

Theses of doctoral (PhD) dissertation

**THE CORRELATIONS OF THE USE OF INFORMATIONAL
AND INFO-COMMUNICATIONAL TECHNOLOGIES IN
AGRARIAN ECONOMICS**

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1. THE BACKGROUND AND OBJECTIVES OF THE RESEARCH AND THE PRESENTATION OF RESEARCH HYPOTHESES

My choice of topic dates back to my MSc thesis. That was when I started to engage in integrated management systems while I was examining the management system of a particular commercial enterprise, its implementation and operation. In selecting the research topic, it soon became clear that comprehensible analyses on integrated management systems have often been made; however, the examination of specific sectors have been significantly less frequently dealt with by analyses. In my PhD dissertation, I collected data, information for the informatics-based examination and analysis of the agricultural sector, by using a questionnaire survey.

The main objectives of the research

Nowadays, digitalisation is an unavoidable topic in the media, education and conferences. Information technology is an integral part of our lives.

Enterprises which can and want to attune to the times and are able to effectively and efficiently use the opportunities provided by new technologies play a key role in the economy. For the examination of the area, I set several research objectives, i.e.:

1. The examination of the enterprise leader and owner's attitude and leadership mindset, and also the influence of age, sex and education on the use of ICT¹ at the company.
2. The examination of whether the structure of the organisation has an effect on the supply of IT devices at the company.
3. The analysis of the diversification of the enterprise and its effect on the enterprise and use of digital devices.
4. The assessment of whether the size, location and soundness of financial management (balance sheet, profit and loss account data) affect the use of the digital and IT system of the enterprise.

¹ Information and communication technologies

I included agrarian enterprises applying double-entry bookkeeping in my investigation. I chose these organisations because, in agriculture, the statistical population is so big that I would have had neither the financial resources nor the time framework to contact that many enterprises. Thus, I specifically sought to examine the enterprises and ensure the broader use of results with representative research.

Based on my objectives, I formulated six hypotheses regarding the digitalisation of agrarian enterprises applying double-entry bookkeeping:

H1: There is a correlation between the use of the integrated internal computer system and the demographic features, such as age, sex and education of the leader, owner of the enterprise. It can be assumed that younger and better-qualified leaders or owners tend to use ICT more at work.

H2: I suppose that the legal form of the enterprise also affects the use of the integrated information system.

H3: I assumed that in Hungary, those agrarian enterprises use integrated information systems whose activities point towards diversification, who engage in more diversified and more complex activities.

H4: I assume that the turnover and balance sheet total along with the highest number of employees (i.e., the size of the organisation) have an influence on the use of the integrated information system in the case of agrarian enterprises as well.

H5: The enterprises can fall behind the higher level of digitalisation due to the influence of the regional development factors possibly independent of them. On the basis of this, I supposed that those enterprises which use integrated management information systems, more often come from the more developed regions of Hungary, namely western Hungary and Pest County.

H6: I assume that those enterprises which use management information systems are less prone to subsidy-dependant conduct. They are less likely to expect a superior power, such as the state or the European Union to help them to operate their businesses or achieve growth.

2. THE SAMPLE AND METHODS APPLIED

During my research work, I carried out primary and secondary research as well, and at the same time, I applied qualitative and quantitative methods in order to be the most effective.

2.1. A questionnaire survey among agrarian entrepreneurs

The examination of the operators within a sector can be carried out most easily by assessing the external and internal environment. In the first period of the research, I compiled a logic model (Chart 1) outlining the research-related tasks and questions. In creating the objective of the research, I came to the conclusion that I had to create a unified concept with the help of the logic model in order to conduct an effective and successful primary research.

<i>General characteristics of the company. Factors determining organisation</i>	<ul style="list-style-type: none"> ▪ the type of company, general characteristics (size, main activity and specific fields, headquarters, location, type of organisation) ▪ characteristics describing decision makers (age, sex, education, interests)
<i>The criteria of introducing a company information system</i>	<ul style="list-style-type: none"> ▪ the use of the internet and IT devices ▪ the circumstances and reasons of introducing information systems ▪ the informatics background of the company ▪ factors affecting the choice of an information system ▪ entrepreneurial attitudes concerning the introduction
<i>The effect of the company's information system on its operation</i>	<ul style="list-style-type: none"> ▪ advantages of using information systems ▪ factors affecting operation, with special emphasis on IT technologies ▪ experiences concerning the introduction of the information system as regards efficiency and economy
<i>Experiences concerning the company's information system</i>	<ul style="list-style-type: none"> ▪ general characteristics of the applied system ▪ experiences regarding being online ▪ the chances of developing and using the system in daily routine ▪ entrepreneurial attitude after use

Chart 1. The Logic Model of the Research

Source: Own compilation based on Ghauri-Grønhaug (2010)

2.1.1. Selection of the sample to be examined

In my investigation, I consulted the agrarian enterprises applying double-entry bookkeeping with the help of a questionnaire, using simple random sampling.

In determining the sample, the main motivation was to “use simple random sampling in the case of homogeneous finite multitude when the sample is selected without placement, providing the same probability for any sample with an element ‘n,’” which is the precondition for representativeness (Hunyadi-Vita, 2008; p 45.). During the sampling, I only focused on the enterprises applying double-entry bookkeeping as the size of the population did not make the complete survey of the agrarian enterprises possible due to time and financial factors. Compiling the database necessary for sampling, I applied the comprehensive list of agrarian enterprises applying double-entry bookkeeping provided by the AKI (Research Institute of Agricultural Economics) that contained the enterprises broken down by county. This list, containing 10,648 agrarian enterprises applying double-entry bookkeeping, provided the database for my study. I chose this list because it contained information on the agrarian enterprises, which I found relevant and important: names of the organisations, addresses, telephone numbers, main activity codes and net annual turnover.

