

## Intensity of ICT use by managers of agricultural enterprises

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**Abstract:** The growing importance and relevance of ICT in business increases the dependence of business entities on ICTs, to which the managers of agricultural enterprises need to pay the necessary attention. The penetration of ICTs also affects the companies that do business in the area of agriculture. High quality and accessible information today has a strategic economic and social importance for the management of this sector; therefore, the use of ICTs by the company managers is becoming an essential part of their daily lives. In their work, the managers of agricultural enterprises most often use a personal computer. The intensity of the laptop use is increasing and thanks to the mobility and connectivity, smartphones are also getting ahead. The use of these devices closely involves operating and application software. The most popular operating system is Windows. In terms of applications, the managers most often use the most popular package MS Office. The research involves an analysis of the intensity of the ICT use by managers with emphasis on agricultural enterprises in the Slovak Republic. The scientific article presents the results of an implemented survey focusing on the intensity of the ICT use by managers and the verification of the hypothesis of a significant influence of a manager's job position on the intensity of the ICT use in the company.

**Keywords:** communication, information, ICT indicators, hardware, software

The driving force behind our modern society is information and information and communication technologies, which are an essential part of the infrastructure of organisations, enterprises. Their development substantially affects the economic environment and they are among the factors of prosperity and business competitiveness. Without information and the use of information and communication technologies, it is currently not possible to manage businesses, organisations and decide professionally. For an efficient management, the managers of organisations need relevant information crucial for an appropriate decision making. In all organizations of the state sector, the public sector, in associations and private enterprises, managers work in the following categories:

top, middle and lower level management with an important mission – to influence the activities of the organization and its results.

Information-communication technologies (ICTs) penetrate into the social life and on all levels of the economy, which changes the society into the information society. It can be briefly defined as a society in which the main focus is information and information technologies. The growth potential of organizations has become the information and there is an increasing need for a comprehensive, systematic approach to information throughout the whole society. The access to information cannot be achieved without using new ICTs, which include all technical, application and organisational means for the information processing.

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The information society preserves the cultural and linguistic diversity of the individual countries in the process of the integration of national economies and the creation of a global market. Participation in the information society means a faster communication, the development of new ideas, more creative ideas and education in the terms of lifelong learning. In the developed countries of the world, the information society is the reality and a dominant element in the policy of all member countries of the European Union. “It is precisely learning organisations that may be an effective means to achieve a change in the complex system of human endeavours. Building of learning organisations is indivisibly linked to the growth of people who learn to look at the world as system thinkers, who develop their personal mastery, and who learn together to uncover and rework the schemes of thinking” (Senge 1995).

The need for the ICT use at agricultural enterprises, but also its increasing intensity of use has been pointed out by several authors (Vaněk and Jarolímek 2003; Šajbidorová 2004; Maumbe and Okello 2010; Hennyeyová 2012). The ICTs have a demonstrable positive effect on the income growth in developing and developed countries (Röller and Waverman 2001; Waverman et al. 2005). In rural areas, the ICTs can raise incomes by increasing the agricultural productivity (Lio and Liu 2006) and introducing income channels other than the traditional farm jobs. The current limited evidence from individual farmers and fishers in India supports the conclusion that the ICTs improve incomes and the quality of life among the rural poor (Jensen 2007; Goyal 2010). The idea that a wider access to and the use of ICTs throughout a country will reduce the inequalities in income and the quality of life between rural and urban residents is compelling. Despite the scarcity of evidence to support this notion (Forestier et al. 2002), it underlies widespread policy initiatives to ensure an equitable access to the ICTs in all areas. Maumbe and Okello (2010) point to the ICTs as a powerful tool in the area of agriculture and rural development also in developing countries.

The importance of informatisation was also strengthened by the Government of the Slovak Republic, when the Minister of Agriculture in 2001 created the Department of Informatics at the Ministry of Agriculture of the Slovak Republic. Its main task was the creation, update and implementation of the Sector Informatisation Policy, which was gradually constituted in the course of 2001 and 2002.

