



*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from AgEcon Search may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

## Identification of Business Informatics Specifics in Agricultural Enterprises

K. Kubata, P. Šimek

Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

### Abstract

Presented paper deals with analysis and identification of business informatics specifics in agricultural enterprises in the Czech Republic farming at land of size up to 500 hectares. The study is based on thorough review of literature about latest issues in agriculture business informatics. There is a follow up to certain results of previous research on business informatics in agriculture that was conducted by authors in 2013. The analysis has brought findings that business informatics has several peculiarities that must be regarded in informatics implementation and innovation. Those are common economic and organisational effects and further aspects typical for the agriculture such as climate, local conditions and seasonal nature of production.

### Keywords

Business informatics, information, information systems, agriculture, farm.

Kubata, K. and Šimek, P. (2016) "Identification of Business Informatics Specifics in Agricultural Enterprises", *AGRIS on-line Papers in Economics and Informatics*, Vol. 8, No. 3, pp. 69 - 76. ISSN 1804-1930, DOI 10.7160/aol.2016.080307.

### Introduction

Business Informatics (BInf) in an agriculture enterprise should be clearly beneficial for competitiveness of the company (Kubata et al., 2014), which is to a large extent depending on a suitable implementation and use of BInf. However, this is not a common practice. The application of business informatics varies between enterprises and is confronted with limitations within organisations (Voříšek et al., 2015).

Without doubts, business informatics has its role in Czech agriculture and it is necessary to invest in it as in other branches of national economy. The presented paper brings a critical review of the use of BInf in agricultural enterprises. The need for BInf differs in relation to size and production type of a company, which is another issue that needs to be taken into account. Utilization of BInf in a quality way is, and will be, of a growing importance in the future because the digitisation of business processes in any kind of company, including agricultural companies, is a current trend (D'souza et al., 2015; Tien, 2013). But, there are several setbacks such as data security, high investments and Internet connectivity

speed that could be addressed by BInf used in an appropriate way and quality.

### Business Informatics in agriculture improvements and risks of use

The informatics in agriculture is specific with changing climate and local conditions, seasonality and not easily predictable length of production. The use of information technologies also depends on the size and type of agricultural company starting from small farmers managing everything by themselves or with help of agricultural advisory (Sarangi, 2016) and using accounting software only, through middle sized farms where several specialized programs are used according to the type of production such as plant or animal production or precision agriculture (Durmus et al., 2015; Malik et al., 2011), up to large capital ventures that deploy all enterprise information systems (Kubata et al., 2014) and special technologies (Pang, 2015; Steinberg et al., 2016). Based on these facts, it is necessary to make an overview of the current state of the art of business informatics (Buchalcevova and Pour, 2015).

Pour and Novotný (2010) has revealed that around 65 % of Czech company representatives perceive

that using informatics has a significant impact on reaching strategic goals of company and that the information strategy is in line with the company strategy. The company strategy could be also realized by company management concepts and focus and not only by a formalized set of documents, as one can often observe in current practice. More than 50 % of respondents replied that informatics plays a supportive role, which does not need to be an opposite to the above stated results, hence both strategic and supportive functions can complement each other effectively. Further 30 % of respondents perceived informatics as a plain technological solution, which is also a positive answer. However, the least positive result was that only 30 % of companies used some sort of indicators to measure benefits of informatics in the organization. There are two obvious reasons, firstly, a relatively high complexity and objectivity of measurement, secondly, a work-intensive detection of relevant figures for informatics analysis (Voríšek et al., 2015). In contrast, among agricultural enterprises, 59 % of respondents claimed that “informatics is perceived as a necessary technological solution to realize business goals”, 16 % thought that “informatics has a substantial influence on realization of business goals” and only 12 % had opinion that “informatics has no influence on realization of business goals.” (Kubata et al., 2014). Those aspects also influence production control and reflect digital divide in rural and agricultural areas (Herdon et al., 2015).

There is no single optimal way of business informatics management, which is given by a number of objective and subjective influencing factors. Instead, ICT management shall strive for an optimal combination of factors (Voríšek, 2009).

Business informatics is a very up to date topic in agriculture because transformational and professional ties are often missing in companies.