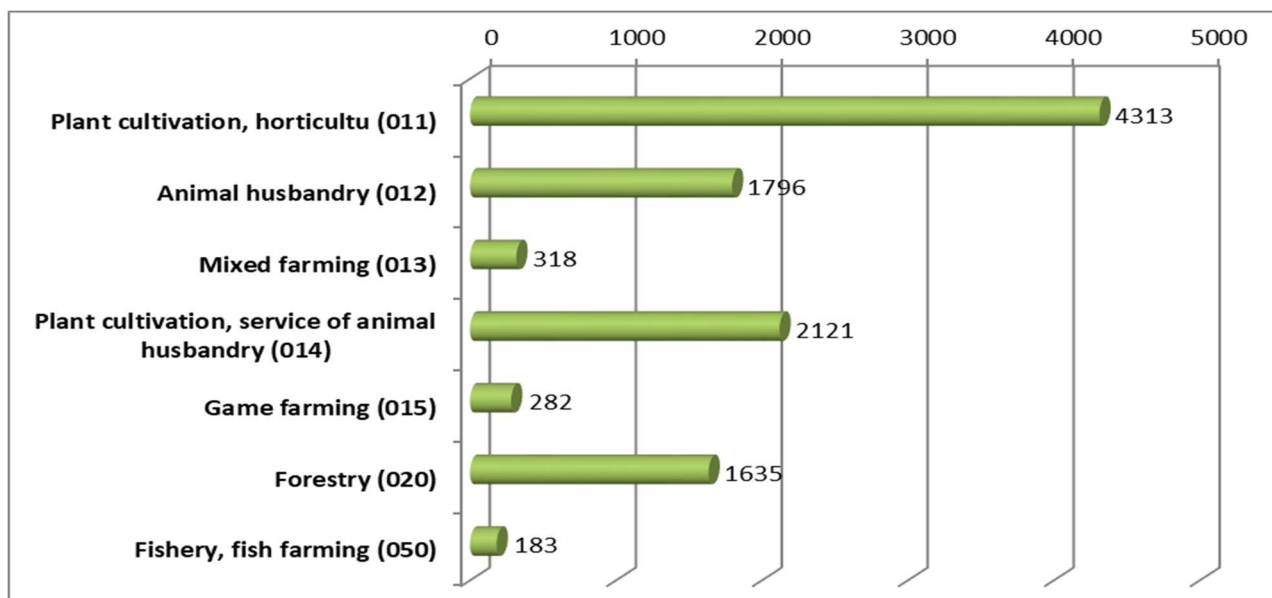


Fig. 2: The number of agrarian enterprises according to main activities in Hungary

Source: My own compilation (based on AKI data 2010); n=10,648

Fig. 2 shows that the most significant main activity was plant cultivation under TEÁOR² 11 which includes 4,313 enterprises, Under the category “plant cultivation and animal husbandry service,” 2,121 entities, 1,796 animal husbandry and 1,635 forestry enterprises can be classified, together constituting the population. I compiled the activity-based composition of the sample on the basis of the comprehensive list of activities. As I determined the order first according to geographical features, then according to the activity, ensuring that the selected sample fulfilled the criteria of representatively and stratified sampling. Based on these criteria, I summarised the enterprises, involving every twentieth of them in the research.

On the basis of the available data, I calculated the composition of respondents in the sample. This composition enables representativeness on the basis of activities in full multitude.

2.1.2. The methodology and features of compiling the questionnaire

The foundation of the research was a questionnaire survey. During the compilation of the questionnaire, a preliminary, semi-structured interview done with ten agricultural enterprises of different sizes when I surveyed what major questions I would have to focus on within the topic, helped me. Conducting interviews seemed to be the most suitable method in order to carry out the most accurate and most thorough preliminary assessment, based on which I could compile the questionnaire to fully conduct the research.

I compiled the final questions of the questionnaire on the basis of the results and experience of the direct discussions and focus group interviews and using the software EvaSys, I created an electronic survey interface. The interviews also highlighted that I should not only focus on internal information management, but also on general and modern questions. To the questionnaire, I attached a supplement that I compiled on the basis of Gábor (2007), which contains the classification of information technology (hereinafter: IT) systems, with which I clarified the relevant subjects.

²The Hungarian activity classification (TEÁOR'08) is identical with NACE Rev.2. used by the EU; used to determine the activities of enterprises

The investigated areas were built up and are going to be presented on the basis of the themes of the main groups of questions, which are as follows: the enterprise and its leadership; information management; the IT system of the enterprise and the plans, relationship network and leadership of the enterprise. The main groups of questions were structured around the following topics:

- **The enterprise and its leadership:**
 - main facts and main activities: location, the start of the business, form of enterprise,
 - information on the size of the enterprise and data on its balance;
 - information on the head: age, sex, education
- **Information management:**
 - data on the use of computers and the internet,
 - information acquisition, habits of use
- **The IT system of the enterprise:**
 - the IT system,
 - attitudes towards informatics,
 - strategy concerning the IT system,
 - questions on the current system;
- **Plans, relationship network, leadership:**
 - competitive advantage, tenders,
 - keeping contact and new technologies.

I was striving to compile the questionnaire in a way that the responses could provide the widest range of possibilities for analysis and assessment. Accordingly, I endeavoured to design the set of questions to provide the respondents with the widest possible range of opportunities to respond. The initial phase of the questionnaire is characterised by general and demographic questions, multiple-choice and yes-or-no questions. Within the topic of information and information management, 5-point Likert scale questions on leadership attitude appear, along with the general scale questions enabling definite answers.

2.1.3. Mathematical and statistical methods applied

Economics is the science of research and analyses. Economic phenomena have a continuous, significant, mutually reinforcing, determining, inter-conditional influence on one another. During the analysis of the data, the statistical investigation of these relationships and different variables is carried out.

The main objective of my research was the examination of the correlations based on the responses provided by the enterprises. For this purpose, I was striving, using statistical methods, to find the correlations and examine whether there are any correlations between the particular variables, answers.

During my research, I applied:

- cross-tab analysis,
- correlation analysis,
- variance analysis,
- regression analysis,
- factor analysis.

With the help of the statistical analyses, I processed my database in the SPSS software which offered ample opportunities for an extensive and in-depth statistical analysis. This enabled me to run statistical analyses that provided an extensive analysis of data.

2.2. Presentation of the features of the samples

The sample size is 270, out of which the oldest and still operating enterprise was founded in 1936 and the youngest respondent organisation was founded in 2009. 94.6% of the enterprises in the sample do not have a public-sector or municipal owner, while in the case of the remaining 5.4% the state or local government is present to some extent. 5.9% of the enterprises surveyed indicated that they engage in agricultural activities outside Hungary as well.

Figure 3 shows that the ratio of distribution on a county level corresponds with the ratio of questionnaires sent out, thus geographical representativeness is provided.