## MATERIALS AND METHODS

The aim of the research was to include in the survey the managers of companies within the Slovak Republic. The object of the study is a target group of managers of different levels and sectors: state sector, public sector, associations, private companies, manufacturing and non-manufacturing sector. The questionnaire was distributed among 200 managers by the electronic means. The response rate of the questionnaire was 180 respondents, which forms the underlying basis for partial quantitative analyses. The structure of the analysed sample of 180 respondents is specified in the following tables (Tables 1 and 2). In the results section of the paper, we present partial results of the research of those respondents who indicated their work area as agriculture, forestry and fishing, i.e. agricultural enterprises. In the process of compiling questionnaires, we issued from the analysis of the individual problem areas and justified the structural, content and criteria validity (Gavora et al. 2010). The reliability, i.e. preciseness, of the questionnaire was determined by three factors: the number of items, homogeneity and the task complexity.

The respondents in the survey were managers of companies and organisations. 34.11% of them were managers of non-manufacturing and 68.89% of manufacturing companies and organisations. The most represented companies had the legal form of a business company 50.00%.

We have divided the managers of the individual companies into 3 segments according to their job position: 1 – lower level managers – 32.22%, 2 – middle level managers – 42.78%, 3 – top level managers – 25.00%. This criterion was often used in the individual statistical analyses. The managers most often had the 2<sup>nd</sup> level university education – 69.44%.

Table 1. Structure of respondents according to the legal form and company activity (%)

Legal form	Company/organisation activity		Total sum
	non-manufacturing	manufacturing	
Association	1.11	23.11	24.22
Business company	26.33	33.67	50.00
Trade	1.11	0.00	1.11
Other	5.56	6.11	11.67
Total sum	34.11	68.89	100.00

Source: own processing

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Table 2. The structure of respondents according to the job position and achieved education

Job position	Highest degree of education achieved (%)				Total sum (%)
	secondary education completed by diploma	level university education			
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	
1 – lower level managers	10.00	2.78	19.44	0.00	32.22
2 – middle level managers	6.11	1.11	33.33	2.22	42.78
3 – top level managers	5.56	1.11	16.67	1.67	25.00
Total sum	21.67	5.00	69.44	3.89	100.00

Source: own processing

In addition to the basic statistical methods of the descriptive statistics, correlation, extrapolation, we also applied the systemic methods to look for links among the individual issues. The normality of the data distribution was tested by the Levene's test. When further analysing the data with the normal distribution, we used the *T*-test and the Anova with Bonferroni correction. For data that do not qualify for the normality of data distribution, we used the Mann-Whitney test and Kruskal-Wallis test.

When analysing the intensity of the ICT use, we defined a hypothesis: Between the job position of a manager and the intensity of the ICT usage, there is a significant relationship of  $p < 0.05$ . The intensity of the ICT use by company managers is influenced by the job position of the manager within the company.

## RESULTS AND DISCUSSION

The following results presented partial results of the research, namely the use and the intensity of use by the ICT managers of agricultural enterprises, who marked the sector of their activity as the Statistical Classification of Economic Activities in the European Community (NACE) 1A – Agriculture, forestry and fishing.

In analysing the results of the survey of using the individual ICT indicators, we delimited the boundaries of 3 standard levels of the ICT usage by managers. We defined the range based on the calculated average value of 41.23% and the standard deviation of the use of the analysed ICT tools by managers, which was calculated using the following formula:

$$\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i = \pm 29.62\% \quad (1)$$

where:

$\bar{x}$  = average

$x_i$  = individual sample value

$N$  = number of selection value

### Level 1 ( $x \leq 12\%$ ) – non-systematic use

Managers use the ICTs sporadically and the periods of taken actions are acyclic. The frequency of their use is often per quarter, half a year, a year. They use the ICT tools in rare cases and their use is not a part of their daily work.

### Level 2 ( $12\% < x \leq 70\%$ ) – systematic use

Managers use the ICT tools in their work in regular periods with the frequency of 1 time per week or in repeated cycles (the period of financial statements, start/end of the period, reporting, statements...).

### Level 3 ( $70\% < x \leq 100\%$ ) – intensive use

The level three represents an intensive use of the ICT tools. This is a recurring use of technologies in their daily work.

Table 3 presents the results of the survey of the use and the level of use of the individual variables by the managers of agricultural enterprises (hardware, software, ICTs in work with information and in communication).

