Evolution of the ICT Field: New Requirements to Specialists

Vladimir Ryabov, PhD, Principal Lecturer, School of Business and Culture, Lapland UAS
Tuomo Lindholm, MBA, Senior Lecturer, School of Business and Culture, Lapland UAS

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With the rapid pace of technological development, the nature of professional work is also under transformation. It is changing the way specialists work and the requirements to their professional competences. The ICT field is at the vanguard of this change. In this article, we analyze evolution of the professional work with a focus on the ICT field. Today, ICT infrastructure, components, and tools are tightly integrated into the business logic and processes at the enterprise. This change is posing new requirements for professional knowledge and skills. We outline the most important trends in this area and suggest the important competencies for the profile of future ICT specialists.

Evolution of the professional service process

In the early days of professions, the professional service process was holistic and professionals were serving their clients throughout the different stages of the process. Professional service process is a sequence of different activities required to perform a professional task. With economic development of the society, the cost of professional involvement in the service process was rapidly growing. The reason for that, also according to Susskind and Susskind (2015), is institutionalization of professions, which means creation of clear boundaries and requirements for specialists who would like to belong to a specific profession. Institutionalization of professions includes special education and training, professional associations and guilds, certification, and many other requirements which allowed a specialist to practice, for example, medical or legal services. We have witnessed strong institutionalization of different professions during the past centuries. The cost of acquiring a

permission to act as a professional is nowadays very high, and this is reflected in the cost of the professional service.

Today, we are witnessing an emerging trend changing the professional landscape. The professional service process is often divided into separate stages, some of which do not require high qualification and can be implemented in a cheaper way. This is visible well in the medical field, where the actual doctor's involvement is limited only to the situations that inevitably require it. People, who have less professional qualification, implement other stages of the professional service process. This creates increasing labor opportunities for example, for paraprofessionals. Additionally, some parts of the service can be implemented by computer systems, such as automatic reservation systems, or even robots. This is decreasing employment opportunities within the profession for every human.

Such a division of labor is certainly increasing the economic efficiency of businesses. The management of the professional service process becomes more efficient as well as the use of highly qualified and paid labor. At the same time, this is also decreasing work opportunities for highly qualified and educated professionals in many fields with some exceptions. Instead, there is an increasing need for collaboration and shared use of data and information between the actors in a particular service process. Thus, the competitive environment within professions is changing.

Maintaining professional competence is challenging

The professional landscape is also changing due to the increasing amount of professional information released every year and the rapid technological development that makes prior education and qualifications obsolete very quickly. There is an increasing challenge to stay up-to-date and competent in many professions, especially where the role of technologies is significant.

A good example of such a turbulent professional field is Information and Communication Technologies (further in the text ICT). According to Bernstein (2016), knowledge and skills connected to product life-cycles may become obsolete in just a few years. New technologies appear on the market annually, and the requirements to the competence profile of ICT specialists are changing continuously. In overall, it becomes increasingly difficult for an average professional worker to stay up-to-date in own field, to read continuously published

professional literature and to follow the technological development trends. ICT professionals tend to specialize with a very narrow focus, specific software products or programming languages. This thought to allow them to keep their profile up-to-date and stay competitive in their field.

However, this is a dangerous tactics as technology development is changing the professional landscape rapidly. Even strong professional knowledge and skills become quickly irrelevant and obsolete. Recent examples are Symbian OS, Windows Mobile, and MeeGo, which became irrelevant in a period of just a few years. This threw many professionals to the unemployment market, professionals with highly developed skills in the obsolete technologies. This also means that specialists are narrowly focused and many cannot easily move from one specialization to another. This creates a lack of mobility from the professional competence point of view.

The most important trend within the ICT field is a continuously growing integration with business perspective. Technologies are no longer seen as mere tools, but rather as solutions to business problems and even enablers of specific businesses. Therefore, the selection and use of particular technologies or technological products should be based strongly on the analysis of the business context and specific business development needs. The lack of business understanding among ICT specialists is one of the important professional challenges. From a business point of view, there is also an increasing lack of specialists who are able to think strategically, broadly, with professional flexibility, desire to look at things from another point of view. There is also a challenge that business and ICT actors cannot communicate effectively with each other as they speak different professional languages. This undermines an enterprise's capability to develop its business.

To solve the general problem of narrowly focused specialists, some educational institutions attempt to established multidisciplinary study programs combining disciplines and students from different fields. However, because every field has an overwhelming amount of professional knowledge accumulated, multidisciplinary education cannot cover subjects from multiple fields satisfactorily in a fixed period of study time. The result is probably a specialist who is aware of basics in several areas and is not a highly qualified professional in anything. Such an approach assumes huge personal desire for continuous learning on the part of students, which should carry on also after university education is completed.