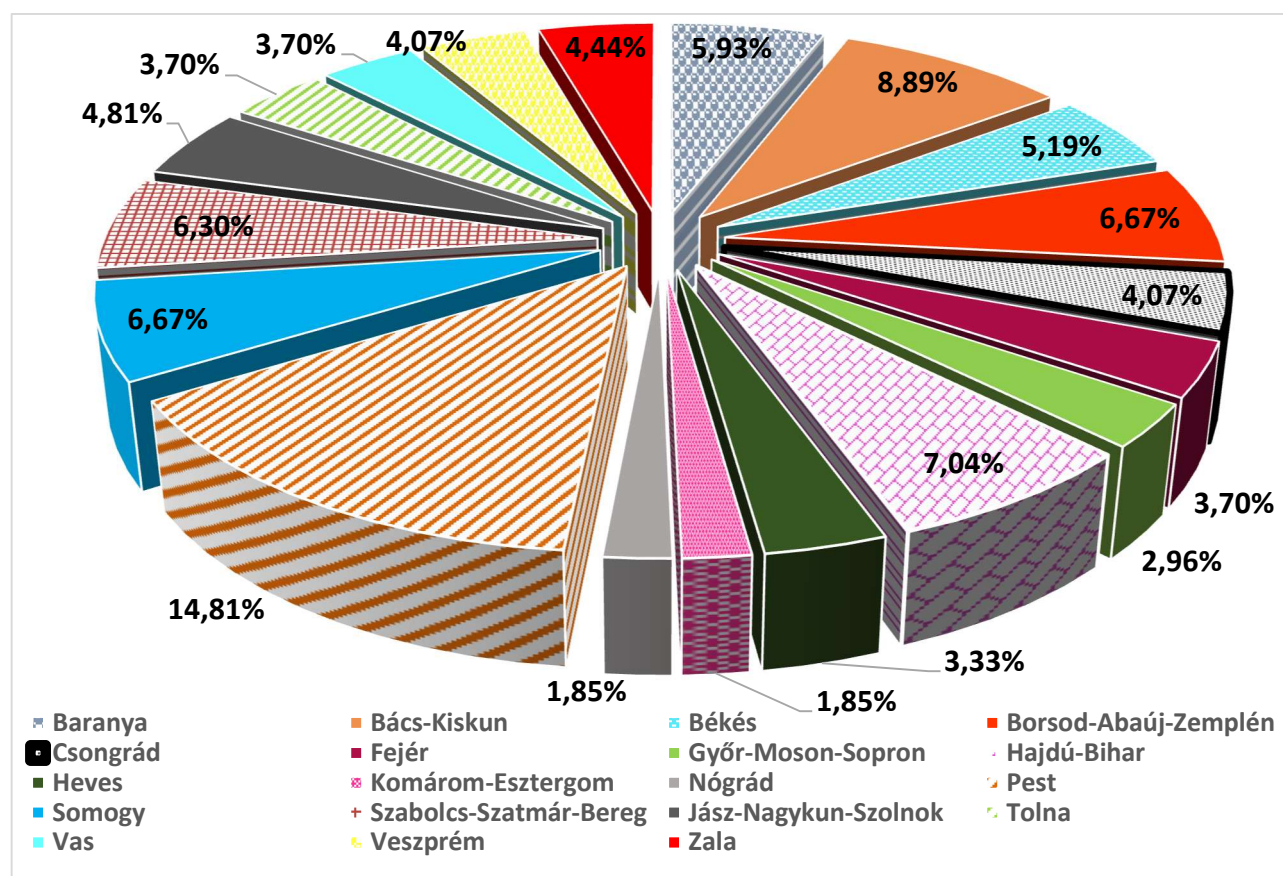


Fig. 3: Geographical distribution of the questionnaires in the sample, (%)

Source: My own research, 2017.; n=270

In Figure 4, I summarised the main activities of the enterprises in the sample, which corresponds with the ratio of the questionnaires sent out, providing the second layer of representativeness.

Figure 4 also shows that the most respondent fall under the cultivation of crops and other plants n.e.c. main activity, while the respondents in the field of fishery represent less than 1 per cent of the full multitude, just as in the case of the population.

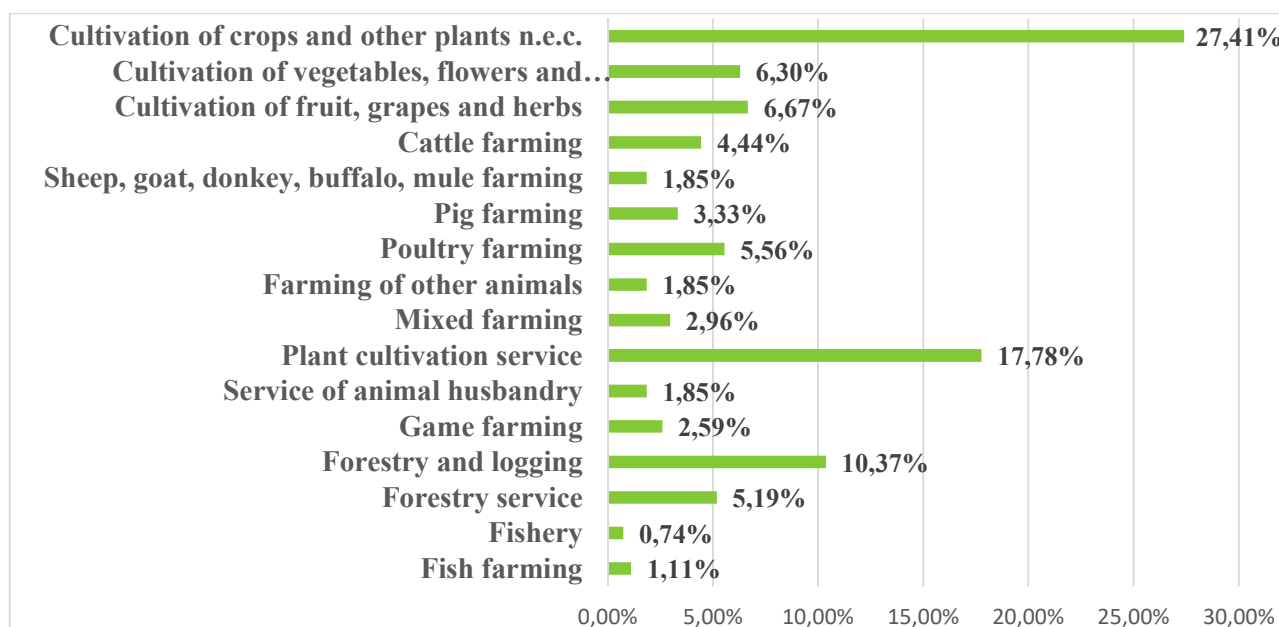


Fig. 4: Distribution of the questionnaires in the sample according to activities

Source: My own research, 2017.; n=270

Studying the sample, I analysed the distribution of the enterprises if I examine the annual net turnover of each size category. Just as in the full multitude, micro enterprises were predominant. This category represents 64.44 per cent of the full multitude, while small enterprises make up 24.07 per cent and medium-sized enterprises account for 10.37 per cent within the sample. Large enterprises represented 1.11 per cent of the respondents, which is a very favourable ratio, given that there are very few operators in the size category in the full multitude as well. During my research, I reviewed the factors of the enterprise, such as characteristics of organisation, size categories. I examined the demographic characteristics, such as sex, age and education.