At companies, the managers most often use PCs by 97.78%. We positively view the penetration of mobile devices. Laptops are increasingly available at the companies by 86.67%; their frequency rate is nearly equal with the PCs. The penetration of mobile devices is the lowest in case of the Personal Digital Assistant (PDA) by 11.67%, followed by tablets by 38.33%, and 58.33% of managers use a smartphone. The use of scanners and memory devices is on a high level, both of the monitored indicators are approximately on the level of 85.00% and more. Network devices are used by the managers on the level of 56.67%.

The most frequently used operating system is, also based on our assumption, the Windows operating system, which is used by up to 98.89% of managers (Table 4). The Windows is currently one of the most widely used operating system in the companies. Other operating systems are usually preferred by individuals on private computers. However, the Linux operating system is used by 5.11% of managers at work as well.

Table 3. Use of hardware by managers of agricultural enterprises

Variable	Using (%)	Not using (%)	Level of use
A1 Work with PC	97.78	2.22	3
A2 Work with notebook, laptop	86.67	13.33	3
A3 Work with tablet	38.33	61.67	2
A4 Work with PDA	11.67	88.33	1
A5 Work with smartphone	58.33	41.67	2
A6 Work with printer – printing of documents, toner replacement	90.00	10.00	3
A7 Work with scanner – scanning, copying	87.22	12.78	3
A8 Work with camera	52.22	47.78	2
A9 Work with memory media (USB drive, memory cards, CD)	85.00	15.00	3
A10 With network devices – wifi router, modem, switch	56.67	43.33	2

Source: own processing

The Unix operating system is used only by 3.22% of managers. The low percentage of the use of the other operating systems is reflected in the indexes of the literacy level in the area of operating systems. The Smartphone operating systems (Android, iOS, Symbian, Windows Phone 7, Bada ...) are used by 52.22% of the managers, which also correlates well with the use of smartphones (58.33%) and the related literacy level (62.93%).

The most often used applications include the components of the MS Office pack (Table 4) – the MS Word by 97.78%, the MS Excel on the equal level, the use of other applications gradually drops (MS Outlook 82.22%, MS PowerPoint 79.44%, MS Access 32.78%, MS Picture Manager 15.00%, MS Publisher 6.11%, MS InfoPath 3.33%), and similarly the literacy of managers in these applications. The MS Word, MS Excel, MS PowerPoint, MS Outlook and web browsers (87.22%) belong to the level three, the intensive use of ICTs. The managers systematically use (level 2) the company IT systems, which are determined by the company's focus and the manager's job position. In case of the data backup, compression, storage, logging, installation of applications, the work with antivirus applications, videoconferences, smartphone applications, the fact was confirmed that these operations are carried out by managers systematically in repeated cycles rather than intensively in the everyday business practice. Other applications belong to the level 1, the managers use them sporadically.

Table 4. Use of software by managers of agricultural enterprises

Variable	Using (%)	Not using (%)	Level of use
<b>Operating system</b>			
B1 Windows	98.89	1.11	3
B2 Linux	5.11	94.89	2
B3 Unix	3.22	96.78	1
B4 Work with Android, iOS smartphone operating system...	52.22	47.78	2
<b>Application software</b>			
B5 MS Word	97.78	2.22	3
B6 MS Excel	97.78	2.22	3
B7 MS Point	79.44	20.56	3
B8 MS Outlook	82.22	17.78	3
B9 MS Access	42.78	57.22	2
B10 MS Picture Manager	15.00	85.00	2
B11 MS Publisher	6.11	93.89	1
B12 MS InfoPath	3.33	96.67	1
B13 CAD	14.44	85.56	2
B14 GIS	16.11	83.89	1
B15 ALFA	7.22	92.78	1
B16 OMEGA	28.78	71.22	2
B17 OLYMP	17.78	82.22	1
B25 Other corporate management information systems	26.89	73.11	1
B26 Other management decision support systems	12.44	87.56	1
B27 Other executive information systems	2.22	97.78	1
B28 Editors for image processing and editing	4.44	95.56	1
B29 Music applications	27.78	72.22	2
B30 Video applications	18.89	81.11	2
B31 Data backup, compression	25.11	74.89	2
B32 File saving, burning	40.00	60.00	2
B33 Installation of applications	15.00	85.00	2
B34 Installation of operating systems	7.56	92.44	1
B35 Work with antivirus applications and techniques	51.89	48.11	2
B36 Web browsers	9.44	90.56	1
B37 Skype	13.33	86.67	2
B38 Network – networking, configuration, data and file sharing	62.89	37.11	2
B39 Development of macros	64.00	36.00	2
B40 Programming, development of applications	42.22	57.78	2
B41 Use of smartphone applications	27.22	72.78	2
B42 Open source applications, for example Google Disk...	44.44	55.56	2
B43 Data transfer – Bluetooth	96.22	3.78	3