There is a need to set out quality and performance requirements for business informatics and expected effects. A qualified estimation of business informatics level in an organisation, definition of problems, and proposal suggestion have to be done as well (Pour, 2006). Therefore, real data flows must adhere to exact production processes in the company, e.g. like in harvesting of special crops (Ampatzidis, 2016). Moreover, business informatics shapes enterprise information system (Gála et al., 2009).

Compatibility and compactness of enterprise

information system bring expected effects (Buchalcevova, 2016). The level of employees digital skills is another important fact impacting the success of business informatics (Agrocenzus, 2010). User trainings, security guidelines for information system use and security policy are foundations of trouble-free operation of business informatics. The Internet is a significant source of data and business opportunities for agricultural enterprises, but also raises issues with privacy protection, data transmission and time investment.

The main source of informatics effects is in applicaitons such as enterprise applications, e-business, e-commerce, etc. However, the level of application use is strongly dependent on ability and motivation of users that can be hardly managed by informatics itself (Pour, 2010). The aforementioned facts expose the issue of digital literacy of users in agricultural enterprises.

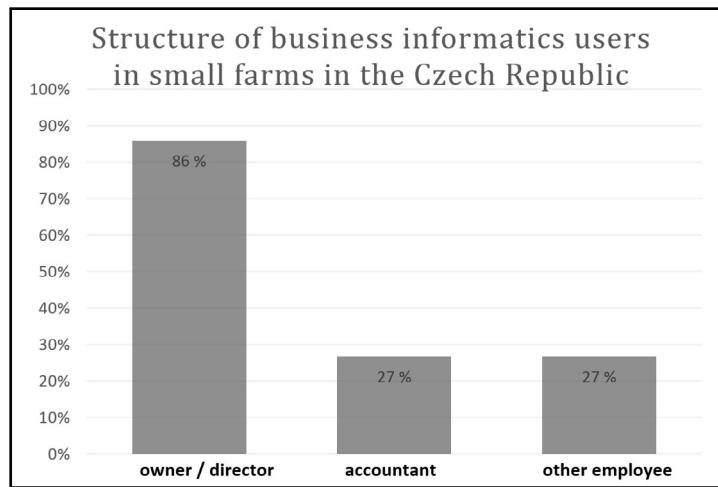
Further and probably the most important fact is that if company management lacks will to change, no innovation of business informatics in agriculture will happen. Making a substantial financial investment in implementation of business informatics in an agricultural enterprise is a closely tied step. There are also non-economic effects that are very important and often may bring a competitive advantage for a company (Pour, 2010).

In small agricultural enterprises, the decision maker is the farm owner or director that have direct motivation to benefit from the improvement of the level of business informatics in their company (see Figure 1).

A development plan for business informatics should be prepared to improve competitiveness of the enterprise (Buchalcevova, 2016).

Questions and issues related to business informatics management should be addressed by a dedicated person that is incorporated in the organisational structure of a company (Buchalcevova and Pour, 2015). However, the organisation structure is often shaped according to the farm’s previous development, personnel, and the fact whether or not the farm owner keeps control over informatics in the company (Šilerová and Havlíček, 2007).

Among further problems belong lack of interest of users, limited information availability and lack of professional training in digital skills. Having internal regulations for operation, security, management and use of business informatics is essential for implementation or innovation of information system in the company



Source: Adapted from Kubata et al (2014)

Figure 1: Structure of business informatics users in small farms in the Czech Republic in 2013.

(Buchalcevova and Pour, 2015), which is also applicable in agricultural enterprises.

Based on previous research of Kubata et al. (2014), the utilization of computer hardware is not a limiting factor to BInf development. The hardware capability is important for availability of up to date information about climate, seasonal character of production and further information needs supplied with the Internet. Internet based services for agriculture are growing with fast pace (Rysová et al., 2013).

Lastly, security rules must be followed while working online. According to Doucek (2008), security and security standards are number one and must be kept. There are so-called security requirements for information system that reflect the nature of the system, system requirements and number of standards, norms, laws and regulations. There should also be a standard implementation support comprising technical and methodological help, training of implementation team and end user training. The security policy consists of principles and rules to protect organization's assets. The policy should be regularly updated with ongoing changes of surrounding environment (Gála et al., 2009).

Hoffmann et al. (2013) observes the lack of knowledge about mobile business and low number of mobile applications in agriculture. There is some potential in mobile documentation according to Costopoulou and Molhanec (2014). While broadband Internet connection is usually available in urban areas, the availability in rural areas still poses a problem (Vanek et al., 2010).