Figure 5 shows the composition of the respondents' education in the examined sample.

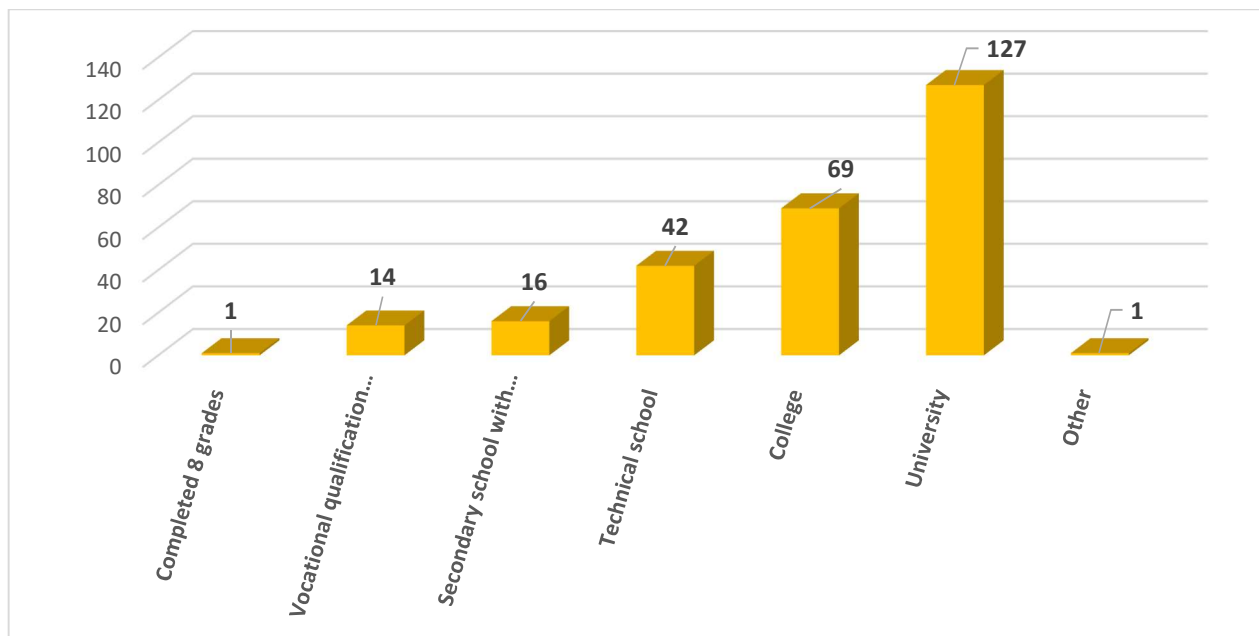


Fig. 5: The composition of the sample according to the owner and leader's education (number of people)

Source: My own research, 2017.; n=270

Figure 5 shows that in the sample, 196 people had tertiary education, while only 74 leaders out of the 270 respondents had secondary education or lower. On the basis of the sample broken down by gender, it can be stated that male leaders dominate in this sector since only five female leaders were among the respondents, while 37.2 per cent of them were men and in 60.9 per cent of the cases, the enterprise was jointly managed by the different genders (i.e., women and men together), the cause of which lies in the joint-stock company and cooperative forms.

3. THE MAIN ASSUMPTIONS OF THE DISSERTATION

The examined areas were grouped around the themes of the main questions, thus the results are also presented in the similar manner. These are as follows: the company and its management; questions concerning the management of information; questions on the information system of the company; questions related to the plans, relationship network and leadership of the company.

The following statements are made, based on the research hypotheses, in relation to the use of information and info-communication devices by companies:

H1: I assumed that those in charge of making decisions at enterprises had a significant influence of the digitisation of their organisation. I examined the most important influencing factor in the relationship between the demographic traits of the decision makers of the enterprise and digitisation from this point of view. Based on my research, I could prove the hypothesis that there was a strong relationship between the qualifications of the decision makers and the level of the digitisation and use of integrated systems of the company. This part of my hypothesis was considered to be proven. On the basis of my research results, it might be stated that the process of digitisation has many obstacles along the way. A significant part of farmers might be able to apply knowledge of informatics but only in a rudimentary and isolated way. In many cases, it is employees and contracted entrepreneurs who do this job, and the leaders, the management and owners only observe the events from the background.

Of all demographic data, the most important factor is the qualification of farmers. The higher qualification an entrepreneur has, the more likely they are to use IT systems and digital technologies. It is very important for them to be up-to-date and exploit this strategically significant field for the successful operation of their enterprise.

Figure 6. shows that another demographic factor, i.e., age, does not show any significant deviation in the examination of the use of integrated IT systems. In the examination, I used cross-tab analysis for the conflation of every partial factor, that is, age and qualification. I feel it important to point out that although age does not appear as a statistically verifiable influencing factor, it may still have an effect on the attitude of entrepreneurs to digitisation.

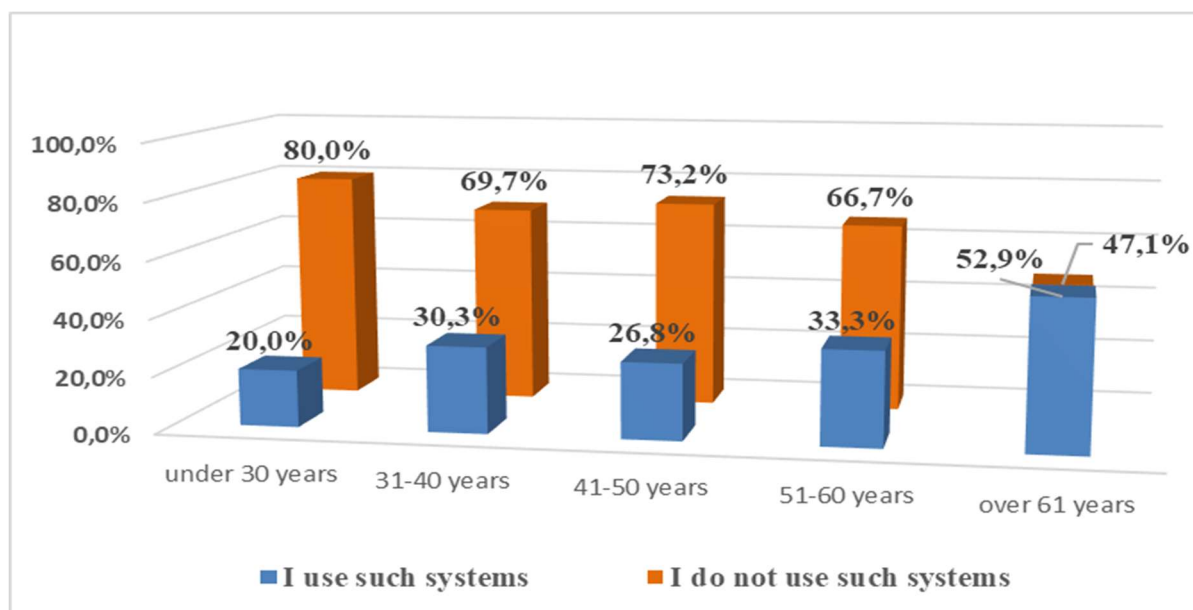


Fig. 6: The correlation of the age of the owner and the use of IT systems on the basis of cross-tab analysis

Source: My own research, 2017.; n=270

The analysis has shown that neither gender, nor age work as a statistically verifiable influence factor, while there is a strong, significant correlation between qualification and the use of integrated IT systems, which can also be formulated as a thesis.