Source: own processing

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Table 5. Use of ICTs by managers working with information

Variable	Using (%)	Not using (%)	Level of use
C1 Searching for information on the web	90.56	9.44	3
C2 Data mining, data warehouses	30.56	69.44	2
C3 Work with internet banking	62.22	37.78	2
C4 Electronic Data Interchange – EDI	9.44	90.56	1
C5 File download and upload	58.89	41.11	2
C6 Shopping in e-shops	45.00	55.00	2
C7 E-advertising	28.33	71.67	2
C8 Work with electronic documents, forms	72.22	27.78	3
C9 Knowledge of legislation – Act on Personal Data Protection, Copyright Act	60.56	39.44	2

Source: own processing

The use of ICTs at work with information is an inevitable part of a manager's everyday work (Table 5). The managers systematically and intensively search for information on the web (90.56%) and at work they use electronic documents and forms (72.22%). These two tools belong to the level 3 of the ICT use. Data mining, data warehousing use (30.56%) and e-advertising (28.33%) are used by the managers systematically. A non-systematic use is registered only with one of the indicators analysed, namely the Electronic Data Interchange (EDI) 9.44%. The portion of those managers who do not use these tools is constantly decreasing. Data mining and data warehousing are also related to the use of the business intelligence applications. Other ICT tools belong in the second degree of the ICT usage.

The use of the communication tools and techniques is currently becoming an integral part of daily management routine (Table 6). The routine, intense activities (level 3) include the e-mail communication in 96.11%, the SMS and MMS messages in 72.78%. The least popular form of the business communication of managers was through the discussion groups by

Table 6. ICT use by managers in communication

Variable	Using (%)	Not using (%)	Level of use
D1 E-mail communication	96.11	3.89	3
D2 Video call	52.22	47.78	2
D3 Chat	49.44	50.56	2
D4 Discussion groups	23.89	76.11	2
D5 Social networks	33.89	66.11	2
D6 SMS, MMS	72.78	27.22	3
D7 Video conferences	38.33	61.67	2

Source: own processing

23.89%, the social networks by 33.89%; these forms belong to the level 2 of the ICT use. The video call, chat and video conference also belong to the level 2 of the ICT use, as they are used in a systematic manner. In the area of the ICT use by managers in communication, we did not find the level 1 – the non-systematic ICT use.

The intensity of the ICT use at work is defined as the extent to which the managers in their work activities rely on the technologies and ICTs. For the intensity of use, we designated the following scale: 1 – none, 2 – irregular, 3 – regular, 4 – frequent, 5 – very frequent (Table 7).

From the results, it can be concluded that the managers without a job specification use the ICTs often – 27.78% – to very often – 48.89% at work in their jobs. After dividing the managers according to their job positions, it can be observed that the middle level managers use the ICTs most frequently. With the lower and top level managers, the intensity of use is very different, variable. These managers use ICTs on the scale from 3 to 5. The intensity of the ICT use by the lower and top level managers is affected by the availability of ICTs and their skills. With the individual middle level managers of agricultural enterprises, it is very similar because the use of ICTs by this group of respondents at work is almost inevitable. It can be observed that ICTs have become a regular part

Table 7. Intensity of ICT use at work

Position	Intensity of use (%)					Sum
	1	2	3	4	5	
1 – lower level managers	0.00	6.90	27.59	22.41	43.10	100
2 – middle level managers	0.00	2.60	6.49	31.17	59.74	100
3 – top level managers	2.22	2.22	28.89	28.89	37.78	100
Intensity	0.56	3.89	18.89	27.78	48.89	100

