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OPEN

Scientific Annals
of the "Alexandru Ioan Cuza" University of Iași
Economic Sciences
62 (3), 2015, 411-424
DOI 10.1515/aicue-2015-0028



REQUIREMENTS FOR CIOs' COMPETENCIES IN THE CZECH ECONOMY

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Abstract

Economy of the Czech Republic, just like the country's ICT sector, underwent significant changes after 1990. The fall of socialism and transition to market economy had significant impact on development of ICT sector and its competitiveness. In the article, we analyze practical requirements in the field of strategic knowledge demanded from Chief Information Officers (CIOs). The analysis is based on a representative survey carried out among approximately 1,000 companies on the Czech market in 2006, 2010. The last survey in 2015 was performed in the form of interview in 147 corporations. The companies are divided by branch in economic sector, by dependence on ICT and by size. The requirements put on CIOs are divided into sixteen knowledge domains. The results of the survey indicate that ICT sector in Czech Republic has gone from centrally planned economy to almost advanced economy since 1990. This is evidenced by identified development of strategic knowledge and practical skills required from CIOs in Czech Republic between 2006, 2010 and 2015. Knowledge requirements on CIO's decreased visible between year 2006 and 2015 but change between 2010 and 2015 is not noticeable. In general, we can say that requirements on CIO's are in 2015 lower than in 2010 except domains like "Team leadership skills", "IS/ICT knowledge", "Knowledge in Business Sector" and "Law".

Keywords: Chief Information Officer, CIO competences, knowledge profile, ICT skills, ICT management

JEL classification: A23, J01, J21, J24, O15

1. INTRODUCTION

The implosion of the socialist camp and the socialist system were reflected very strongly in the economic field in the conditions of former Czechoslovakia (Czech Republic). The transition of the country's economy from central planning to market economy was accompanied by political and ownership changes, which were accompanied by changes on both macro- and micro-economic levels (Klaus, 2006). One of the important accelerators of the economic reform and subsequent development became ICT. However, in line with the development of ICT, new ICT roles arose and the knowledge

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required from them developed dynamically. With the development of ICT and economy as a whole, there were naturally also significant debates about the impact of new ICTs on economic performance and competitiveness in general, and on productivity, efficiency, and innovation in particular. Notably, in seeking an explanation for the acceleration in productivity and economic growth experienced in many industrialized countries in the latter half of the 1990s and early 2000s, many economists have looked at the development, application, and utilization of ICT as a critical factor. It has been argued that ICT represents a new general purpose technology, with the potential of transforming economic processes into a “New Economy,” generating a sustained increase in economic growth through processes of technological development and innovation. Hence, at firm level, the expectations are of greater efficiency, lower costs, and access to larger and new markets, while governments see the application and use of ICT as generating higher national productivity, job creation, and competitiveness. (World Bank, 2007).

In the Czech economy, this development manifested twice, for the first time, in 1990s, when ICT services were privatized (Klaus, 2006), and Czech companies were outfitted with software and hardware. For the second time, this development manifested also in the first years of the new millennium, when new trends appeared in the form of participation in international integration in the field of providing ICT services and increased share of foreign and international companies in the ICT services market. Along with that, the trend of improving the qualification of experts and CIOs in the companies appears.

The subject of the current article is the analysis of strategic thinking and practical ICT skills requirements for the role of CIO. The research on ICT specialists conducted in the Czech Republic had a broader context in which we examined not only common business practice needs but also a possibility of satisfying such needs by human resources represented by university graduates from ICT area of specialization. During the research we identified interesting trends in the development of requirements from practice for ICT roles identified by us. In this paper, our attention is focused on the development of requirements for CIO role. The article shows the development of business practice requirements on strategic thinking and practice skills for CIO role identified by us during two surveys. The first survey was conducted in 2006 and the second one in 2010. The development of requirements for a CIO role was studied from various perspectives. Detailed views of the points at issue are:

- With respect to all sectors of economy based on the dependency on ICT and
- With respect to the size of companies (10-49, 50-249 and more than 250 employees) included in the survey.

We don't take into account in this paper questions connected with gender that are solved for example in (Rodgers and Boyer, 2006).