H2: It was assumed there was a correlation between the legal status and the use of IT systems. Enterprises using IT systems also have a more complex organisational structure and thus operate in a legally more varied and diversified structure compared to companies with a simple, functional organisational structure.

Figure 7. reveals that enterprises with a bigger and more complex organisational structure and legal status are more likely to use integrated IT systems in their operation. The most outstanding one is the joint-stock company, 36% of which use and only 2.8% of them do not use IT systems on the operation and management of the enterprise.

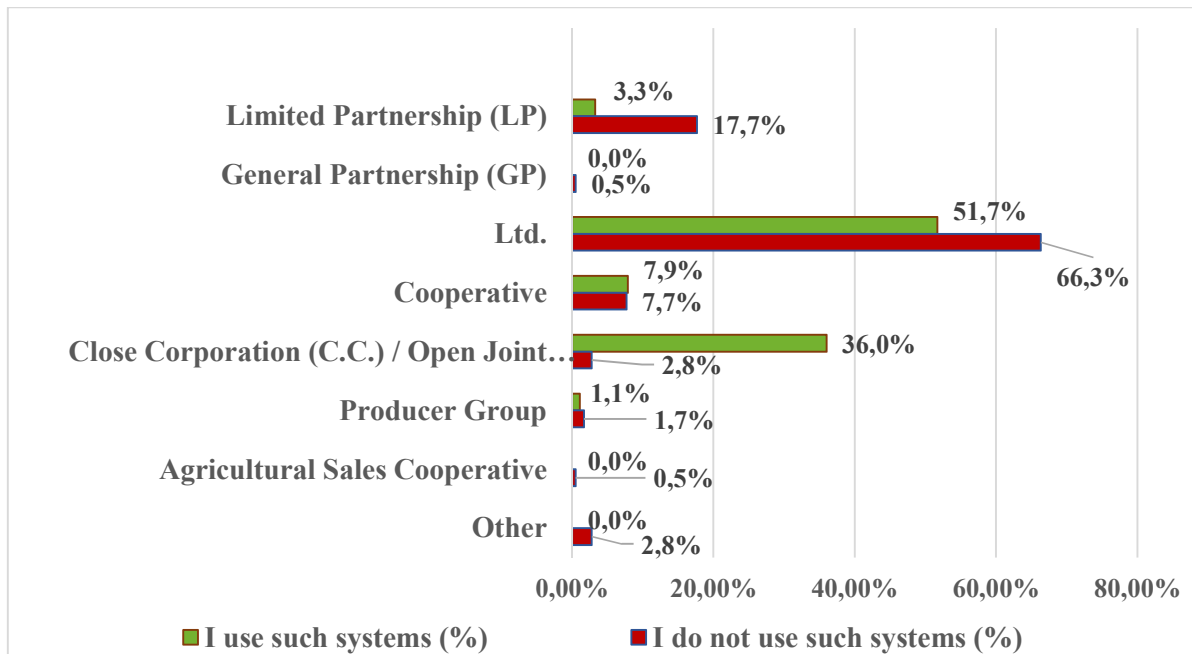


Fig. 7. Cross-tab analysis of enterprises according to legal status

Source: My own research, 2017.; n=270

It was corroborated during the analysis that the organisational and legal form was a statistically verifiable influencing factor.

H3: It was assumed that the complexity of the activity and the kind of profile of the enterprise itself was also affecting whether the company used integrated systems in the operation.

				Sum of Squares	df	Mean Square	F	Sig.
Total activities * What kind of IT system does the enterprise use?: I do not use such systems	Between Groups	(Combined)		226,658	1	226,658	49,839	,000
		Linear Term	Unweighted	226,658	1	226,658	49,839	,000
			Weighted	226,658	1	226,658	49,839	,000
	Within Groups		1218,808	268	4,58			
	Total		1445,467	269				

Chart 2: The conflation of activities with the use of IT systems at 5% significance level

Source: My own research, 2017.; n=270

Chart 2 is the Anova chart of the analysis performed with SPSS software, which shows the correlation between the examined factors. After the analysis of the number and kind of activities, my hypothesis was proven and both cross-tab analysis and variance analysis showed a strong and statistically relevant correlation in these cases.

H4: My starting assumption was that a company with more diversified activity was bigger in size as well. These enterprises have more income and more favourable economic characteristics compared to smaller and less diversified enterprises.

