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# Factors influencing the need of companies for IT specialists[1]

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The lack of trained IT specialists has become a significant problem for companies. Our research focuses on identifying the factors influencing the need of Hungarian companies for IT specialists. We have chosen this target group from the totality of companies because we could not identify a detailed database of self-employed entrepreneurs. The task of IT specialists is to develop and operate information systems. Hence, we have studied the topic from this perspective. However, many studies have demonstrated that the applied information system is dependent on company size. Thus, the goal of our research is to show the effect of company size, the applied information system and its mode of use on the company's need for IT specialists. Hypotheses have been set up and tested through empirical research. Based on the statistical analysis of the data sample, it has been established that the company size influences the type of the applied information system, the manner of application and the demand for IT specialists. The results also indicate the effect of ERP system usage. The type of IT services that are rendered does not influence the need for IT specialists.

**Keywords:** demand for IT specialists, ERP, cloud service.

**JEL codes:** C12, J23, O15.

## Introduction

Information is one of the most important company resources. It is necessary for the creation and efficient operation of organisational processes and decision-making, maintaining relations with the business environment and influencing

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market participants. For our purposes, information is defined as the new knowledge resulting from the processing and interpretation of data, providing a way of reducing entropy (Nagyné–Gubán 2016).

The processing of the data is carried out by information systems developed and operated by IT specialists. Due to the changes in the market and the regulatory environment, the need for up-to-date information is continuously increasing, which enables fast and flexible adaptation. This need imposes the requirement to apply developed and efficient information systems, leading to an increased demand for IT specialists.

The current media, including traditional journals and the Internet, often report that the lack of IT specialists has risen to such a high level that it significantly threatens the functioning of the companies. The gravity of the situation is also reflected by the fact that the training of IT technicians and the teaching of IT subjects have become central issues. At the same time, it is also vitally important to get to know the needs of the businesses.

What kind of IT specialists and professional skills are needed? This is the main question of our present study, focused on interdependences between the information systems applied at the companies and their need for IT specialists. After reviewing the relevant scholarly literature, we will present our analysis based on empirical data collection, which included 98 companies who filled out our online questionnaire.

## Literature review and theoretical framework

### *Information system, IT system, information technology (IT), information science*

There are different interpretations in the literature regarding information systems, IT systems and information technology. These concepts are often used as synonyms. The IT system is the activity of collecting, managing, processing, storing and representing information using information technology (Badinszky 2011; Chikán 2008; Raffai 2003; Szepesné 2010). Regarding these theories, we find it problematic not only that they approach the concept of the information system from a single aspect, the technological side, but also that they use the concepts of data and information as synonyms. In a previous paper, based on the review of the relevant literature, we already demonstrated that these concepts were different (Nagyné–Gubán 2016).

According to a similar view (Budd 2011), information is the meaningful, interpreted and context-dependent data. Thus, we also believe that there is a difference between the definition of the information system and that of the IT system. On the one hand, *information system (IS)* refers to the organised ensemble of the transactions of the company, its environment and the interactions between them, the data describing them and the information activities and resources (hardware, software, manware/people and orgware/management processes). Similar definitions can be found in several studies (Bocij et al. 2003; Halassy 1996; Sziray–Gaul 2006; Kacsukné–Kiss 2007; Sasvári et al. 2014). On the other hand, the IT system is only a technical subsystem of the information system, encompassing the hardware and software components involved in data collection, storage and transfer.

There are also interpretations that use the concepts of information system architecture and technological architecture (Kadre 2011). The former refers to processes, data and staff, while the latter to hardware and software conditions. The concept of information technology (IT) appears to be synonymous with the IT system. National and international statistics, as well as some studies, also use the concept of information and communications technology (ICT) (Sasvári 2010; Badinszky 2011). Based on this interpretation, communication is a separate resource alongside software and hardware.

As for us, we share the opinion of the authors who consider communications technology to be part of information technology (Sziray–Gaul 2006; Bocij et al. 2003). The concepts of information science and information technology are often interpreted in the same way (Sziray–Gaul 2006; Hetyei 1999, 2001), i.e. as representing only the hardware and software resources of data and information processing. In other words, it is viewed as a technical aspect of the information system. The abbreviation 'IT' is also most often used in the sense of information science, e.g. in expressions such as 'IT applications' and 'IT management'. Thus, we will also use the concept of 'IT specialists', or 'IT professionals', according to this interpretation. Nevertheless, we consider the wider interpretation as appropriate, defining 'information science' as the science of producing, structuring and operating information systems (Szepesné 2010).

***Classification of IT applications according to functions***

The 'classification of information systems' is used in the literature to refer to the establishment of software categories. These are also called 'computer applications' (Cser–Németh 2007) or 'IT applications' (Benkőné Deák et al. 2008). Software groups are defined according to functions. Table 1 summarizes the categories defined by the authors.