2. BACKGROUND

Transition economies are defined as countries that are in transition from a communist style central planning system to a free market system (Roztocki and Weistroffer, 2008a; Lee *et al.*, 2012) present that the two regional groups of transition economies are distinguished in their contribution (Lee *et al.*, 2012) - Central and Eastern Europe and Latin America. The International Monetary Fund's classification does not include Latin countries. The definition of transition economies applies to a country or region with low absolute, but fast growing, and authorities committed to economic and political liberalizations (Arnold and Quelch,

1998). As we discussed, most studies on transition economies have aimed at examining ICT-driven economic and political changes in the initial stages of transition process, so they do not present rich insights on the transformative role of ICT in this type of economy. Countries in Central and Eastern Europe included the part of Soviet sphere of influence. They have the same transitional year of 1990, the year for the collapse of the U.S.S.R. and the subsequent dismantling of communism in Eastern Europe. The five-exemplar countries included in this study joined the European Union in 2004. While their overall economic and societal indicators had stabilized, their economic markers remained below the European and OECD average. Important economic indicators such as GDP per capita and employment ratio were much lower than other OECD countries. In this regard, these countries hoped to catch up with living standards in developed countries and use ICT to stimulate overall societal improvements. Higher ICT spending would reflect such efforts around 13.2% of GDP, which is approximately twice as high as the average spending of other OECD countries (Doucek, 2010; Hančlová and Doucek, 2011; Agayev and Mamedova, 2012). The manner of transition from central planning to market economy left also its marks on the development of the ICT sector and on the requirements and knowledge for the CIO role.

The process of ICT adoption in developing countries is connected with different considerations as compared to practice observed in developed economies (Bingi *et al.*, 2000; Roztocki and Weistroffer, 2008a). In particular, ICT adoption projects conducted in developing and transition economies **struggle with lack of ICT experience**, inadequate ICT infrastructure and maturity, and **lack of long term strategic thinking** (Huang and Palvia, 2001; Roztocki and Weistroffer, 2008b; Solar *et al.*, 2013). Lack of strategic thinking and lack of experience in ICT yields lack of human resources in the ICT field on the market in the Czech Republic are presented f. e. in (Doucek, 2010) and subsequently low competitiveness of the whole economy due to underdeveloped ICT (Soľoducho-Pelc and Radomska, 2012), (Doucek *et al.*, 2014, Doucek *et al.*, 2013; Crespo and Cota, 2012).

Another aspect with impact on the CIO competencies are ICT trends. Some of these are specified in Roztocki and R. (2012). According to Cohen *et al.* (2002) the main features of ICT are as follows:

- very dynamic technological changes, with rapid penetration and adoption rates,
- decreasing costs for new equipment,
- a rapidly increasing range of applications and penetration in an increasing number of realms of professional and personal life.

In the world literature, various concepts of **CIOs' competences** may be found (for example (Porter, 2008). Their extent is given by the range of professions and their activities performed by managers in the ICT field. ICT managers are not only chief information officers (CIO) but they are also at the level of informatics department management, project management or they hold a position of specialized directors (e.g. safety director, computer network department director, etc.).

3. METHODOLOGY AND DATA COLLECTION

The research methodology was based on the problem formulation, i.e. identification of the development of requirements from practice for ICT specialist roles highlighting the role of ICT managers with respect to time, field of company's activity, and the company size.

To define individual ICT roles for the purpose of business practice it is essential to understand who may be considered an ICT specialist. During our survey we adopted the

following concept of an ICT specialist. An ICT specialist is considered to be an employee whose job position requires specific knowledge and skills about the creation, implementation and operation of ICTs in companies and use of ICTs in support of main company processes. Working with ICTs is their main job task (OECD, 2010). End users whose activity does not influence the work of other ICT users are not, therefore, considered to be ICT specialists. The reason behind such concept is the fact that a growing number of professionals (traders, physicians, financiers, architects, accountants and others) use ICTs in their work but they do not influence other ICT users. For the purpose of the first survey conducted in 2006 six basic roles of ICT specialists were defined in cooperation with professional associations of ICT specialists and companies – The Czech Association of Chief Information Officers (CACIO): business analyst/architect, CIO (Chief Information Officer), salesperson for ICT products and services, developer/IS (of information systems) architect, application and ICT infrastructure administrator, advanced ICT user/ methodologist.