In addition, the costs of building network infrastructure outside the city or village is on average by 80 % higher than in the city or village (Schneir and Xiong, 2016). Hilbert (2016) claims that number of Internet subscriptions is not the main indicator of divide, but also the bandwidth distribution among countries which is undergoing a significant change. Considering the Internet as a key online medium for conducting business even in agriculture, relevant information sources will be examined in further text. The most used sources among farmers are such as commodity prices, subsidies, weather forecast (Edwards-Murphy et al., 2016), etc.

The objective of the paper is to identify specifics of business informatics (BInf) in the way that enables to address further development of BInf in agricultural enterprises. Agricultural business informatics should be a compact element increasing strategic advantages of agricultural companies.

## Materials and methods

The main research focus of the paper is put on business informatics. The current state of agricultural business informatics is analysed by means of exploratory analysis. Secondary resources such as scientific papers and official statistics are analysed and synthesized and based on deduction main specifics of business informatics in agriculture are formulated.

Besides the specifics, optimal conditions for deployment are outlined and areas for improvement are identified.

## Results and discussion

Risky areas and framework of business informatics in agriculture were described in the chapter Introduction. Description of specifics of business informatics in agriculture identified by synthesis and deduction is introduced in the following text:

### Production specific issues

Company specific issues are comparable across other areas of national economy (Pour and Novotný, 2010). In agriculture, climate and local conditions, seasonality of production and hardly predictable progress of production must be considered. Transformation and processional links are often missing in agricultural enterprises which disturbs execution and management within companies. Further, farmers are conservative towards BInf in many cases. When communication processes are interrupted or missing, there are very limited choices to deploy advanced software for decision making. As Tyrychtr et al. (2015) observed that the rate of use of advanced software tools such as business intelligence, expert and analytical systems is low among Czech farmers and is not related to the type of production, the size of farmed land, the number of employees or the amount of financial subsidies.

### Incompatibility of software

Plenty of software in agriculture area was created and launched spontaneously and with limited capabilities. There is a frequent incompatibility between programs and data are not portable which decreases its usability (Tyrychtr et al., 2015). There is also a lack of harmonised support of the use of software which hampers the productivity of the software within agricultural enterprises (Gála et al., 2009). Vendor lock-in or the use of proprietary hardware or software are other limiting factors.

Managing agricultural production concentrates to systems integrating inputs coming from near surroundings such as environmental impacts, public organisations, quality approval and vegetation conditions. A series of norms ISO 11783 (ISOBUS) "Tractors and machinery for agriculture and forestry - Serial control and communications data network" has been introduced due to ICT advancements and overwhelming lack of interoperability between agricultural machinery and computers (Fountas et al., 2015).

### Lower digital literacy of employees in agriculture, need for additional training and support

Digital literacy of people working in agriculture

has been issue since past (Agrocenzus, 2010). If the farm management is concerned about good operation of BInf in the company, they need to create good condition and provide training and user support to employees from IS suppliers or software vendors (Pour and Novotný, 2010; Cruz-Jesus et al, 2016). The need for high skilled information workers in agricultural enterprises is growing because the production is based on complex process where information processing and knowledge are needed (Ulman et al, 2015).

### Conditions for operation and improvement of business informatics in agriculture

#### Support of company management and sufficient budget

Company management support and sufficient budget have direct impact on quality operation and development of business informatics in agricultural enterprises. Decision must be done after thorough needs analysis of the company management (Gála et al., 2009).

#### Organisational compliance

Organisational compliance of business informatics in agricultural enterprise must be set and controlled in line with hierarchy, development plan, user motivation, deadlines (Šílerová and Havlíček, 2007; Doucek, 2008).

#### Internal regulations and documentation

This issue is significant for business process optimization to facilitate equal access of all users within the company (Buchalcevova, 2016).

#### Sufficient hardware availability

This aspect is not limiting in regards to undergoing ICT development and profitability of agricultural enterprises that can allow to invest money in new equipment (Kubata et al., 2014). More than 25 % of Czech farmers invested in purchasing new hardware for business purposes since 2013. Smartphones and tablets were dominating these investments (Ulman et al., 2015).