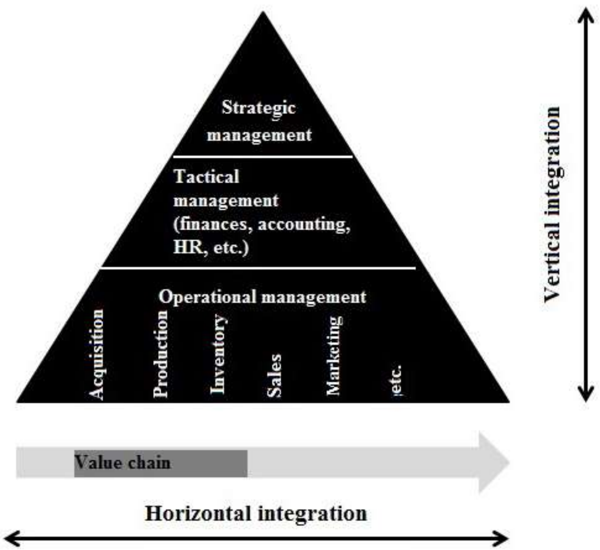
**Table 1. IT applications**

| Name – abbreviated designation |
|---|
| Transaction Processing System – TPS |
| Online Transaction Processing – OLTP |
| Office Automation Systems – OAS |
| Workflow System – WS |
| Data Warehouse – DW |
| Customer Relationship Management – CRM |
| Supply Chain Management – SCM |
| Supplier Relationship Management – SRM |
| Expert System – ES |
| Group Support Systems – GSS |
| Knowledge (Management) System – KWS (KMS) |
| Enterprise Performance Management – EPM |
| Production Planning and Scheduling – PPS |
| Material Requirements Planning – MRPI |
| Material Requirements Planning – MRPII |
| Geographic Information Systems – GIS |
| Computer Integrated Manufacturing – CIM<br>– Computer-Aided Design – CAD<br>– Computer-Aided Engineering – CAE<br>– Computer-Aided Production Planning – CAP<br>– Computer-Aided Manufacturing – CAM<br>– Computer-Aided Quality Assurance – CAQ |
| Management Information System – MIS, VIR |
| Executive Information System – EIS |
| (Group) Decision Support System – (G)DSS |
| Online Analytical Processing – OLAP |
| Business Intelligence – BI |
| Enterprise Resource Planning – ERP |
| Total Enterprise Integration – ERP II. |
| Integrated Enterprise Application – IEA |

*Source: Own compilation based on Koloszár (2013)*

In this paper, we will use the categories of IT applications from Table 1 to evaluate the information systems of the companies. However, we have filtered out the overlapping designations, and we have established function groups as well.

The emergence of integrated systems brought about a qualitative leap in the field of IT applications. ERP systems are known in the literature as integrated management systems (Giller 2014) or integrated company management information systems (Hetyei 1999). These are used for the uniform treatment of transactions, resource planning and the service of the corresponding executive levels. ERP systems characteristically treat all enterprise processes and functions uniformly, in a modular system and using a common database, while being customisable and configurable. Special processes and requirements are only possible through the further development of the software package. The integration emerging in ERP systems is illustrated in Figure 1.




*Source: Own compilation based on Nicolescu et al. (2007)*

**Figure 1: Integration through ERP systems**

However, both in practice and in some segments of the literature, software not covering the entire field of integration is also referred to as ERPs (Kadre 2011; Cser–Németh 2007). We have also dealt with the interpretation of integrated systems in our research.

Several authors confirmed the link between company size and the employed information system (Sasvári et al. 2014; Koloszár 2009). This finding was accepted in our research as well and, so, we considered the classification based on the number of employees as a variable in our analysis of the need for IT specialists.

***Opportunities for enterprises regarding the development of information systems***

During the development of information systems, companies have to decide how to provide the software necessary for data processing.

The potential sources of IT applications are the following (Komló 2013):

– Own development. The system is developed in-house by the company's own specialists, based on the specific requirements of the enterprise.

– Development by an IT company. In this solution, the framework system of the software developer company is remodelled according to the special needs of the enterprise.

– Ready-made software packages provided by IT companies, so-called 'canned' systems, i.e. systems developed for standard processes on the basis of model companies. Theoretically, these are customisable as well, but this need is limited in practice. Vice versa, the business processes are more often adapted to the software.

– Outsourcing, when an IT company offers hardware and/or software services for operating the information system of another enterprise. In the case of complete outsourcing, the recipient of the service only records the data. The service provider ensures the processing, the necessary hardware, software and manware resources, and provides outputs. On a lower level, the recipient leases the infrastructure, i.e. the IT resources (hardware, network and professionals) running its own application. There is also the option of only requiring the software from the service provider if the enterprise already has the necessary infrastructure.

IT services are available through 'cloud computing' via the Internet. There are three different levels (Repschläger–Zarnekow 2011):

1. Infrastructure – Infrastructure as a Service (IaaS). Providing hardware elements, e.g. virtual machines, storage space and network.
2. Development environment – Platform as a Service (PaaS). Providing hardware elements, e.g. database management systems and development software.
3. Providing data processing (application) software – Software as a Service (SaaS).

