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DIFFERENCES IN THE USE OF IT INFRASTRUCTURE AMONG BUSINESS ENTERPRISES OPERATING IN THE VISEGRÁD GROUP OF COUNTRIES

Attila Joczik[1], Peter Sasvari[2]

Abstract

The aim of using information technology and information systems is to improve the efficiency and effectiveness of economic activities. Examined by their size categories, the enterprises operating in the Visegrád group of countries produce different average added value, which can also be detected in their use of IT infrastructure. In comparison to their Visegrád peers, micro-enterprises in Slovakia, small-sized businesses in Poland, medium-sized enterprises in the Czech Republic and corporations in Hungary produced the highest added value on average, which is closely related to the usage of IT infrastructure in those countries. It also follows that various business information systems can be found at the small- and medium-sized enterprises in the Czech Republic and Poland in the largest proportion. These systems were applied by Hungarian and Slovakian small- and medium-sized enterprises at the lowest frequency rate. Personnel responsible for the operation of IT functions at micro- and small-sized enterprises vary from country to country, an employee working at a lower position was entrusted with this task in the Czech Republic and Slovakia, while IT managers in Hungary and external specialists in Poland were in charge of the operation of IT infrastructure. Corporations tended to entrust IT managers with this task in each of the studied countries.

1. Introduction

Businesses have been using electronic devices to help their operation at some level since the emergence of computers. The development of computers has helped businesses to improve their information and communication processes. Naturally, it, similarly to all technical innovations, was initially only available for large companies that had enough capital and were able to finance their development. Computers appeared at these companies for the first time and were initially applied only to perform simple computing tasks. Later corporate databases were formed in which data could be stored. This period is called the period of island systems when each corporate module had its own IT support for fast data processing. However, with the robust development of the internal computer networks and the Internet, it has become almost inevitable to merge these systems in a single interface in the companies' internal and external information flows. That is how a business society has evolved by now in which market share is substantially dependent on the IT support behind business enterprises. Information technology put a device in the hands of enterprises with which they can achieve things that were previously considered impossible. Nicholas Carr argues that information technology have reached its maturity to the extent that it is now an integral part of every business enterprise's infrastructure. As the performance of the technology was growing and its size and relative price fell, the use of information stored in computers extended to other

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fields of application: from the organization of e-commerce to the automation of production. It was not simply about performing tasks, which could also be performed by traditional methods, faster and more efficiently by a computer but it also became possible to give answers to questions with the help of computer that had not even arisen before because they simply could not occur. In the seventies and eighties, Information technology did not contribute to the growth of GDP, however, new studies have shown that in the 1990s high GDP growth was mainly caused by the increase in information technology to a great deal (David, 1990). The basic assumption of our research is that in countries where the use of IT devices is higher, the enterprises have higher capability of manufacturing more complex products. The production of more complex products means higher added value. Added value at basic prices can be simply defined as the difference between gross output (at basic prices) and intermediate consumption (at purchaser prices) and can be decomposed into the following components: Compensation of Employees; Gross Operating Surplus; Mixed Income; and Other Taxes on Production less Subsidies on Production. It follows that the IT development level of the Visegrád group of countries is different and it has to be reflected in their capability of generating added value. In the seventies and eighties, Information technology did not contribute to the growth of GDP, however, new studies have shown that in the 1990s high GDP growth was mainly caused by the increase in information technology to a great deal (David, 1990). The basic assumption of our research is that in countries where the use of IT devices is higher, the enterprises have higher capability of manufacturing more complex products. The production of more complex products means higher added value. Added value at basic prices can be simply defined as the difference between gross output (at basic prices) and intermediate consumption (at purchaser prices) and can be decomposed into the following components: Compensation of Employees; Gross Operating Surplus; Mixed Income; and Other Taxes on Production less Subsidies on Production (OECD, 2009). It follows that the IT development level of the Visegrád group of countries is different and it has to be reflected in their capability of generating added value. The average added value of the **micro-enterprises** per company in the EU was EUR 71,000 in 2012. Hungary with its average value of EUR 17,000 lagged behind the Czech Republic (EUR 19,000) and Poland (EUR 22,000). The Visegrád group of countries was lead by Slovakia with its value of EUR 39,000. The average added value generated by the **small-sized** businesses in the EU is more than 10 times higher than that of the micro-enterprises, with an average value of EUR 881,000. In this respect, Poland (EUR 540,000) got on the top of the list. In this size category, Hungary with its average of 315.000 remained 64 % below the EU average, preceded by both Slovakia (EUR 447,000) and the Czech Republic (EUR 390,000).