Evolution within the ICT field and consequences for the profession

Following the digitalization of businesses, there is an increasing number of companies whose main source of competitive advantage is the innovative and effective use of information systems. Today's ICT environments are larger and more complex than ever before. ICT professionals in these environments are becoming increasingly involved in the management, development and support of information systems tightly integrated with the business logic.

New technologies, such as Internet of Things and smart, connected products, penetrate business processes and create a demand for understanding how to utilize them effectively. As these emerging technologies and processes mature, their quality and level of automation increases. This enables codification and robotization of many processes, previously requiring human involvement. It is evident that the overall professional ICT landscape is evolving, and that the ferocity and pace of related changes are increasing.

The building blocks of information systems are becoming increasingly complex and the level of their interconnectedness is growing. For example, the latest version of Microsoft Office product family integrates commonly used productivity software such as Word and Excel, with Windows 10 operating system and several cloud services including Dynamics 365, Yammer, and SharePoint. Integrations and interconnections enable new inter-firm and cross-functional processes and workflows that can increase the productivity and effectiveness of the professional service processes. The basis of this phenomenon is the development of continuous and collaborative use of business information and data, and it is also visible in the similar offerings from Google and Apple.

This evolution of the structure and use of information systems changes the knowledge and skill requirements for the optimal use of ICT in business. Today, the skills of optimizing and using separate information systems are not sufficient anymore. Instead, there is new demand for understanding how and why different information systems are utilized and interconnected. For example, today it is not enough to know how to use Excel. A specialist should be able to design and implement spreadsheet workflows that benefit the professional service process. The understanding of the purpose and business outcomes of information systems interconnections is one of the key elements of their successful optimization. This understanding cannot be established only based on technical knowledge and skills.

It is now common to utilize ICT to enable the employees of an enterprise to work with business information and data from various and mobile locations. When the employees respond to the demand to work at home or in transit, their use of different mobile ICT solutions such as laptops, tablets and phones increases. This, in turn, increases the number and the variety of devices used across the information systems of the enterprise. It is also becoming more common that the employees own some of the devices that they use at work. The increasing number, variety and different ownership of devices creates new knowledge requirements for the ICT specialists.

The rapid increase in the number and variety of devices has shifted the focus of ICT specialists from the hands-on or remote management of individual devices to the centralized management of device groups. ICT specialists plan how device configurations are changed, target the change to specific groups of users and/or devices and then, let information systems perform the implementation of the change. This method increases the impact of individual changes and thus, requires careful and systematic planning and a holistic view of the effects and outcomes of the change. Additionally, ICT specialists must be able to understand how centralized management systems work.

Unified endpoint management systems are one example of centralized management systems. These systems reduce the workload of ICT specialists by making it possible to perform remote management and support activities to groups of tens, hundreds and even thousands of end user devices at the same time. Moreover, they enable the automation of selected activities thus, relieving the ICT specialists completely from their previous tasks. Additionally, the systems are capable of continuous monitoring of the performance and the state of devices. This means that ICT specialists are now able to utilize this data to perform proactive and pre-emptive tasks. This described change does not only involve device management but similar systems are also available for managing for example, servers, software, documents, code, ICT assets and service requests.

The effective and systematic development of enterprise ICT environment and its use requires harmonization i.e., reduction of the variety in ICT resources, configurations and ICT enabled processes. ICT specialists should be able to analyze the ICT requirements to identify similarities and patterns, which are the basis of the harmonization process. It is essential that ICT specialists collaborate with business actors to identify and document their ICT requirements based on their business purpose, roles and activities. Moreover, ICT specialists

understand how to synthesize ICT requirements and other business information to group and combine requirements, users, devices, configurations and software effectively. These groups are the key elements of business reporting and ICT management activities.

New Requirements to ICT specialists

Based on the discussion above, the fundamental question is: What kind of ICT specialists are we going to have in the future and do they possess professional competencies that correspond to the changing requirements of enterprises? Today, many professionals face challenges to stay competent in their field and their educational background is getting outdated quickly. Additionally, there is a growing pressure to deal with new business requirements and processes. ICT specialists must understand business needs correctly and be able to propose an optimal ICT solution.

It is not enough anymore to focus on learning pure technology. ICT education with a very narrow specialization may not be a strategically wise choice. Instead, ICT specialist education should focus on business purposes of utilizing different ICT tools and technologies, which are instruments. ICT *per se* cannot guarantee a business success because its value materializes from its effective use and integration into the business model and the value chain. ICT must be adapted to the particular enterprise infrastructure, including processes, culture and organization.

The future ICT professionals must have holistic thinking abilities combining both business and ICT competences. The ratio between competences defines employment opportunities. In the future, ICT specialists with business competences may generally have more employment opportunities than those with technically focused competence profiles. The role of ICT education should change correspondingly. Finally, in addition to the subject specific competencies, education should prepare future specialists for life-long learning, which might turn out to be the ultimate competence at the end.

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