Based on the requirements for skills, abilities and competences of ICT managers (Zanda, 2011) and after consultations with experts from academic environment and top and ICT managers from business environment the following main activities for CIO role were defined:

- Preparation of company strategies – strategy targets
 - Information strategies (how ICTs will be implemented in a company in order to support the achievement of its strategic goals).
 - Sourcing strategies (which services, processes and sources should be owned / internally administered and which ones should be purchased from partners),
- ICT performance management – tactical targets
 - Measurements of corporate ICT (based on PDCA approach) (Jaquith, 2007, Maryska and Novotny, 2013).

A CIO is required to possess the knowledge of best global practices as well as of local conditions and business culture (Xu and Xu, 2011). In particular, off-shore outsourcing of these activities is unlikely to happen in current conditions (Contractor and Mudambi, 2008).

Each of the above mentioned roles was described in a structured format. Business practice usually uses various names to designate professional roles. For this reason the description of each professional role was extended to include common names of positions which are used in business practice and which may be included in the given professional role. Furthermore, we extended the description of roles to include key knowledge and activities which we assume are associated with the given role (Doucek *et al.*, 2007).

These methodology modifications do not affect the issues discussed in this article because the CIO role was incorporated in both the surveys almost without change in the description of key knowledge and key activities.

3.1. Skills Categories

Another research task was to identify the skills which a good ICT specialist should possess in order to be admissible for business practice. The definition of obligatory knowledge and skills was followed by the definition of skills domains. Skills domains include knowledge and skills which can be acquired through a verbal message (pedagogical process) or by practical exercises. Their definition was based on (Strawman *et al.*, 2004) and they were broken down into the following skills domains: MS01 Process Modeling, MS02 Functionality and Customization, MS03 IS/ICT Management and Definitions of ICT

Services and Operation Variations, MS04 Analysis and Design (of business information system as a whole and of its parts), MS05 Software Engineering (techniques and procedures for the creation of programme products), MS06 Data and Information Engineering, MS07 IS/ICT Knowledge, MS08 Operational Excellence, MS09 Team Leadership Skills, MS10 ICT Market Knowledge, MS11 Organizational Management Methods, MS12 Enterprise Finance and Economics, MS13 Sales and Marketing, MS14 Mathematics, MS15 Law, MS16 Knowledge in Business Sectors. Furthermore, domains were internally broken down into ICT and non-ICT knowledge and skills. Pure ICT knowledge is to be found mainly in MS01 – MS08 domains.

Knowledge and skills on the transition between ICT and non-ICT is represented by MS09 and MS10 domains. Other knowledge domains (MS11 – MS16) represent a set of knowledge and skills which can be classified as non-ICT knowledge.

The domains significant for the purposes of our article are MS09-MS12 and MS16. These domains comprise CIO expertise related to a transition from central planning to market economy (transition economy). They contain expertise that enhance CIOs' managerial skills, the skills of working team leadership and the knowledge of the different economic sectors (MS16) – i.e., with respect to (Bingi *et al.*, 2000; Roztocki and Weistroffer, 2008a) and (Huang and Palvia, 2001; Roztocki and Weistroffer, 2008b), these are domains covering strategic skills of CIOs and their overall knowledge of ICT issues rather than narrowly focused skills relation to deployment of information systems in organizations. The domain MS09 was conceived for ensuring CIO's skills of working team leadership and with an aim of achieving strategic objectives not only of ICT, but also of the whole organization. The domain MS10 comprises knowledge of the overall awareness of the ICT market, not only local, but also international. This involves not only the knowledge of ICT product packages offered, but also hardware and subsequently also knowledge of the systems of management, application of deployment. MS11 comprises information on management methods and on solving the most pressing issue of present, namely linking ICT to the company's organizational structures. MS12 deals with strategic and tactical connection of financial management and corporate ICT management. Also the domain MS16 is very important, where we queried knowledge and skills in a particular economic sector. The questions in this domain were focused on linking ICT management to achieving the organization's own business objectives – i.e., the connection between ICT and the core business management both on strategic and tactical levels.