In the case of medium-sized enterprises employing more than 50 workers the highest average added value was measured in the Czech Republic (EUR 2,616,000). The average added value in this size category was EUR 2.270.000 in Hungary, which was not enough to reach 44% of the EU average. With this result, Hungary was behind Poland (EUR 2,566,000) and Slovakia (EUR 2,351,000) as well.

2. The aim of the research and its methodology

Within our research concept, the business infrastructure of the four Visegrád group of countries, the Czech Republic, Hungary, Poland and Slovakia was examined among the microenterprises and SMEs operating there. According to our core assumption, the examination of the four elements of IT infrastructure – hardware, network, software and meatware, respectively – is essential because they all contribute to the creation of greater added value.

According to our assumptions:

- in terms of the frequency of using hardware and network infrastructure, the ranking of the four Visegrád group of countries was the Czech Republic, Poland, Hungary and Slovakia in 2012.
- the analysis on the use of business information systems is carried out by size categories under the assumption that the ranking is essentially determined by the average added value. According to this, the rankings should be as follows in the case of **micro-enterprises**: Slovakia, Poland, the Czech Republic and Hungary; **small-sized enterprises**: Poland, Slovakia, the Czech Republic and Hungary; **medium-sized enterprises**: the Czech Republic, Poland, Slovakia and Hungary.
- the persons responsible for the operation of IT functions are similar in each size category in every studied country. In the size category of medium-sized enterprises, IT managers are entrusted with this task in most cases.

The empirical survey was carried out by questionnaires sent to companies. During the compilation of the questionnaire, we took into account the relevant literature as well as the results of some former empirical studies on the subject.

The questionnaire is divided into five blocks. The first part contains questions about the company background information, then issues related to the IT infrastructure. The third group of questions focuses on the business issues related to Internet usage habits, while the fourth and longest section is aimed at assessing the usage patterns of information systems. The fifth block of questions is related to information management practices of the companies, while in the end of this section, we ask about some information on the human resources related to IT.

The questionnaire was sent to thousands of companies, 36 questionnaires from The Czech Republic, 155 from Poland, 94 from Hungary, and 86 from Slovakia were returned by the set deadline. The survey was conducted by the close co-operation between three universities, namely Masaryk University in the Czech Republic, Maria Curie-Sklodowska University in Poland and the University of Miskolc in Hungary. The sample of the respondent enterprises is not representative so the results of the survey can only be interpreted within the range of the responding enterprises.

3. The general ICT development level of the Visegrád group of countries shown by the ICT Development indices

IT infrastructure refers to the composite hardware, software, network resources and services required for the existence, operation and management of a business IT environment. It allows an organization to deliver IT solutions and services to its employees, partners and/or customers and is usual internal to an organization and deployed within owned facilities (Janssen, 2013). IT infrastructure consists of all components that somehow play a role in overall IT and IT-enabled operations. It can be used for internal business operations or developing customer IT or business solutions. Typically, a standard IT infrastructure is distributed according to the following components: *network* (Server-based network, Internet connectivity, firewall and security.), *hardware* (Servers, computers, data centers, switches, hubs and routers, etc.), *software* (Business Information Systems, productivity applications and more.) and *meatware* (Although conflicting, human users, such as network administrators (NA), developers, designers and generic end users with access to any IT appliance or service

are also part of an IT Infrastructure, specifically with the advent of user-centric IT service development) (Janssen, 2013).
In information technology, a server is a computer or software that facilitates the access to the data stored or generated on it for other computers or allows the utilization of its hardware resources (such as printers, mass storage devices, CPU). Workstations and portable computers are devices used by individual workers.