Source: own processing

of the everyday working activities as confirmed by the survey Time Management of Managers and the Impact of ICTs on Time Management by Šajbidorová and Lužňáková (2013). The survey shows that a significant proportion, almost 90% of respondents, already cannot imagine the fulfilment of their job tasks or their normal life without ICTs; the intensity of their use is frequent or very frequent. The ICTs are a good source of prompt information, diaries, means of communication, but also fun for the free time and the necessary downtime at work. On the other hand, 78% of the respondents answered that they are very often burdened by unnecessary information which they would not receive without the ICTs, that they spend a disproportionate amount of time reading and writing e-mails, often at the expense of the personal communication with business partners and friends. 6% of the respondents even admitted that the computer has become their “drug” and they spend every free moment with it. The results of the survey clearly show that a significant portion of the managers perceive ICTs as an indispensable part of their business and personal life – they significantly reduce the time required for gathering information, communication, administration and other processes.

In verifying the hypothesis set out in the relationship between the job position and the intensity of ICT use, we used the Levene’s test. The data did not meet the condition of the normal distribution of data (Levene’s statistics  $p = 0.022$ ). We have therefore tested this data by the Kruskal Wallis nonparametric K Independent test.

The gathered results confirmed that the intensity of the ICT use differs significantly based on the manager’s job position (Table 8). The job position has a significant influence on the intensity of the ICT use in a company ( $\chi = 11.237$ ,  $df = 2$ ,  $p = 0.004$ ). We ob-

serve that the hypothesis - Between the job position of a manager and the intensity of the ICT use, there is significant relationship – has been confirmed. We note that the significant relationship has been confirmed. We note that between the job position of a manager and the intensity of ICT, there is a significant relationship.

The equipment, use and the level of intensity of the ICT use in agricultural enterprises proves the technical maturity of the agricultural sector, but this area requires a constant innovation and modernisation in terms of the sustainable development, the benefits of the ICTs and the related increase in the efficiency of their application. Five main trends (Goyal 2011) have been the key drivers of the use of ICTs in agriculture, particularly for poor producers: low-cost and pervasive connectivity, adaptable and more affordable tools, advances in data storage and exchange, innovative business models and partnerships, and the democratization of information, including the open access movement and social media. These drivers are expected to continue shaping the prospects for using ICTs effectively in developing the country’s agriculture.

The results of the research were confirmed by the results of Hennyeyová (2012). The preferences of agricultural enterprises in relation to the benefits of the ICT use showed that the greatest benefit is considered to be the flexible communication and the efficient access to information. The smallest benefit is considered to be a higher competitiveness and the cost reduction. Communication is influenced by the booming mobile, wireless and internet industry. ICTs found a foothold even at poor small farms and their activities. The ability of ICTs to bring a refreshed momentum to agriculture appears even more compelling in the light of rising investments in agricultural research, the private sector’s strong interest in the development and spread of ICTs, and the upsurge of the organisations committed to the agenda of agricultural development. Managers of agricultural enterprises in the Slovak Republic also gradually shift to smart mobile devices and mobile applications. The intensity of the use of these devices has an increasing tendency. The use of mobile devices at agricultural enterprises is increasing in all countries of the world. The importance and relevance of the implementation of mobile devices and applications was emphasized in the study by Qiang et al. (2011). Mobile technologies differ from PCs especially in terms of connectivity, which is the most important contribution for agricultural enterprises.

Table 8. Testing dependence between the intensity of ICT use and the job position

Position	N	Mean Rank
1 – lower level managers	58	81.34
2 – middle level managers	77	104.37
3 – top level managers	45	78.57
Total	180	
Test Statistics		Intensity
Chi-Square		11.237
df		2
Asymp. Sig.		<b>0.004</b>

Source: own processing

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Smart mobile devices have the 3G connectivity and higher, which operates continuously and with an expanding coverage. This means that a relatively fast internet access is provided at all times and everywhere. Moreover, using the GPS, the device is able to determine its location. The advantage is the GSM network enabling calls and SMS messages. Of course, in addition to a better connectivity, there are other conveniences – touch control, built-in camera, compass, accelerometer, gyroscope, sensor of outdoor lighting and other sensors. Smart devices with the GPS and mobile applications or their interconnection with geographic information systems are becoming practical equipment for managers of agricultural enterprises, which, besides the work efficiency, expand their mobility. Due to significant benefits, the index of increase in the use of smart devices has grown at a faster rate in the recent years than in the use of other ICT tools, and not only in the Slovak Republic.