Each of above mentioned skills domains was described in such a manner that the survey respondents would be able to specify how many days of intensive training (8 hours of class training) they require the ICT manager should attend in each domain. Individual domains, their description and mapping between individual surveys are specified more detail in, for example, (Maryska *et al.*, 2010). These domains represent optional knowledge and skills the ICT manager should possess. Volumes of knowledge, quantified in individual skill domains, were converted into a six-level scale. The conversion method was specified as follows: **1 – No knowledge**, **2 – A general overview** of the subject area (corresponding to ca 1-2 days of intensive training), **3 – A basic orientation** in the subject area and terminology (corresponding to ca 3-5 days of intensive training), **4 – A solid overview** of the subject area and basic practical skills (corresponding to ca 6-20 days of intensive training), **5 – A solid overview** of the subject area **and solid practical skills** (corresponding to ca 21-40 days of intensive training), **6 – The highest knowledge quality** – profound up-to-date knowledge and advanced practical skills (corresponding to 41+ days of intensive training).

3.2. Survey among Economic Operators

Requirements of economic operators for the role of ICT manager were identified by the sample survey method (Pecáková, 2010). In order to define the observed sample information on economic operators was used. The first survey in 2006 used data about economic operators from the end of 2005 (CSU, 2007; Doucek *et al.*, 2012). The second survey conducted in 2010 used the data from the beginning of 2010. In 2005 there were 1,266,336 active economic operators in total. At the beginning of 2010 it was 1,399,983 operators.

The first classification criterion of economic operators was the type of activity performed by the economic operator. The Czech Statistical Office distinguishes 17 main sectors according to the ISCO classification (CSU, 2010). These sectors were, for the purpose of the survey, broken down into three groups according to the intensity of ICT utilization as follows:

Low IT –sector includes companies with **low ICT utilization rate** whose main processes do not show high dependence on ICTs. This is mainly the “primary economic sector” – agriculture, hunting, forestry, fishing, mining, quarrying, textile industries, leather and footwear, wood, of wood and cork industries, construction, building industry, etc. This sector did not change its characteristics during transition period.

Medium IT – medium ICT utilization rate. Economic operators in this group include regular partners with whom we come into contact in everyday life. They are mainly economic operators falling within the sector of trade activities, real estate agencies, food, beverages, tobacco industries,, mechanical engineering – light and heavy engineering, services to citizens, state and public administration, oil companies, fuel producing sectors, transport and storage, hotels , restaurants etc. – i.e. in secondary, tertiary or quaternary public sectors. Changers in transition period thanks ICT were significant.

High IT –Sectors with **high requirements for ICT utilization** are represented in economy mainly by financial institutions – banks, insurance companies, brokerage firms, telecommunication corporations, economic operators providing ICT services, post services, electricity, gas and water supply etc. Apart from the financial sector this group also includes the sector of communications and the provision of communication services. Important representatives of this sector are also mobile operators. Other representatives of the sector are ICT companies involved in ICT services and productive manufacturing. Therefore, this is mainly a market quaternary sector. Changers in transition period thanks ICT were crucial. This business cannot be realized without ICT support.

The second classification criterion for economic operators was the number of employees. Economic operators were, according to their number, divided into the following five groups: 0-9, 10-49, 50-249, 250-999, 1,000 and more.

3.3. Data Collection Method

The basic method for the collection of data was survey sampling. The basic set of active economic operators was, for the purpose of the sample survey, split into 18 strata in 2006 based on six size categories and three categories according to the requirements of their field of operation for the use of information technologies. Probability sampling without replacement was done in each stratum. The sample of observed economic operators does not contain clearly identifiable homogeneous subgroups of economic operators. This is, in particular, due to the size of economic operators which include a wide range of values. It

also relates to the fact that the same variables may be seen in the number of ICT specialists in observed economic operators. All such facts were taken into consideration during the survey preparation in such a manner that in subgroups in which it was possible to expect a lower number of operators (for example, large operators with high dependence on ICTs) a higher proportion of observed economic operators of all operators of the given subgroup was required. In 2006, the observed sample was set to be 1,002 operators (Table 1). The survey among economic operators was carried out by a private company specializing in conducting surveys on a professional basis. The survey was performed by using CAWI (Computer Aided Web Interviewing) and CATI (Computer-Assisted Telephone Interviewing) methods.