The ICT Development Index (IDI) is an index published by the United Nations International Telecommunication Union based on internationally agreed information and communication technologies (ICT) indicators. The ICT Development Index is based on 11 ICT indicators, grouped in three clusters: access, use and skills (Sanou, B., 2012). According to the IDI sub-index, in terms of IT infrastructure the Czech Republic is considered to be the most developed among the Visegrád group of countries. It is the 20th in the European Union, followed by Hungary (21st), Poland (22nd) and finally, Slovakia (24th). The Networked Readiness Index (NRI) is defined as the "degree of preparation of a nation or community to participate in and benefit from ICT developments". The index is a composite of three components: the environment for ICT offered by a given country or community; the readiness of the community's key stakeholders (individuals, businesses, and governments) to use ICT; and finally, the usage of ICT amongst stakeholders (Bilbao-Osorio, Dutta, Geier and Lanvin, 2013). Based on the NRI sub-index, Hungary (27th) is the last in the ranking of the EU countries. The best position was reached by the Czech Republic (13th), followed Poland (21st). Slovakia (24th) outpaced Hungary by three positions.

3.1. The number of workstations used by enterprises

In the case of **micro-enterprises**, 4 desktop or laptop computers in Poland and 3 pieces in Hungary and Slovakia were used by workers in 2012. **Small-sized enterprises** in Hungary had an average of 7 workstations. This figure was considerably higher in the Czech Republic as an average of 20 workstations were available for small-sized enterprises to perform a variety of tasks. The average number of workstations available for Polish small-sized enterprises was 14, while their peers in Slovakia used only 4.

Table 1 - The average number of workstations used and the frequency rate of server-based networks in percentage by enterprises in 2012

	The average number of workstations			The frequency rate of server-based networks		
Country	**Micro-enterprise**	**Small-sized enterprise**	**Middle-sized enterprise**	**Micro-enterprise**	**Small-sized enterprise**	**Middle-sized enterprise**
The Czech Republic		20	59		86	94
Hungary	3	7	55	30	52	93
Poland	4	14	89	28	58	94
Slovakia	3	4	8	14	59	85

The results showed that the greatest number of workstations were used in the size category of **medium-sized enterprises** in Poland, with operating an average of 89 pieces. They were followed by their Czech peers with using 59 pieces, while an average of 55 workstations were used by the Hungarian medium-sized enterprises. The lowest number was measured among the Slovakian enterprises.

3.2. The frequency of applying server-based networks

In the case of **micro-enterprises**, server-based networks were most frequently used in Hungary (30%). It was closely followed by Poland (28%), while half of the Hungarian frequency rate was measured in Slovakia. According to the results, the use of server-based

networks reached the highest proportion among **small-sized enterprises** in the Czech Republic (86%). 59% of the small-sized enterprises in Slovakia and more than half of them in Poland (58%) used such networks. Only 52% of small-sized enterprises in Hungary used this type of devices. The Czech Republic showed the highest frequency rate in the category of **medium-sized enterprises** (94%) as well. The same rate was measured among the Polish enterprises (94 %), while 93% of the Hungarian enterprises used them in this size category. Slovakia presented a slightly lower rate of 85%.