The penetration of use in case of the business intelligence applications is relatively low, which can be explained by the fact that the spread of these software applications is limited. The survey by Hamranová (2013) also showed that only 22% of the companies have implemented the business intelligence applications, which confirms the low penetration of the implementation of these tools. Business intelligence applications have a justified significance also in agricultural enterprises (Tyrychtr et al. 2015). The current business intelligence applications are all about flexibility, interactivity, getting in the shortest possible time and in the easiest way the most accurate information from which a new fact can be deducted; just to get a certain added value out of it for the management or decision making. Not only routine decisions on the lower or middle level, but also the individual important strategic decisions need the most accurate and comprehensive data with the possibility of revealing the background, which might cause undesired deviations. Using the business intelligence applications, the managers can find answers to a whole series of questions. Business intelligence applications help not only the companies but also the managers to make their work more efficient and allow them to think independently.

According to Látečková and Ratulovská (2013), the use of ICTs also influences the increase in productivity. They argue that the development of ICTs greatly affects the competitiveness and the prosperity of companies. These tools allow the management to better utilise the potential of the working staff as well as other parts

of the company. ICTs are essential to maintain the company on the market and are used in the management of information systems across the organisation.

There is a series of educational activities for developing the potential of managers and employees in all areas of the company. The basis of the IT education is all levels of schools, while the universities play the key role in preparing the students – future professionals – for practice in the area of the computer science and ICTs. Given the dynamics of development in this area, it is necessary to educate managers after completing their studies in schools and to involve them in the lifelong learning, which is usually organised by the universities and educational institutions. Lifelong learning includes all the activities that take place throughout the life with the aim of improving the knowledge, skills and abilities. We claim that the formal education provides a certain knowledge base. The optimal use of knowledge and skills in practice in such a pace as required by the needs of the society is insufficient and there is only one possible path - the permanent lifelong learning.

## CONCLUSION

The presentation of the results of the survey on the state of the ICT sector in a company's economy confirms that the important position of the ICT sector in all companies regardless of their size structure is undeniable. The use of ICTs by company managers is an essential part of their daily routine in agricultural enterprises.

The survey results confirmed that the managers at work most often use their PCs by 87.78%, while the laptops are increasingly used at work as well by 86.67%. 58.33% managers also use the smartphone for work. A similar trend as from the results of the survey by Qiang et al. (2011) can be observed in the use of smartphones, which identifies an increase in the intensity of the use of mobile devices. The penetration of smart devices in agricultural enterprises in the Slovak Republic is increasing. Managers use these devices in their work more often because of their mobility and functionality. This trend has been adopted by several web portals and software solutions used by the managers by making their design responsive. The least used mobile device is the PDA in 11.67%. The use of hardware is closely related to the use of the operating and application software. The Windows is currently one of the most widely used operating systems in the companies. An analysis of

the application software research shows that the MS Office pack is the most intensely used and the most wide-spread. The addressed managers systematically and intensively search for information on the web. It is desirable that the managers improve their knowledge and skills in the EDI, as this data exchange standard is used only by 9.44% of the managers. Enterprises should exploit this exchange of data more in the future as the EDI saves time, costs, brings the regional independence from the administrative and business centre, a competitive advantage on the domestic and foreign markets and, above all, it makes them better informed. Business intelligence applications are used relatively little (approximately by 20%), which was also confirmed by a survey by Hamranová (2013) 22%. We can observe a similar trend in agricultural enterprises as in the manufacturing companies. Above all, agricultural enterprises increase the intensity of using mobile devices with the internet connection. The use of the internet and e-mail communication by the managers is now a necessity and it is becoming a routine.

Based on the partial results of the survey of the use and the intensity of ICT use by managers, we verified the hypothesis and it has been confirmed. The intensity of the ICT use differs significantly based on a manager's job position. The job position has a significant influence on the intensity of the ICT use in a company.

In conclusion, we can observe that ICTs penetrate into the agricultural sector as well and it has been confirmed that their major importance and contribution to the business development is unquestionable. Investments in ICTs have a significant impact on the economic growth, the labour productivity growth and the increase in the overall competitiveness of the company.

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