#### Online sources integration

Every farmer needs information both from inside and outside of his or her company. If those sources are integrated it could help to provide better operation of BInf in the company (Rysová et al., 2013). However, the outer sources of data and information are vast and heterogeneous as could be seen in Table 1 (see below).

Institution	Web address
State Agricultural Intervention Fund	www.szif.cz
Ministry of Agriculture	www.eagri.cz
Commodity Exchange in Brno	www.pbb.cz
Czech and Moravia Society of Cattle Breeders	www.cmsch.cz
State Veterinary Administration	www.svscr.cz
Central Institute for Supervising and Testing in Agriculture	www.ukzuz.cz
Czech Hydrometeorological Institute	www.chmu.cz
Institute of Agricultural Economics and Information	www.uzei.cz
Czech Agrarian Chamber	www.agrocr.cz
State Land Administration	www.pfcr.cz
Czech Office for Surveying, Mapping and Cadastre	http://nahlizenidokn.cuzk.cz/
Agrarian portal	www.agromanual.cz
Agrarian portal	www.agroweb.cz
Agrarian portal	www.agris.cz

Source: self-authored

Table 1: Overview of agricultural information resources at the Internet.

### Mobile computing

Nowadays, all farmers have necessary equipment to use mobile hardware and software (Kubata et al., 2014; Hoffmann et al, 2013). However, the group of farmers with under 500 hectares of farmed land experienced certain obstacles in leveraging latest technologies due to limited personnel, time constraints and need to focus only on profitable activities such as production. These limitations are observed namely at farms where only the farm owner executes most of tasks related to production (see Figure 1).

### Conclusion

Variability of production is an important fact influencing the state of the art and quality of business informatics in agriculture. Besides common economic factors, other aspects typical for agriculture such as climate and local conditions and seasonal character of production must be considered. Despite large conservatism of agricultural entrepreneurs, it can be assumed that an effective and quality implementation of business informatics may lead to strategical advantages of the company.

Deficiencies of business informatics that were identified within the paper are not extremely far from standards of business informatics in other sectors. Business informatics in agriculture is perceived as marginal by farmers for reaching their production goals.

A detailed overview of specifics and drawbacks of business informatics in agriculture has been

presented in the paper. Among risk factors that must be identified and addressed in agricultural enterprises belong production specific issues, incompatibility of software, lower digital literacy of employees, need of training and user support, need for skilled knowledge workers and difficulties with planning the production due to climate and local conditions and seasonality. For operation and improvement of business informatics within agricultural enterprises, support of company management, organisational compliance, development plan, user motivation and following time tables are required. Keeping sufficient budget for investments, internal documentation, hardware availability, online sources and mobile computing integration are other necessary parts of business informatics deployment.

Above given aspect may represent limiting factors for increase in operation and compactness of business informatics and for gaining strategical competitive advantage of agricultural enterprises. Provided list of BInf specifics may serve as additional input for decision-makers in agricultural companies.

Based on the presented results, we can claim that there are substantial opportunities to conduct more research on quality and efficiency of business informatics in agricultural enterprises.

### Acknowledgements

The results and knowledge included herein have been obtained owing to support from the Internal grant agency of the Faculty of Economics

and Management, Czech University of Life Sciences in Prague, grant no. 20161018, "SW licence a ekonomické dopady ve firmě" (Software licences and economic impacts in the company).

*Corresponding author:*

*Ing. Karel Kubata*

*Department of Information Technologies, Faculty of Economics and Management Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 - Suchdol, 165 21, Czech Republic*