4. Business Information Systems

In order to understand business information systems, we need to be aware of their general features, functions and key activities, together with their inter-relatedness to one another. There are several definitions offered on business information systems in the literature. According to Burt and Taylor's approach, "business information systems can be regarded as an information source in any combination thereof, or any access to and any recovery of their use or manipulation. Any business information system is designed to link the user to an appropriate source of information that the user actually needs, with the expectation that the user will be able to access the information satisfying their needs" (Burt, and Taylor, 2003: 52). Davis and Olson define business information systems as "*an integrated user-machine system for providing information to support the operations, management, analysis, and decision-making functions in an organization. The system utilizes computer hardware and software, manual procedures, models for analysis, planning, control, and decision-making by using a database*" (Davis, and Olson, 1985: 78).

In a broader sense, a business information system is the collection of individuals, activities and equipment employed to collect, process and store information related to the company's environment, its internal activities, together with all transactions between the company and its environment. Beyond giving direct support to operations, its basic task is to provide decision-makers with the necessary information during the whole decision-making process. The system's main components are the following: (1) *Individuals*, the actual users of technical apparatus. Belong to this group both people who develop, maintain and operate the system and users of information, as top managers who receive information on the factors affecting business operations, and use business information systems to make decisions in relation to planning, implementation and monitoring business activities. (2) *Information* (processed data on external and internal facts and communication) which – due to its systematized form – can be used directly in the decision-making process. (3) *Technical apparatus*, nowadays usually a computer system (hardware and software) that supports and connects the subsystems applied to achieve corporate objectives.

The computer system standardizes a significant part of the information and communication system, thus making it easier to produce and use information. According to one definition proposed (Csala, Csetényi, and Tarlós, 2003: 110) "*business information systems are systems that use information technology to collect information, transmit, store, retrieve, process, display and transform information in a business organization by using information technology*."

4.1. Business information systems and corporate decision levels

Depending on the organizational structure of enterprises, management activities are realized in different divisions of labour and at various levels. According to Robert N. Antony's comprehensive framework, there are three types of organizational controlling systems:

strategic planning, management control, and operational control. Based on Antony's classification and in line with our assumptions, these systems can be transformed into decision-making and organizational levels of specific activities that are completed with a fourth one. These four levels are associated with the following tasks:

- *Top-level management* determines the business policy of an enterprise but they should provide guidance for the strategy to be implemented as well. In addition to the preparation of plans, they have to ensure their implementation and the correction or modification of their strategy if circumstances and conditions change.
- *Middle-level management* has to implement a policy specified by the top-level management, elaborating and implementing tactical tasks.
- The responsibility of the *operational level* of management is to directly control the implementation of real processes based on the strategy and tactics defined by the upper management levels.
- At the lowest executive level, the implementation of simple mass transactions is done. It can also be called the level of *tasks*.

If it is true that certain specific business information systems can closely be connected to certain decision-making levels, then it is worth examining how each business information system is related to the other and exactly what levels of decision-making they are designed to support. An executive information system (EIS) is a type of management information system (MIS) that facilitates and supports senior executive information and decision-making needs. It provides easy access to internal and external information relevant to organizational goals. It is commonly considered a specialized form of decision support system (DSS). Management information systems (MIS) are distinct from other information systems because they are used to analyze and facilitate strategic and operational activities. Originally, the term Management Information System "MIS" described applications providing managers with information about sales, inventories, and other data that would help in managing the enterprise. Over time, the term broadened to include: decision support systems, resource management and human resource management, enterprise resource planning (ERP), enterprise performance management (EPM), supply chain management (SCM), customer relationship management (CRM), project management and database retrieval applications. Transaction processing is a style of computing that divides work into individual, indivisible operations, called transactions. A transaction processing system (TPS) or transaction server is a software system, or software/hardware combination, that supports transaction processing. According to the traditional structure, MIS, DSS and EIS are based on a TPS system. CRM, SRM and SCM systems are basically designed to support decision-making at operational and tactical levels but it is inevitably necessary to have an underlying TPS system that addresses the daily tasks. ERP systems include some important functions of TPS, and be able to support the full operational level. Business Intelligence (BI) systems can include all sorts of decision-support systems used at middle and senior management levels that appear as BI applications. BI systems are always based on some lower-level support systems, mostly on ERP systems. ERP and BI systems can also be found in a complex package.