The second survey was conducted at the end of 2010. It was also carried out with the help of experience and facilities of a private company specializing in conducting surveys. In both cases they were companies which were part of multinational companies providing their services also on the territory of the Czech Republic. The structure of the sample of economic operators in the survey conducted in 2010 slightly differed from the first one. This was caused by some changes in the stratification methodology for economic operators. The essential change is the classification of economic operators according to the number of employees. Economic operators were divided into only three groups in the second survey according to the number of employees. Based on experience from the first survey conducted in 2006 and also based on recommendations of experts from the Czech Statistical Office the groups with 0 and 1-9 employees were excluded from the survey (these were in most cases sole traders or micro companies with a minimum impact on the overall situation of economy). Groups with 250-999 and 1,000+ employees respectively were consolidated into one group of 250+ employees. The resulting sample of economic operators contained 1,011 economic operators in the classification shown in Table 1.

The factor of the operator's dependence on ICTs remained unchanged from the previous survey carried out in 2006.

Table no. 1 – Structure of the Observed Sample in 2006 and 2010

Category		0-9		10 – 49		50 – 249		250 +		Total	
Sector	2006	2006	2010	2006	2010	2006	2010	2006	2010	2006	2010
Low IT	84	28	45	28	46	53	44	193	135	84	84
Medium IT	112	56	57	56	474	107	98	331	629	112	112
High IT	166	160	66	122	142	30	39	478	247	166	166
Total	362	244	168	206	662	190	181	1,002	1,011	362	362

Source: authors

Table no. 2 – Structure of the Czech Economy

	0-9	10-49	50-249	250+	Total
Low IT	313,203	14,270	4,317	456	332,246
Medium IT	835,935	28,014	6,217	1,346	871,512
High IT	59,441	2,216	710	211	62,578
Total	1,208,579	44,500	11,244	2,013	1,266,336

Source: CZSO

The third round of the research was realized among stakeholders, CIO's, managers and ICT managers in 147 companies (39 in Low IT, 96 in Medium IT and 12 in High IT) in

summer 2015. Only preliminary over all results of this survey are presented in this article. We choose different approach to research in 2015 because it should give initial information for the further directions of our research work.

3.4. Principles of Data Processing and its Evaluation

Data collected from respondents was processed with the use of technology enabling work with a large volume of data. For the processing of data we used the platform Microsoft SQ Server 2008 R/2 (MS SQL). Extracts of data from primary systems were made in two forms: in the form of text files and in the form of extracts in Microsoft Excel format.

In the MS SQL Server database system the data model DWH (data warehouse) was prepared in the traditional architecture of DWH Stage and DWH Core. The filling of the proposed DWH was realized by means of import and transformation processes, known as ETL (Extract Transform Load). These ETL instruments, called Microsoft Integration Services, are a standard part of the MS SQL platform.

For analytical work an analytical layer was built up over the data model and the data were prepared in it in Microsoft Analysis Services, which are also part of MS SQL. Data blocks and dimensions were prepared within the framework of SSAS.

With respect to the subsequent statistical analysis of respondents' answers in both surveys variables were evaluated **mainly by the median**. To compare differences in knowledge domains of ICT role manager the box plots method (for sampling distributions) and scatter plots (for medians) were used (Pecáková, 2010; Vojacek and Pecakova, 2010).

The EM algorithm (expectation-maximization) (Bilmes, 1998; MacLennan *et al.*, 2009) was selected from cluster analysis methods which best described our data set.

4. RESULTS

The surveys carried out among economic operators identified a total of seven roles of ICT experts in 2006 and 2010. In this article attention is focused only on the presentation of results acquired for ICT manager role, which is currently considered to be one of the most demanded roles on labor market (OECD, 2010; OECD, 2011).

Surveys carried out among economic operators aimed to identify which knowledge economic operators require from those who want to become CIO. By processing the survey results according to the methodology described in section 2 the following conclusions have been drawn – classified per company type. Another criterion for the analysis was the evaluation of economic operators' requirements for CIO role according to the size of such operators.

Note: Although the survey was carried out in each year in question over a sample of more than 1,000 economic entities in the Czech Republic, the lower number of respondents for each group is yielded by the fact that not all respondents needed make a statement on the CIO position. If a respondent did not include this position, the results of his/her response have not been included in this article.

