 0.08).

Feature to be analysed is the amount of self-propelled farm equipment:

- More frequent decision to use e-commerce service when purchasing agricultural machinery and taking part in collective purchasing is typical of farms with a smaller number of self-propelled machinery (-0.91; 0.084 and -0.95; 0.05), see Fig. 3, trend lines t_1 and t_2 , respectively;
- Why are e-commerce opportunities not used when selling agricultural products, purchasing materials and making collective purchases? Here, farms with a smaller number of self-propelled machinery are more likely to cite a lack of skills, the lack of suitable e-pages and a single e-platform covering the interests of agricultural entities (-0.91; 0.083, -0.93; 0.07 and -0.93; 0.07).

When analysing the questionnaire, the non-use of the e-commerce solutions for the *sale of agricultural products* was mentioned by respondents in the following way: "Since I grow the crop, it is practically impossible to sell them directly by internet from the field", "Since buyers credit the purchase of fertilizers, seeds, plant protection products, I have to sell at least part of the production to them to pay for the materials received". Other farmers state that it is too much investment, others do not trust on e-commerce solutions, others have where to sell their products, so they do not need e-commerce.

Farmers explain the non-use of e-commerce opportunities *to purchase materials* as "A long-standing relationship with 2-3 suppliers who provide consultations on the use of purchased products, such as plant protection products". Other respondents point that they have no information about the digital agriculture platforms other than the websites of the country's main suppliers.

Farmers justify the non-use of e-commerce service when *buying agricultural machinery* with the following comment: "The purchase of machinery is difficult to standardize, because every farm, including mine, has specific needs and a direct consultation is always desirable. There is a need for a discussion with the seller or direct contact with the manager. It also takes a long time." Other respondent indicates that they have no information about digital agriculture platforms other than the websites of used machinery and major machinery vendors.

Until now, only theoretical studies of the need for electronic platforms have been conducted, without examining the demand and the functionality of electronic platforms. This study used a pilot needs analysis study and basically answered what factors influence the emergence and existence of electronic platforms. Therefore, the conducted research made it possible to model the need for the functionality of the electronic platform and to constantly improve it.

Conclusion

During the research, the aim was to determine the factors that promote the interest of small farmers in e-commerce and the application of a specialized e-commerce

platform for agricultural business in Lithuania. Farmers' interest in applying the tools of the electronic trading platform in the daily activities of farmers was determined: from the purchase of materials, tools, and raw materials to the sale of their own products. The investigated factors show the interest of farmers and the progress of farms in achieving efficiency.

Most Lithuanian farmers do not sell their products or buy resources using e-commerce tools. One of the main reasons for this situation is the lack of a specialized e-commerce platform for agriculture business offered by a third (non-interested) party for the needs of agricultural entities. Such a platform covering Lithuania, the Baltic States or Eastern Europe has not been introduced in the market yet. Its creation could give a serious impetus to the development of online trade in the Lithuanian agricultural sector.

The use of a specialized e-commerce platform for agriculture is useful as a means of marketing products and expanding the distribution of products. Such platforms are beneficial to sellers and customers because they attract more customers to buy the product, allow more economical use of resources, reduce transaction costs;

Empirical research has shown that in some cases the factors of a farmer's age, length of service and availability of resources are significantly correlated with the decision and arguments to use/not to use online opportunities when selling agricultural products, purchasing materials, machinery or making collective purchases:

- a. as the farmer grows older, the decision and argument for not using e-resources increases;
- b. as the farmer's work experience increases, the need to use e-resources when purchasing machinery weakens, and the argument for this becomes stronger;
- c. when purchasing agricultural machinery, there is more often a lack of skills to use e-resources in larger-scale and farms with fewer employees;
- d. farms with less self-propelled machinery more often argue that there are no skills to use e-resources, there are no suitable web pages to buy materials, there is no e-platform to make collective purchases. However, farms with less technical resources are more likely to use e-resources when buying agricultural machinery.

Farmers would be interested in trading online if they were offered a significantly lower price for the resources they needed.

The timeliness and speed of product delivery have a positive effect on the farmer's decision to use e-commerce platforms.

An important factor in increasing activity in e-commerce platforms is the targeted training of farmers in the use of e-commerce services.

The next steps of this research will be aimed at modeling the performance of such an interactive electronic platform. Initially, the basic operational capabilities of such a platform will be presented, farmers will be asked whether it meets their needs and what suggestions farmers make for improving the platform. Such research is carried out in 3 stages. After the third stage, the main version of the platform is launched with maximum improvements.

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CZYNNIKI KSZTAŁTUJĄCE ZAPOTRZEBOWANIE NA WYSPECJALIZOWANĄ PLATFORMĘ E-COMMERCE DO ZARZĄDZANIA PODMIOTAMI ROLNYMI

Streszczenie: Wydaje się, że drobni producenci rolni mogą wiele zyskać dzięki wykorzystaniu technologii informatycznych w biznesie, zwłaszcza biorąc pod uwagę ich przestrzenne rozproszenie pod względem oddalenia i niewielką skalę obrotów. Jednak dostępne statystyki pokazują niższy wskaźnik wykorzystania technologii informacyjnych do celów biznesowych w rolnictwie. Niniejszy artykuł przedstawia badanie czynników wpływających na przyjęcie rozwiązań e-commerce przez drobnych rolników na Litwie. Celem było zidentyfikowanie czynników, które powodują zainteresowanie drobnych rolników handlem elektronicznym i dostosowanie specjalistycznej platformy handlu elektronicznego dla przedsiębiorstw rolnych na Litwie. Badanie jest nowatorskie, ponieważ dotyczy niezbadanego obszaru - wykorzystania rozwiązań e-commerce przez rolników na Litwie. Nowatorstwo tego badania opiera się na założeniu, że drobni rolnicy rozwiną swoje gospodarstwa, jeśli zaczną korzystać z narzędzi platform elektronicznych w swojej codziennej działalności. Badanie zostało przeprowadzone przy użyciu kwestionariuszy od 284 respondentów (około 0,25% wszystkich litewskich rolników, zgodnie z danymi z 2019 r.) ze wszystkich regionów Litwy. Dane zostały zebrane wyłącznie za pomocą kwestionariuszy online w grudniu 2022 i styczniu 2023 roku. Wyniki pokazują, że istnieją ważne czynniki powodujące niechęć rolników do korzystania z platform elektronicznych, takie jak wiek i doświadczenie rolnika. Wyniki badania stanowią ważny wkład w rozwój technologii informatycznych w rolnictwie, w tym potwierdzają potrzebę wprowadzenia i rozwoju specjalistycznej platformy handlu elektronicznego w sektorze rolnym.

Słowa kluczowe: e-commerce, technologie informacyjne, małe gospodarstwa rolne, zachowania rolników