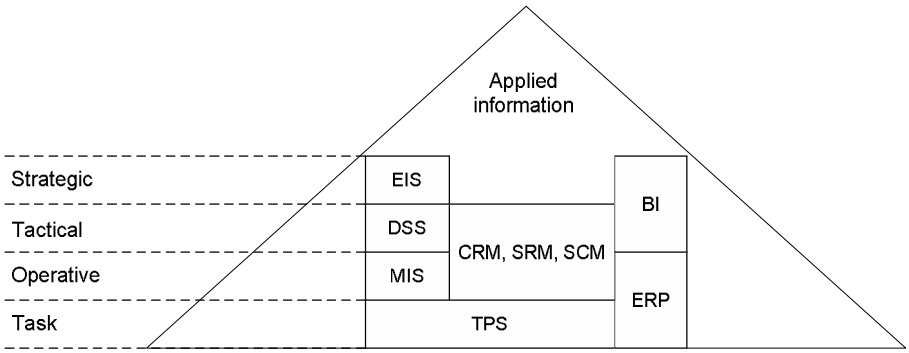

Figure 1 - Corporate decision-making levels with the supporting business information systems

It is needed to emphasize that this categorization should not be regarded as a rule, it describes only the current major trends. There are instances showing that some systems also extend to other levels of decision-making, and general shifts between these levels are also possible due to the continuous development.

4.2. The use of business information systems in the Visegrád group of countries

A quarter of the Hungarian **micro-enterprises** used or planned to use TPS systems. The intended use of ERP systems did not exceed 10% in this size category. 15% of them reported about planning to use MIS and SRM systems, which was the highest proportion after the rate of using CRM systems (35%). The use of strategic systems was less than 5%. The use of SCM systems did not exceed 5% in Hungary in 2012. It could be observed that none of the Hungarian micro-enterprises used business information systems with a frequency rate higher than 5 %. A third of micro-enterprises used TPS systems in Poland. The proportion of the intended use of ERP systems was up to 30% in 2012. Use of MIS up to 6 %, and the intended use of 10%. A third of micro-enterprises in Poland were interested in introducing SCM and SRM systems. The rate of the intended use of CRM systems exceeded 20%, although only 6% of them used them actually. Using DSS systems did not exceed 3% in Poland in this size category. Only a fifth of Polish micro-enterprises were affected by using strategic systems in 2012. The use of business information systems by micro-enterprises in Slovakia did not exceed 10%. The highest frequency rate was measured in the case of TPS systems, 17 % of the Slovakian micro-enterprises were planning to introduce this type of system. The planned implementation of ERP systems affected a tenth of micro-enterprises in Slovakia. At the operational level, the use of MIS was 7% in 2012. The same rate was measured in the case of CRM, SCM and SRM systems and their intended use did not exceed 13% in any cases. The use of DSS systems affected a tenth of Slovakian enterprises and similar rates were measured EIS and BI systems as well. Based on the data measured among the micro-enterprises in the three Visegrád group of countries, it can be stated that the use of business information systems was at the most advanced level in Poland, followed by the Slovakian and Hungarian micro-enterprises.

Table 2 - The penetration rate of business information systems among enterprises in the Visegrád group of countries in 2012