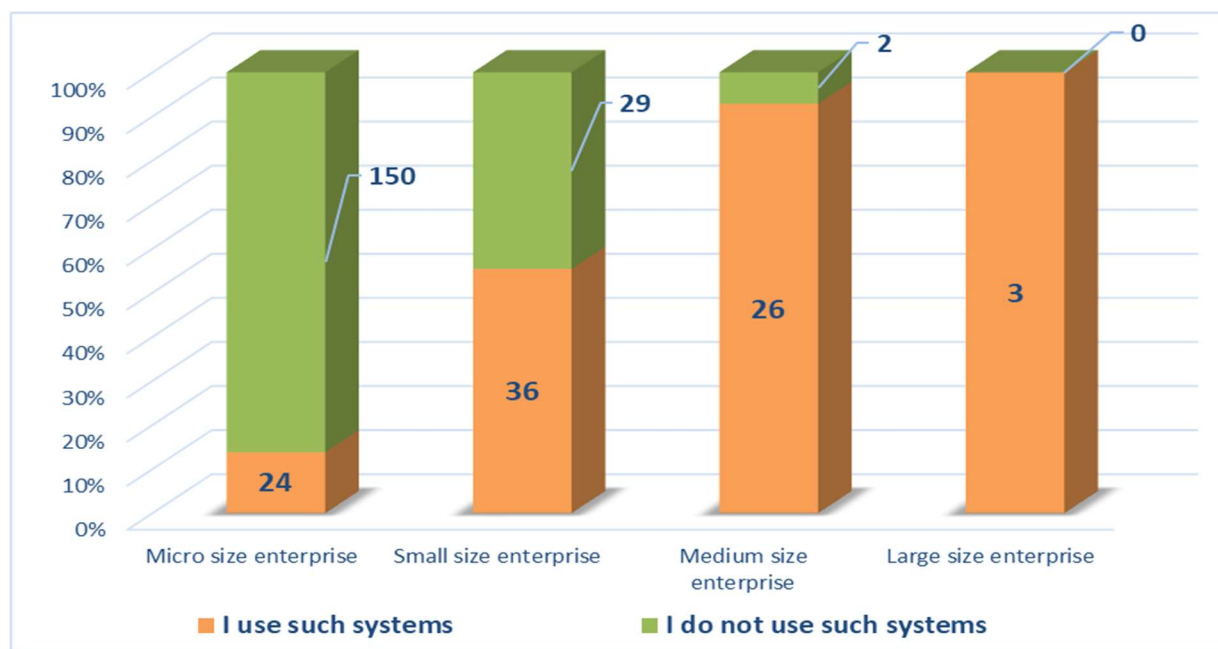


Fig. 8: The conflation of the classification of enterprises based on size and the use of IT systems

Source: My own research, 2017.; n=270

Figure 8 reveals the kind of correlation shown by cross-tab analysis between the legally determined size of the company and the use of integrated IT systems.

My hypothesis was verified: the bigger the turnout (balance, annual net income, operating result, and related to this, the number of employees), the more likely it is that they use some kind of integrated technology in order to enhance daily operation and decision making.

The results of the examination of hypotheses H3 and H4 prove that the extent of using an integrated IT system and the level of digitisation is greater in the case of a bigger and more complex company, and the enterprise is also more likely to use new technologies better and easier. It follows from this that it would be important to improve the complexity of enterprises in general – the diversification of activities would promote agrarian enterprises and the economy in general. On the one hand, this could reduce the vulnerability of these enterprises and, on the other hand, it could increase flexibility and the ability of using innovative and new technologies.

H5: It was assumed at the beginning of the research that enterprises which operate in a more developed economic environment (West-Transdanubian region, Central Hungarian region) are more likely to be more developed from the point of view of digitisation.

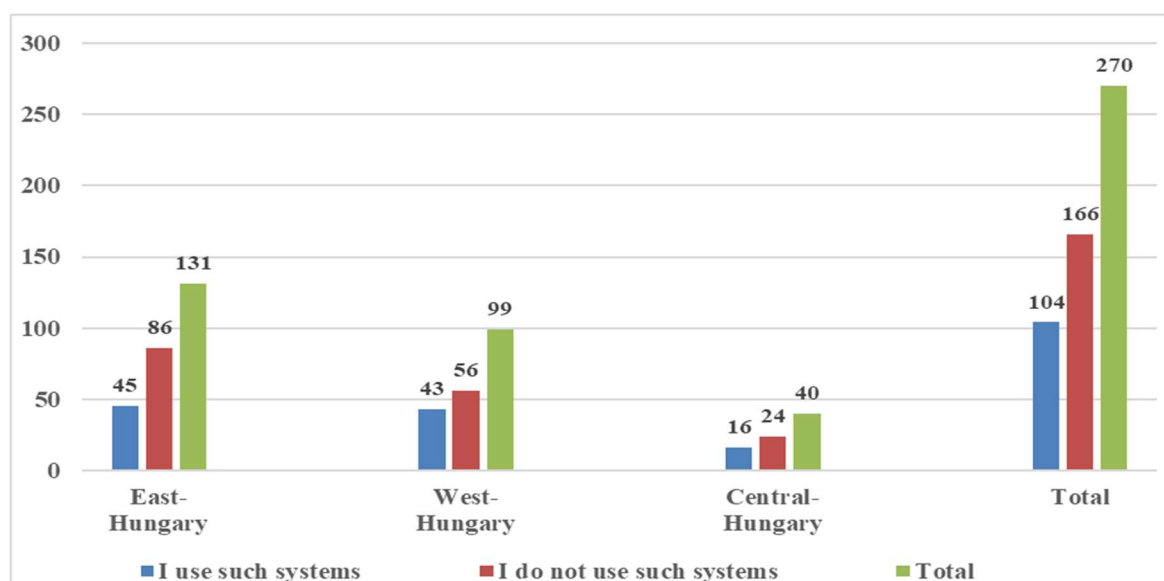


Fig. 9: The conflation of the geographical location of enterprises and the use of IT systems, based on cross-tab analysis (nr. of enterprises)

Source: My own research, 2017.; n=270

Figure 9 exhibits that the research was also extended to geographical circumstances, that is, the area where the company was located within the country and its correlation with the use of both IT devices and the of integrated management systems. This hypothesis of mine was not verified. The results show that there is no correspondence between the level of the company's digitisation and its location.

H6: I surmised that a high level of state subsidy in the case of agrarian enterprises did not motivate the owners and managers of these companies to use modern technologies and to increase efficiency. My calculations point out that there is a strong correspondence between the expected level of state subsidy and the rejection of the use of integrated systems. I concluded that a certain kind of dependence is observable of EU sources, which does not prove to be effective, and which is also reinforced by analyses in relevant literature.

Figure 10 clearly reveals that most respondents regarded cost reduction as most important, since almost 71% of them said that this was the best way to improve efficiency. Only 10.7% of the participants thought that the application of IT possibilities was crucial, while the

exploitation of the chances offered by the Internet was chosen by only 9.9%. My research results show that, according to farmers, the strengthening of state subsidies was more important than flexible adaptation to market circumstances. The answers were marked in a 5-point Likert scale in the questionnaire. I examined answers to 12 questions, since among the questions there was an “Other” category, which was not included in the analysis in order to avoid distortions.