4.1. Requirements per Company Dependence on ICT

For the purpose of our survey economic operators were divided into three groups according to demands on the use of ICTs and their technological dependence on ICTs.

Table no. 3 – Requirements of Companies for the CIO Role Based on the ICT Utilization

ICT utilization	Low IT		Medium IT		High IT	
	2006 n=26	2010 n=35	2006 n=74	2010 n=22	2006 n=93	2010 n=71
MS01 Process modeling	3.42	2.89	3.58	3.02	3.58	2.76
MS02 Functionality and customization	3.42	3.31	3.45	3.25	3.67	3.14
MS03 Management IS/ICT	3.23	3.06	3.38	3.15	3.56	3.21
MS04 Analysis and design	3.04	3.29	3.36	3.28	3.59	3.18
MS05 Software engineering	3.00	2.66	3.14	2.76	3.43	2.79
MS06 Data and information engineering	2.62	3.03	3.27	3.13	3.35	3.00
MS07 IS/ICT knowledge	3.19	3.57	3.45	3.64	3.72	3.55
MS08 Operational excellence	3.00	3.31	3.59	3.46	3.81	3.56
MS09 Team leadership skills	3.54	3.09	3.47	3.24	3.95	3.46
MS10 ICT market knowledge	3.23	3.00	3.24	3.21	3.53	3.07
MS11 Organizational management methods	3.15	2.94	3.39	2.77	3.42	2.84
MS12 Enterprise finance and economics	2.92	2.51	3.26	2.72	3.27	2.48
MS13 Sales and marketing	2.88	2.40	3.05	2.33	3.26	2.13
MS14 Mathematics	2.77	2.37	3.00	2.48	2.97	2.04
MS15 Law	2.77	2.46	2.89	2.38	3.00	2.39
MS16 Knowledge in business sectors	2.85	3.29	2.93	3.13	2.86	3.14

Source: authors

Remark: The Low IT means Low ICT utilization rate, Medium IT – Medium ICT utilization rate and High IT = High requirements for ICT utilization (see above) The "n" means number of respondents in the group.

The evaluation of the obtained results for organizations by dependence of the organization on ICT show very interesting shift between 2006 and 2010, in particular in the domains that are important for transition economies, which are discussed in detail later.

The domain MS09 – Team leadership skills – indicates a slight change in understanding the CIO's role in the organizations, as CIOs are no more in charge of concrete projects, but from the strategic viewpoint, they move to the correct role, in which they primarily direct a small number of direct reports in carrying out their tasks in managing the company's ICT. Therefore, the demands on concrete skills in this area decline, which are characteristic and essential for lower management levels (the team leaders), who directly communicate, assign and in particular motivate their subordinates.

MS10 – ICT market knowledge, MS11 – Organizational management methods, MS12 – Enterprise finance and economics – the changes in the demands on CIOs indicate growing specialization within the economic sectors, where CIOs are no more required to understand the surveyed areas of internal management of the company, as is, for instance, for the domain MS10 assignment and organization of tenders, and for the domain MS11 design of organizational structures, and for the domain MS12, for instance, financial management. The domain MS16 – Knowledge in business sectors – shows increased demands on the domain's skills. This confirms the trend that the transformation of the Czech ICT sector is not yet complete, as the role of CIOs is understood more as managing the ICT operations than a strategic function of connecting between the business objectives and ICT management.

Research 2015 among stakeholders, managers, owners etc. provides similar results like research from year 2010. The leap was much bigger between year 2006 and 2010 than between 2010 and 2015 in ICT.

4.2. Requirements per Company Size

In order to identify the knowledge and skills requirements another dimension was selected – a company size. We took into account the needs and general situation of a rather small open economy and therefore the distribution of companies into size groups was adapted to common practice in the Czech Republic. Small companies (10-49 employees) which have approximately a 16 % representation in the observed sample and the Czech economy as well, medium-sized companies (50-249 employees) and is most heavily represented by 66 % and large companies (250+ employees) - their proportion in economy was identified as approximately 18 %. The “n” means number of respondents in the group.