Country		the Czech Republic			Hungary			Poland			Slovakia		
Levels[3]	IS	Used	Not used, introduction is planned	Total	Used	Not used, introduction is planned	Total	Used	Not used, introduction is planned	Total	Used	Not used, introduction is planned	Total
Micro-enterprise													
IV.	BI	no data available			0	5	5	6	16	22	3	7	10
	EIS				0	5	5	9	9	18	7	7	14
III.	DSS	no data available			0	5	5	3	6	9	3	7	10
	SCM				5	10	15	9	24	33	7	13	20
	SRM				5	15	20	12	18	30	7	7	14
	CRM				5	35	40	6	23	29	7	10	17
II.	MIS	no data available			0	15	15	6	10	16	7	7	14
I.	ERP	no data available			0	10	10	12	18	30	7	10	17
	TPS				5	20	25	36	12	48	10	17	27
Small-sized enterprise													
IV.	BI	43	0	43	7	11	18	15	23	38	5	9	14
	EIS	29	0	29	4	11	15	6	19	25	5	5	10
III.	DSS	14	0	14	0	30	30	10	15	25	5	0	5
	SCM	14	14	28	11	19	30	13	33	46	14	23	37
	SRM	14	29	43	15	15	30	31	18	49	9	32	41
	CRM	20	20	40	15	19	34	16	26	42	9	23	32
II.	MIS	29	0	29	7	26	33	13	24	37	5	5	10
I.	ERP	86	0	86	15	22	37	29	24	53	27	27	54
	TPS	57	0	57	30	19	49	33	28	61	38	10	48
Medium-sized enterprise													
IV.	BI	36	29	65	7	19	26	48	9	57	18	9	27
	EIS	0	23	23	26	4	30	35	6	41	8	25	33
III.	DSS	0	33	33	19	19	38	20	53	73	9	27	36
	SCM	13	31	44	26	26	52	21	21	42	17	50	67
	SRM	25	13	38	37	19	56	48	12	60	18	45	63
	CRM	19	44	63	44	15	59	48	12	60	17	42	59
II.	MIS	20	40	60	41	15	56	39	23	62	17	17	34
I.	ERP	80	20	100	41	15	56	65	21	86	58	25	83
	TPS	63	6	69	52	7	59	66	9	75	75	8	83

Reaching the highest frequency rate, 86% of the **small-sized** businesses in the Czech Republic used ERP systems. More than half of them, 57% used TPS systems. 43% of them implemented various types of BI systems. The average rate of small-sized enterprises planning to introduce various information systems is quite low, it reached only 6% comprising three systems: SCM, SCM, CRM in 2012. In the case of small-sized enterprises in Hungary, TPS systems are used most commonly (30%), followed by ERP (15%) and CRM (15%) systems. 15% of them used SRM systems. None of the small-sized enterprises applied any type of decision support systems. Similarly to the Hungarian example, the most frequently used information system was TPS with 33%. It was followed by SRM (31%), ERP (29%) and CRM (16%) systems. Nearly 38% of the Slovakian small-sized enterprises used TPS systems, businesses 27 % of them applied ERP systems and the third most frequently used systems was SCM with 14%. SRM systems were operated by 9% of them but nearly a third of the respondents were reported on planning to introduce such systems.

When the four Visegrád countries are compared, it can be found that in the case of use and intended use of business information systems, the Czech Republic reached the highest frequency rate in terms of using ERP and TPS systems. The second highest rate was measured in the case of the Polish small-sized enterprises, followed by their Hungarian and Slovakian peers. In contrast, at the level of operative decisions, Polish small-sized enterprises produced the most favorable score in the use or intended use of MIS systems. Poland was followed by Hungary, the Czech Republic and Slovakia. When it comes to tactical decisions, the use and the intended use of CRM, SRM and SCM systems reached the highest rate among the Polish small-sized businesses. Small-sized enterprises operating in the Czech Republic also showed

[3] I=Task; II=Operative; III=Tactical, IV=Strategic

high rates in the field of using CRM systems. DSS systems were mostly used by small-sized enterprises in the Czech Republic, although when their planned use is taken into consideration, their Hungarian counterparts showed the best results.