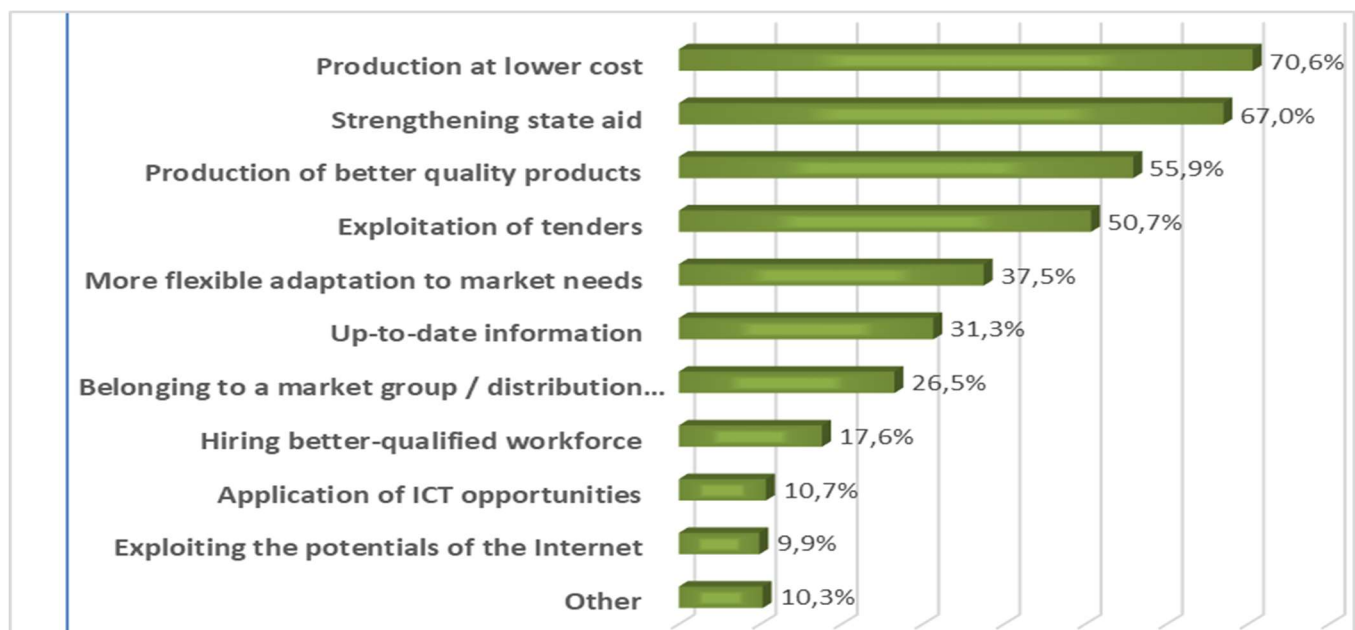


Fig. 10: Opinions on the improvement of the company and on the importance of the increase of efficiency

Source: My own research, 2017.; n=270

The pool of data in this case can be regarded as a multitudinous variant space, so I applied the procedure of data reduction, which condenses the data in variants including fewer and only the most essential factors. The data were examined with KMO test and Bartlett test as well, on the basis of which both main component analysis and factor analysis could be performed on the sample.

Based on the results of factor analysis and on my initial hypothesis, I managed to coin a new concept which I termed **learned economic helplessness** (or “waiting for the bird to fly in one’s mouth roasted” effect, “**waiting for the bird**” effect for short).

The phenomenon “waiting for the bird” is used for cases when the manager or owner of enterprise expects help or support from the government or any higher agency instead of behaving as an entrepreneur and working out a strategy. The person fails to thoroughly

examine the characteristics of the enterprise (such as risk taking spectrum, rational action, reserves), is not willing to prepare an action plan to exploit the hidden reserves of the operation that could make the enterprise more efficient and profitable but hopes for government action or support for the emerging problems.

My research results show that from the aspect of the acquisition of IT devices and their use, important factors are the qualification of the manager or owner, the diversification of the enterprise and the form of organisation. The size of the enterprise is also a significant factor, which is mainly affected by the operating result and the annual net income, with respect to the use of integrated IT systems. It also became obvious that there was no statistically verifiable correlation between the location of the enterprise and its level of digitisation.

It might be assumed that a statistically supportable correlation can be detected between the use of integrated management systems of agrarian enterprises and

- the qualification of the manager or decision maker;
- the diversification of the enterprise;
- the main activity of the organisation;
- the size of the enterprise;
- the form of organisation.

At the same time, results revealed that factors such as the development of the region or sub-region has little effect on the use of integrated systems.

4. THE NEW AND ORIGINAL RESULTS OF THE DISSERTATION

On the basis of the results of primary and secondary research carried out during the completion of the thesis, the following new assumptions may be made:

New results:

1. A close and positive relationship was proved, on a representative sample, between the use of info-communication devices and the qualification of managers or owners of agrarian enterprises employing double-entry bookkeeping in Hungary. The qualifications of the leader of the organisation determines the integrated management system and the digital devices used by the enterprise.
2. A strong and stochastic correlation was found, on a representative sample, between the organisation structure of the enterprise and the employment of digital technologies. The relationship is massive and positive, since the more complex legal organisation the enterprise possesses, the greater is the extent of its use of integrated systems in its operation.
3. It was found, on a representative sample, that there was a positive correlation between the diversification of agrarian enterprises and the use of integrated IT systems. The more diversified the scope of activity of an agrarian enterprise is, the more likely it is to use an IT system of higher complexity during its operation.
4. It was proven, on a representative sample, that a close and positive correlation existed between the size, income and balance sheet total of an enterprise and the use of IT systems. The size of an enterprise, regulated by laws conforming to EU standards, determines the use of an integrated system by that company.
5. Based on my research results, I managed to coin a new term, “learned economic helplessness,” named on the basis of results on representative samples and earlier, similar examinations of others (Kállay, 2014; Csomós, 2014; Béres, 2007). There is a stochastic and positive correlation between the nonchalant attitude of entrepreneurs waiting for state subsidies and the rejection of the use of IT systems. In order to prove my result in a wider scope, further research and the inclusion of other sectors in this research might be necessary.

Original results:

1. During the research, two demographic factors, age and gender, were also conflated with the use of up-to-date digital technologies. It was found that there was no statistically verifiable relationship between age, gender and the use of integrated IT systems. This result of mine may be considered original, since, differently from other scholars, I did not manage to find a connection between the use of IT tools and the gender or age of owners or managers, on a sample of agrarian enterprises.
2. On the examined representative sample, there was no detectable positive correlation between the geographical location of the enterprise and the use of new, innovative technologies and integrated IT systems. In this sense, my research may be considered to be original, since, on the basis of earlier research in the field of regional economy and sub-regional surveys, a strong and stochastic relationship could have been supposed, which was not verified on my sample.

5. THE PRACTICAL USEFULNESS OF RESEARCH RESULTS

In my dissertation I examined the use of information, info-communication and integrated management system in the life of agrarian organisations. It became evident from the research that the personal characteristic traits of the owners and managers of agrarian enterprises had a decisive effect on the use and adaptation of IT devices. At the same time, the complexity, diversity and size of the organisation necessitates the application of these IT devices. One of the most important results of the research is the detection of the change in the attitudes of entrepreneurs. “Learned economic helplessness” has deeper roots in the thinking of the class of entrepreneurs than might have been supposed earlier. The effects of this are evident in the level of digitisation of the agrarian sector, in spite of the fact that the role of digitisation is outstanding in every sector of the economy. Adaptation ability and flexibility are vital for the participants, since this is what makes them able to survive, increase their productivity and exploit their possibilities. I consider the tendency deplorable which turned flexible and enterprising businessmen into ones dependent on subsidies. It would be essential to change this, because it is impossible to build a dynamic, flexible and high-value added sector with uncompetitive entrepreneurs unable to improve and adapt.