*Phone: +420 22438 2861, E-mail: kubata@pef.czu.cz*

## References

- [1] Agrocensus (2010) „Strukturální šetření v zemědělství a metody zemědělské výroby – 2010“. Czech Statistical Office, 2010. [Online]. Available: [https://www.czso.cz/csu/czso/2126-11-n\\_2011-03](https://www.czso.cz/csu/czso/2126-11-n_2011-03) [Accessed: 27. Jan. 2016].
- [2] Ampatzidis, Y., Tan, L., Haley, R., and Whiting, M. D. (2016) "Cloud-based harvest management information system for hand-harvested specialty crops", *Computers and Electronics in Agriculture*, Vol. 122, pp. 161-167. ISSN 0168-1699, E-ISSN 1872-7107. DOI 10.1016/j.compag.2016.01.032.
- [3] Buchalcevova, A. (2016) „Analysis of the management of business informatics framework from the green ICT viewpoint“, *International Journal of Information Technology and Management*, Vol. 15, no. 1, pp. 41-58. ISSN 1741-5179. DOI 10.1504/IJITM.2016.073913.
- [4] Buchalcevova, A. and Pour, J. (2015) „Business informatics management model“, *Lecture Notes in Electrical Engineering*, Vol. 373, pp. 65-71. ISSN 1876-1100. DOI 10.1007/978-981-10-0281-6\_10.
- [5] Costopoulou, C. and Molhanec, M. (2014) „Evolution towards mobile government: The Greek and the Czech cases“, *Communications in Computer and Information Science*, Vol. 441, pp. 183-191. ISSN 1865-0929. DOI 10.1007/978-3-319-11710-2\_17.
- [6] Cruz-Jesus, F., Vicente, M. R., Bacao, F., and Oliveira, T. (2016) "The education-related digital divide: An analysis for the EU-28", *Computers in Human Behavior*, Vol. 56, pp. 72-82. ISSN 0747-5632. DOI 10.1016/j.chb.2015.11.027.
- [7] Doucek, P. (2008) „Bezpečnost informačních systémů–zákony a instituce“ (In Czech), *Systémová integrace*, Vol. 3, pp. 30 – 44. ISSN 1804-2716.
- [8] Durmuş, H., Güneş, E. O., Kirci, M., and Üstündağ, B. B. (2015) „The design of general purpose autonomous agricultural mobile-robot: "AGROBOT". In: *Agro-Geoinformatics* (Agro-geoinformatics), 2015 Fourth International Conference on. IEEE, pp. 49-53. ISBN 978-1-4673-8088-1. ISSN 2334-3168. DOI 10.1109/Agro-Geoinformatics.2015.7248088.
- [9] D'souza, M. J., Barile, B. and Givens, A. F. (2015) „Evolution of a structure-searchable database into a prototype for a high-fidelity SmartPhone app for 62 common pesticides used in Delaware“. In: *Industrial Instrumentation and Control (ICIC)*, 2015 International Conference on. IEEE, pp. 71-76. ISBN 978-1-4799-7165-7. DOI 10.1109/IIC.2015.7150714.
- [10] Edwards-Murphy, F., Magno, M., Whelan, P. M., O'Halloran, J., and Popovici, E. M. (2016) "b+ WSN: Smart beehive with preliminary decision tree analysis for agriculture and honey bee health monitoring", *Computers and Electronics in Agriculture*, Vol. 124, pp. 211-219. ISSN 0168-1699, eISSN 1872-7107. DOI 10.1016/j.compag.2016.04.008.
- [11] Fountas, S., Sorensen, C.G., Tsipopoulos, Z., Cavalaris, C., Liakos, V. and Gemtos, T. (2015) „Farm machinery management information system“, *Computers and Electronics in Agriculture*, Vol. 110, pp. 131-138, ISSN 0168-1699.
- [12] Gála, L., Pour, J., and Šedivá, Z. (2009) "Podniková informatika", 496 p. ISBN 978-80-247-2615-1.

[13] Herdon, M., Botos, S. and Várallyai, L. (2015) „Decreasing the Digital Divide by Increasing E-Innovation and E-Readiness Abilities in Agriculture and Rural Areas“ *International Journal of Agricultural and Environmental Information Systems (IJAEIS)*, Vol. 6, No. 1, pp. 1-18. ISSN 1947-3192. DOI 10.4018/ijaeis.2015010101.

[14] Hoffmann, C., Grethler, D. and Doluschitz, R. (2013) „Mobile Business: Good Preconditions on Farms“, *Landtechnik*, Vol. 68, No. 1, pp. 18-21. ISSN 0023-8082.

[15] Hilbert, M. (2016) „The bad news is that the digital access divide is here to stay: Domestically installed bandwidths among 172 countries for 1986–2014“, *Telecommunications Policy*, Vol. 40, No. 6, pp. 567-581. ISSN 0308-5961. DOI 10.1016/j.telpol.2016.01.006.

[16] Kubata, K., Tyrychtr, J., Ulman, M. and Vostrovský, V. (2014) „Business Informatics and its Role in Agriculture in the Czech Republic“, *AGRIS on-line Papers in Economics and Informatics*, Vol. 6, No. 2. ISSN 1804-1930.