In the case of decision support systems such as BI and EIS systems, the Czech Republic proved to be at the most advanced level. They were followed by their Polish, Slovakian and Hungarian counterparts. As for the **medium-sized enterprises** in the Czech Republic, 80% of the respondents reported on using ERP, and 20% of them were planning to introduce this type of system. The second most popular information systems was TPS with a usage rate of which is used in 63%. Based on the results, medium-sized enterprises did not plan to introduce any decision support systems at all but a third of them was planning to introduce them. Nearly 20% of enterprises used CRM, SRM and SCM systems and another 20% of them were planning to introduce such systems. 52% of the Hungarian medium-sized businesses used TPS, and 44% of them implemented CRM systems. The use of ERP systems was estimated to be 41%. The highest proportion of medium-sized enterprises in Hungary (26%) reported on intending the application of SCM systems. The most frequently used information system was TPS among the medium-sized enterprises in Poland with 66%. The same rate was measured in the case of using ERP systems. The use of SCM and CRM systems was particularly significant (48%) together with the application of MIS systems (39%). Nearly half of the medium-sized enterprises used some type of BI systems. Three-fourth of the Slovakian medium-sized enterprises used TPS and nearly two-third of them used ERP systems. In the case of less common systems such as SRM, SCM and CRM, 15-20% of them reported on using such systems, most of the enterprises were planning to introduce some of these systems. At the operative level, the use and the intended use of TPS reached the highest rate in Slovakia, whereas the Czech Republic was the most advanced in the case of ERP systems, followed by Poland and Hungary. The use of MIS systems - which is linked to the operative level - was the most significant in Poland. When the use and the intended use is examined, Poland and the Czech Republic are the most developed ones among the Visegrád group of countries. If business information systems are examined at the tactical level, it can be concluded that CRM systems are used or planned to apply by nearly two-third of the Czech enterprises. Three-fourth of the Polish medium-sized enterprises used or planned to use DSS systems, which is the highest score in the Visegrád region. Two-third of the medium-sized enterprises used or were planning to use SCM and SRM systems, reaching the highest rate in the region.

5. Persons responsible for the operation of IT functions in the Visegrád group of countries

As it can be seen on Table 9, among the Hungarian micro-enterprises, IT functions are performed by the owners or the appointed senior management at almost half of the businesses. In contrast, an external consultant is entrusted with this task in the majority of the cases, and an employee working at a lower position is in charge of IT functions in Slovakia. Based on the results of our survey, in the group of the Hungarian small-sized businesses, their executive director or external service providers are responsible for fulfilling these functions in the largest proportion. Operating IT functions by an employee at a lower, departmental position was not significant in Hungary. In contrast, the Czech enterprises leave the operation of these functions to an appointed employee at a lower position. The proportion of external service providers was also high in this country. The majority of small-sized businesses in Poland uses external service providers for the operation of their IT functions. In quite a lot of cases even

IT managers are hired. Similarly, a greater proportion of small-sized enterprises in Slovakia entrust IT managers with the performance of this task.

Table 3 – Persons responsible for operating IT functions in the Visegrád group of countries in 2012

	Micro-enterprise			Small-sized enterprise				Middle-sized enterprise				Corporation			
	H	PL	SK	CZ	H	PL	SK	CZ	H	PL	SK	CZ	H	PL	SK
Chief Information Officer	5	14	14	14	15	23	38	29	48	50	55	46	80	66	83
Chief Executive Officer	45	7	22	14	30	18	23	6	11	3	18	0	0	10	0
An appointed employee working at a departmental level	20	7	58	43	10	18	31	59	19	9	9	27	10	14	0
An external service provider	5	47	6	29	30	32	8	6	22	38	18	9	10	10	17
Other	25	25	0	0	15	9	38	0	0	0	0	18	0	0	0

In terms of the **medium-sized enterprises**, IT functions are operated by IT managers in Hungary in the largest proportion. In the Czech Republic, at more than half of them, an appointed employee is responsible for this. In Poland, IT managers are appointed for this task at more than half of the enterprises. This rate is also characteristic to the medium-sized enterprises in Slovakia.