In my opinion, the common goal of the enterprises and the state should be the motivation of businesses to be more diverse. Not even agrarian enterprises will be able to ignore digitisation, which will demand more role in the life of companies. At the same time, my research was based on a representative sample relying on geographical differences and diversity of activity, which means a statistically significant result for both the agents of the sector and representatives of the government as well. To my mind, the goal is clear: improve the skills, abilities, adaptation competences and technological factors. It would be important to aid all age groups (not necessarily with subsidies) in the reinforcement of the skills of the application of technology and digital devices. I would emphasise the role of education, which would be materialised in close cooperation with institutions of higher education. Not even the existing network of consultants can balance the deficiencies within the field of qualifications, which might lead to tensions within the sector in the long run. In my opinion, there is still a possibility to expand my field of research. Besides the option of examining individual entrepreneurs and primary producers, the research could be broadened to include

other sectors, since the interest of the national economy is the strengthening of an efficient and successful entrepreneurial class that is able to feel comfortable in the digital world.

Several solutions may arise in this case. For instance, one option is a loose cooperation between enterprises, similar to those in Western Europe, and one that resembles marketing cooperatives. The integrated IT system could be procured and used commonly, without the organisations having access to others' data, but still being able to enjoy the advantages of a digital platform. They could form a cooperation, could purchase modern technological means more cheaply and could adapt novelties sooner and more flexibly. This would be a favourable solution for micro and small enterprises, which are the most vulnerable in the sector. Another important aspect is that this solution would help to move toward independence of state subsidies. Experts in agriculture and information technology could work together in order to compile a spectrum of operation systems, from which the organisations could select according to their needs. The advantages of the common use of systems would be cost efficiency, having access to an up-to-date system and digital safety.

The “whitening” of agriculture is unimaginable without the use of management systems and significant digitisation. The following aspects will play an important role in the future:

- The agrarian sector today is characterised by a waste of resources, which appears both in input and in output. On the input side, the best example here is the use of fuels, 10-20% of which could be saved if precision farming was introduced. In the case of an integrated, monitored enterprise backed with an IT system could achieve a 5-10% reduction of all inputs, which is a significant economic potential for both the enterprise and in the national economy. As far as output is concerned, the farmers are not motivated in the introduction of such systems, but the chances are that, even if the subsidy system changes and makes the introduction easier, it will be too late for the business to apply IT technologies in the organisation, and with serious arrears.
- A shrinking might be expected in the ownership of agrarian enterprises, meaning that one owner is going to manage or supervise several enterprises. If the number of companies belonging to one owner increases, the electronic recording, storing and use of data emerging during the operation will be necessary within one IT management system. These systems are able to provide information for decision

makers quickly and irrespective of location, and production losses might be reduced or eliminated with their use. In the case of the anonymous pooling of professional data, the software developer company can provide new derived information for the users, such as location-specific recommendation of breeds, suggestions for nutrients, suggestions for cultivation, etc. The number of enterprises is not expected to decrease, since, because of the decrease of area payments and the regulations concerning land use, it is worth to operate multiple enterprises for those who cultivate bigger areas. In case it is not the owner who manages the monitoring process, this is the best distance method to control production and to provide necessary information for decision making.

- In the case of family businesses, and regarding the present system of subsidies and level of profitability, the spread of these methods are likely to be slow, due to the professional expertise of owners or managers. The likelihood of the wider use of IT tools in the case of individual entrepreneurs, family businesses and primary producers will increase if subsidies are cut back, profitability diminishes and a change in attitudes takes place.
- Livestock breeding is an excellent example for the advantages of automation and digitisation. For instance, in a cattle ranch today, information is available to tell how much fodder a given cattle consumes a day, how many steps it makes a day, when its last oestrous cycle was, how many times it has foaled, how much milk it gives per day, what the cow's life and lactation performance is, how much milk its offspring give and how much milk its siblings produce. If the existence of the farm depends on where and how much the organisation is able to save or which input is profitable, every option is used to uphold the profitability of the enterprise.
- In crop production, the correlation of input, production and profitability is not visible in a field-by-field breakdown. Only accounting records are available about used machines. In the case of power tools, there are scheduled maintenances, but in the case of most agricultural machines information is scarce, sometimes not even their location is known within the area of the farm. Machines are repaired only when they break down, but there are no exact calculations to compare if scheduled maintenance or emergency repair is cheaper. There is huge potential in this field, but until the

above-mentioned cases cause problems, only a small group of entrepreneurs recognise and exploit the hidden potentials.

It is always an important dilemma for agricultural enterprises to decide whether they want to be specialised in a few activities or to be more diverse. This decision is not easy. My suggestion is the diversification of activity, which I would examine from two aspects. On the one hand, the efficiency of enterprises that are already diversified could be improved with the use of IT tools and information management systems. The owners and managers would be able to monitor different processes, to analyse financial indicators and to eliminate possible problems. On the other hand, the introduction of IT management systems would enable less diversified or non-diversified enterprises to expand their field of activity. This way, the manager would be able to monitor and control several processes at the same time, results could be precisely measured and quick intervention would be possible if necessary. Even the given sub-region may profit from diversification due to the increase of employment, which could either keep in place or invite back part of the young generation. The results of the present dissertation may be useful on several levels. First, they may, by relying on the attitudes and personal characteristics of agrarian entrepreneurs, enhance the formation of a suitable digital strategy in the sector. Furthermore, they may support the decision makers of the sector in deciding about the ways entrepreneurs and owners could be helped and motivated in more efficient and successful use of IT devices, in order to create a sustainable agrarian sector. Parallel with this, it would be important to help enterprises to diversify their activity and “whiten” the agrarian sector, so that it may help the development of a result-oriented and more efficient mode of farming.

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6. PUBLICATIONS ON THE TOPIC AREA OF THE DISSERTATION



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List of publications related to the dissertation

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1. **Szabóné Berta, O.:** A digitalizáció szerepe és jelentősége a modern mezőgazdasági vállalkozásoknál egy kutatás tükrében.
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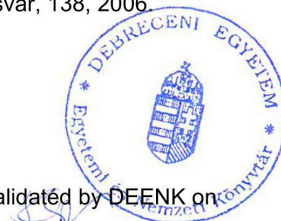
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