Table no. 4 – Requirements of Companies for the CIO Role Based on the Number of Employees

Number of Employees	10 – 49		50-249		250+	
	2006 n=48	2010 n=35	2006 n=55	2010 n=128	2006 n=56	2010 n=78
MS01 Process modeling	3.73	3.19	3.67	2.89	3.41	2.88
MS02 Functionality and customization	3.71	3.27	3.76	3.26	3.48	3.15
MS03 Management IS/ICT	3.63	2.88	3.64	3.13	3.38	3.29
MS04 Analysis and design	3.75	3.12	3.53	3.34	3.32	3.15
MS05 Software engineering	3.60	3.04	3.35	2.71	2.98	2.73
MS06 Data and information engineering	3.60	3.00	3.24	3.05	2.98	3.14
MS07 IS/ICT knowledge	3.92	3.46	3.65	3.60	3.39	3.65
MS08 Operational excellence	3.73	3.50	3.80	3.46	3.52	3.47
MS09 Team leadership skills	4.10	3.35	3.67	3.20	3.66	3.80
MS10 ICT market knowledge	3.65	3.27	3.44	3.13	3.25	3.09
MS11 Organizational management methods	3.79	3.16	3.38	2.76	3.21	2.81
MS12 Enterprise finance and economics	3.46	2.85	3.38	2.59	2.95	2.58
MS13 Sales and marketing	3.54	2.35	3.22	2.23	2.75	2.34
MS14 Mathematics	3.19	2.19	2.91	2.36	2.95	2.32
MS15 Law	2.98	2.58	3.00	2.28	2.84	2.53
MS16 Knowledge in business sectors	2.88	3.46	2.87	3.09	2.89	3.17

Source: authors

MS09 – Team leadership skills – structured by company size shows a clear trend of growing the requirements of leadership in **large companies**. This means that the requirement on CIOs in companies of this type move to leading of collectives, in which the skill of negotiating compromises, motivating, etc., are needed.

MS10 – ICT market knowledge – the conclusions for this domain are equal for all sizes of surveyed organizations. The demands on knowing the ICT market are less important, in view of its typification and internationalization.

MS11 – Organizational management methods – the issues of relationship between the organizational structures and ICT are particularly pressing for small organizations. For the other types of organizations, these issues are included in the standard solutions of corporate ICT operations.

MS12 – Enterprise finance and economics – in general, these issues are solved by specialization – i.e., reducing the demands on CIO managers in knowledge and skills in the field of finance and increasing the demands on financial management in the departments specializing in the financial area, i.e., accounting, budgeting, planning, etc.

MS16 – Knowledge in business sectors – like in the preceding [Table 4](#), also here the increased demands on skills in this domain confirm the trend that transformation of the Czech ICT sector is not yet finished. In particular small companies, which cannot rely so much on work specialization (they have significantly less staff for ICT management and operation), have increasing requirements on the knowledge of the organization's core business by their ICT managers, including the executive on the CIO level.

In smaller and medium-sized companies, the requirements on CIOs are already relatively stabilized and in larger companies, the transition to understanding CIO as a strategic top manager of the organization is not yet complete. Significantly more is expected from him/her on the position of linking ICT with the enterprise's business objectives.

Research realized in year 2015 provides again similar results in almost all domains. The biggest difference was realized in domains MS15 (Law) and MS16 (Knowledge in business sectors). Requirements increase approximately in average for 30% in MS15 = 3.1 and 15% in MS16 = 3.6 for all company groups. Our assumption for this change is, that the current situation and current fights among companies and last wide change in Czech legal system (changes in corporate law, in civil law and the Cyber Security Act – valid since January 2015) requires much higher general knowledge of law than in previous period. The explanation for the MS16 is (from our point of view) that increasing number of companies in economy causes increasing competition and these companies are pushed to be able to spread to another sectors and try to find out new potential clients by this way.

5. CONCLUSIONS AND DISCUSSION

As available literature indicates, developing economies struggle in the ICT field mainly with the following problems:

- struggle with lack of ICT experience,
- inadequate ICT infrastructure and maturity and
- lack of long term strategic thinking

In our article, we present a transition in solving these problems between 2006, 2010 and 2015 in the Czech Republic. In the survey, we focused the positions of ICT managers in the Czech Republic and in this article, we present the conclusions for the position of the organization's Chief Information Officer – CIO. For this role, we study both the requirements from the aspect of **experience in the ICT field** and from the aspect of **strategic orientation of this group of corporate ICT managers**.