[17] Malik, K., Georghiou, L. and Grieve, B. (2011) „Developing new technology platforms for new business models: Syngenta's partnership with the university of Manchester“, *Research-Technology Management*, Vol. 54, No.1, pp. 24-31. ISSN 0895-6308.

[18] Pang, Z., Chen, Q., Han, W. and Zheng, L. (2015) “Value-centric design of the internet-of-things solution for food supply chain: value creation, sensor portfolio and information fusion”, *Information Systems Frontiers*, Vol. 17, No. 2, pp. 289-319. ISSN 1387-3326, E-ISSN 1572-9419. DOI 10.1007/s10796-012-9374-9.

[19] Pour, J. and Novotný, O. (2010) „K výsledkům průzkumu zaměřeného na kvalitu podnikové informatiky“ (in Czech), *Systémová Integrace*, Vol. 6. ISSN 1804-2716.

[20] Pour, J. (2006) "Informační systémy a technologie" (in Czech), 492 p. ISBN 80-86730-03-4.

[21] Rysová, H., Kubata, K., Tyrychtr, J., Ulman, M., Šmejkalová, M. and Vostrovský, V. (2013) „Evaluation of electronic public services in agriculture in the Czech Republic“, *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. 61, No. 2, pp. 473-479. ISSN 1804-1930.

[22] Sarangi, S., Umadikar, J. and Kar, S. (2016) „Automation of Agriculture Support Systems using Wisekar: Case study of a crop-disease advisory service“, *Computers and Electronics in Agriculture*, Vol. 122, pp. 200-210. ISSN 0168-1699, E-ISSN 1872-7107. DOI 10.1016/j.compag.2016.01.009.

[23] Schneir, J. R. and Xiong, Y. (2016) „A cost study of fixed broadband access networks for rural areas“, *Telecommunications Policy*, Vol. 40, No. 8. ISSN 0308-5961. DOI 10.1016/j.telpol.2016.04.002.

[24] Steinberg, M. D., Tkalc̆ec, B. and Steinberg, I. M. (2016) „Towards a passive contactless sensor for monitoring resistivity in porous materials“, *Sensors and Actuators B: Chemical*, Vol. 234, pp. 294-299. ISSN 0925-4005. DOI 10.1016/j.snb.2016.04.169.

[25] Šilerová, E. and Havlíček, Z. (2007) „Efektívne využívání informácií a informačných systémov v rámci zem ědelskopotravínarskych systémov“ (in Czech), Nitra: FEM SPU Nitra, Zborník príspevkov semináru Informačné technológie v riadení a vzdelávaní 2007. ISBN 978 -80-8069-968-0.

[26] Tien, J. M. (2013) „Big data: Unleashing information“, *Journal of Systems Science and Systems Engineering*, Vol. 22, No.2, pp. 127-151. ISSN 1004-3756. DOI 10.1007/s11518-013-5219-4.

[27] Tyrychtr, J., Ulman, M. and Vostrovský, V. (2015) „Evaluation of the state of the business intelligence among small czech farms“, *Agricultural Economics*, Vol. 61, No. 2, pp. 63-71. ISSN 0139-570X. DOI 10.17221/108/2014-AGRICECON.

[28] Ulman, M., Tyrychtr, J., Vostrovský, V. and Jarolímek, J. (2015) „Information and knowledge engineering in agricultural enterprises in the Czech Republic“. In: *Future Communication, Information and Computer Science: Proceedings of the 2014 International Conference on Future Communication, Information and Computer Science (FCICS 2014)*, May 22-23, 2014, Beijing, China. pp. 139-142.

- [29] Vanek, J., Cervenkova, E., Jarolimek, J., and Simek, P. (2010) "State and evaluation of information and communication technologies development in agricultural enterprises in the Czech Republic", *Plant Soil and Environment*, Vol. 56, No. 3, pp. 144-147. ISSN 12141178.
- [30] Voříšek, J. (2009) „Faktory ovlivňující řízení podnikové informatiky“ (in Czech), *Systems Integration*, Vol. 196. ISSN 1804-2716.
- [31] Voříšek, J., Pour, J. and Buchalcevová, A. (2015) „Management of Business Informatics Model - Principles and Practice“, *E+M Ekonomie a Management*, Vol. 18, No. 3, pp. 160-173 ProQuest Central. ISSN 2336-5604.