6. Conclusions

After the examination of the hardware and network infrastructure in the Visegrád group of countries, it can be concluded that the most advanced country is the Czech Republic among them. The highest frequency rate of server-based networks was measured there and the number of workstations and portable computers used by small-sized enterprises was also the highest. Furthermore, both the IDI and NRI indices squarely showed that this country proved to be the most developed one of the Visegrád group of countries. Poland finished in the second position since micro-enterprises and medium-sized enterprises used workstations in the largest number there, and the NRI index showed its relatively advanced level, only being overtaken by the Czech Republic. Hungary can be considered the third among the Visegrád group of countries where the frequency rate of server-based networks and the number of workstations were higher in each size category than they were in Slovakia.

When the use of business information systems by micro-enterprises and SMEs are examined:

> Poland leads the way in the ranking of **micro-enterprises**, followed by Slovakia and Hungary in all decision-making levels. It may be related to the fact that the capacity of generating added value is the lowest in Hungary in this size category.
> in terms of **small-sized enterprises**, Poland proves to be the most advanced country both at operative and tactical levels, and it follows the Czech Republic at a task and a strategic level. It can be explained by the fact that the Polish small-sized enterprises produced the highest added value in this size category.
> the Czech Republic is the most developed in the category of **medium-sized enterprises** at task, tactical and strategic levels, it is only overtaken by Poland only at an operative level. It may correspond to the average added value produced by medium-sized enterprises in Poland and the Czech Republic, that is the Czech Republic is the first and Poland is the second in this regard.

In the case of medium-sized enterprises, specifically IT managers are appointed within the organization for fulfilling IT functions in all of the studied countries. Personnel responsible for the operation of IT functions in the size category of micro- and small-sized enterprises was different from country to country, an employee working at a lower, departmental level was

entrusted with this task in the Czech Republic and Slovakia, while IT managers in Hungary and external specialists in Poland were in charge of the operation of IT infrastructure.

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8. References

[1] ANTHONY, ROBERT (1965). *Planning and Control Systems: A Framework for Analysis*. Harvard Business Review, 1965

[2] BILBAO-OSORIO, B., DUTTA, S., GEIER, T. & LANVIN, B. (2013). *The Global Information Technology Report 2013*, The Networked Readiness Index 2013: Benchmarking ICT Uptake and Support for Growth and Jobs in a Hyperconnected World, 2013 World Economic Forum

[3] BURT, E. and TAYLOR, J. A. (2003). *Information and Communication Technologies: Reshaping Voluntary Organizations?*, Nonprofit Management and Leadership, 11(2), 131–143

[4] CARR, N. G. (2003). *IT Doesn't Matter*. Harvard Business Review, Vol. 81. No. 3, May.

[5] CSALA, P., CSETÉNYI, A. and TARLÓS, B. (2003). *Informatika alapjai* (*Basis of informatics*). Budapest: ComputerBooks

[6] DAVID, P. (1990). *The Dynamo and the Computer: a Historical Perspective on the Modern Productivity Paradox*. The American Economic Review, Papers and Proceedings, Vol. 80. No. 2. May, pp. 355-361.

[7] DAVIS, G. B. & OLSON M. H. (1985). *Management information systems: Conceptual foundations, structure, and development*. New York: McGraw-Hill.

[8] Enterprise and Industry, SBA Fact Sheet 2012, Austria, Belgium, Bulgaria, Cyprus, the Czeh Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom from http://ec.europa.eu/ enterprise/policies/sme/facts-figures-analysis/performance-review/#h2-2

[9] JANSSEN, C. (2013): *IT Infrastructure*, Technopedia, Janalta Interactive Inc., http://www.techopedia.com/definition/29199/it-infrastructure

[10] KACSUKNÉ BRUCKNER, L. & KISS, T. (2007). *Bevezetés az üzleti informatikába* (*Introduction into business informatics*). Budapest: Akadémiai Kiadó

[11] RAFFAI, M. (2003). *Információrendszerek fejlesztése és menedzselése* (*Development and management of information systems*). Novadat Kiadó

[12] SANOU, B. (2012). *Measuring the Information Society 2012*, International Telecommunication Union