“Lack of ICT experience” as it was identified in the papers, e.g. ([Al-Jabri and Fraihat, 2005](#); [Varga et al., 2004](#)) is not so much of a problem in the Czech conditions ([Doucek et al., 2014](#)). This trend can be documented by reduction in the requirements of ICT knowledge and skills over the surveyed period for CIOs basically for all ICT knowledge domains. It is interesting that the practice does not also require in-depth skills in the domain MS01 – Process modeling. These skills are, in the opinion of the authors, essential for obtaining competitive edge using ICT in the company and for its preservation. The domain MS 01 “Process modeling” means solving concrete business situations using ICT – i.e. the level of operating ICT management in the company. We did not identify the size of the company or economic sector in our survey for this fact. This implies that the level of knowledge and skills of CIOs in ICT domains is sufficient for the current Czech practice.

Slightly different situation was identified for the area “lack of long term strategic thinking”. Here, thanks to our survey, we came to conclusions for the domains MS09 – MS 12 and to interesting conclusions for the domain MS 16 – Knowledge in business sectors.

In view of the facts identified in our survey, we must state that in the opinion of the representatives of companies participating in the survey, the problem of insufficient practical knowledge and skills of CIOs for the conditions in the Czech Republic is sufficiently solved.

The problem of lack or low level of long term strategic thinking of CIOs is in the current Czech conditions solved primarily as follows. The activities of CIOs that are closer to “non-ICT” areas are solved by delegation of competencies in these fields to other specialized departments of companies, such as accounting, planning department, financial department, etc., or to the lower level of ICT management – for instance, leadership is delegated to project managers. Another unpleasant fact is that certain key competencies of CIOs are delegated to other departments in the companies. Frequently delegated competencies include design of organizational structures. Delegated competencies and skills are then not demanded from CIOs.

Knowledge and skills for the domain MS16 – Knowledge in business sectors are the biggest identified problem on the CIO market in Czech conditions. The importance of these knowledge is increasing in time as we see in Chapter 3. Unlike the previous problem of “expertise in strategic ICT concept”, it cannot be solved by transfer to other positions in the company or to other roles. Therefore, the demands on the knowledge increased in the surveyed period particularly in the core business of the company. This involves fundamental knowledge allowing CIOs to connect the achieving of the organization's strategic objectives set with the deployment of information technologies. If this group of problems can be solved, the efficiency and purposefulness of ICT deployment in organizations will be increased and thus overall productivity and competitiveness of the Czech economy will grow. The highest importance of this domain was identified in the third round of research. Similar results were identified for the domain MS15 – Law.

A big opportunity and challenge for CIOs is to acquire knowledge and skill in the organization's core business. Here we identified the most pressing shortcomings on the current Czech market, where on the one hand, as our survey confirmed, the requirements of this type of skills by the business grow, but universities are slow in offering corresponding majors in Czech conditions (Doucek, 2010). The majors involving computer science and technology mainly educate in the field of ICT skills and managerial majors train experts with “non-ICT” type skills. However, in order to satisfy the current needs of the Czech economy, CIOs with balanced knowledge of both levels with improved knowledge of the different economic sectors must be trained.

In general we can say that we did not identified essential changes in requirements on CIO's between years 2010 and 2015, as we identified between year 2006 and 2010. This can be explained by the fact that before year 2010 was large boom of ICT. The change of Enterprise Information systems was realized in the majority of large and medium corporations in the Czech Republic. The next period could be characterized as period of relative stagnation (impact of economics crisis has been appeared) and innovation process was competed for next ten years and requirements on CIOs knowledge and competences are relative stabilized. The only two exception are changes in Czech legal system and escalation of concurrence conflicts in decreasing local market. It implies increasing requirements on CIO's knowledge and skills in following domains: MS15 (Law) and MS16 (Knowledge in business sectors).

Acknowledgements

Paper was processed with contribution of GACR by handling tasks “P403-10-0303 Enterprise Architecture as a Principle of Management in Small and Medium Organizations“ and “P403/11/1899 Sustainability support of SME based on ICT innovation”.

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