The higher (2nd and 3rd) levels also contain the service elements provided by the lower level.

The assessment of cloud services varies in the scholarly literature. Generally, the accepted view is that the investment demand for developing IT is lower, operating costs are reduced and the rendered services are scalable and customisable to the company (Szabó et al. 2013; Repschläger–Zarnekow 2011; Komló 2013). At the same time, safety and availability are only mentioned as an advantage by a few authors. Furthermore, there are some papers mentioning this as a safety risk, since company data are stored by the service provider (Komló 2013; Szabó et al. 2013). The dependence on the supplier, inadequate legislation and slow access may also mean disadvantages. However, the cloud service may also present great future potential for SMEs.

Due to the different assessments, we have also dealt in our research with the valuation of cloud computing and its use on the various levels by the companies.

### *IT job profiles according to the recommendation of the EU framework and to Hungarian entrepreneurial needs*

In 2012-2013, the European Commission developed a unified nomenclature, the European e-Competence Framework 3.0 (abbreviated as e-CF 3.0), for IT job profiles. This framework, accepted by 120 stakeholders, contained an ICT profile system encompassing 23 job descriptions, classified into six groups. The list was supplemented in 2018 and, now, there are 30 job profiles listed under seven categories (Breyer 2018).

However, domestic technical literature does not follow the standard categorisation according to ICT job profiles. Szabó (2013) also draws on a markedly narrower categorisation in his study surveying the needs of domestic enterprises for IT professionals: administrator; operator; developer; manager; engineer; consultant; expert, key user, specialist; analyst; system administrator; customer support, help desk, customer service; technician; tester; architect.

In our research, we have classified specialists into two main categories, i.e. system developers and system operators, subsequently establishing job description groups within these categories.

**Table 2. European ICT Profiles**

| Families | ICT Profiles |
|---|---|
| Process Improvement | Digital Transformation Leader |
| | Product Owner |
| | Scrum Master |
| | DevOps Expert |
| Business | Business Information Manager |
| | Chief Information Officer |
| | ICT Operations Manager |
| | Data Scientist |
| Technical | Quality Assurance Manager |
| | Cyber Security Manager |
| | Project Manager |
| | Service Manager |
| | Data Specialist |
| Design | Business Analyst |
| | Systems Analyst |
| | Enterprise Architect |
| | Systems Architect |
| | Solution Designer |
| Development | Developer |
| | Digital Media Specialist |
| | Test Specialist |
| Service & Operation | Data Administrator |
| | Systems Administrator |
| | Network Specialist |
| | Technical Specialist |
| | Service Support |
| Support | Account Manager |
| | Digital Educator |
| | Cyber Security Specialist |
| | Digital Consultant |

*Source: Own compilation based on Breyer (2018)*

***Research objective and research hypotheses***

The objective of our research is to present the factors influencing the need of companies for IT specialists. We studied this topic from the perspective of the information system. After the literature review, hypotheses were established according to Table 3.

**Table 3. Hypotheses**

| Hypothesis number | Content of the hypothesis |
|---|---|
| 1. | We assume that company size influences the usage of ERP systems. |
| 2. | We assume that ERP systems do not fully integrate horizontal and vertical functions and levels. |
| 3. | We assume that company size influences the usage of the IT application. |
| 4. | We assume that company size determines whether an IT specialist is needed. |
| 5. | We assume that the recourse to IT services influences the need for IT specialists. |
| 6. | We assume that the spread of cloud-based technologies is slowed down by the incomplete knowledge of the companies regarding this IT service. |

*Source: Own compilation*

In order to verify these hypotheses, we collected data regarding Hungarian partnerships and then evaluated the results based on quantitative analysis. Through quantitative analysis, we ascertain causal relationships based on measurable data, subsequently generalising them to the basic population (Sajtos–Mitev 2007).

## Methodology

### *Data collection*

Our empirical research, conducted between 1 September 2017 and 28 February 2018, was directed at the evaluation of Hungarian companies. We chose that target group from the totality of companies because we could not identify a detailed database of self-employed entrepreneurs. The sampling was based on the EMIS (Emerging Markets Information Service) database, containing the data of 63 433 partnerships.

According to the data of the Hungarian Central Statistical Office (Központi Statisztikai Hivatal, abbreviated as KSH), by 31 December 2016, there were 540 585 partnerships in Hungary, with 516 743 of them functioning as of 1 January 2017 on a nationwide level. The EMIS database contains the data of 55 644 functional partnerships.

In order to draw reliable conclusions, sample selection must be random. Thus, each element has the same chance of being selected (Babbie 2013). In quantitative data collection, a large sample and random sampling are necessary for statistical analyses and generalizability (Horváth–Mitev 2015).

Due to the large-scale sampling, a questionnaire survey was used for data collection. In order to accelerate our sampling, we used an online self-administered questionnaire, designed as a Google Form. One of the great advantages of this solution is that the series of questions may be directed according to the provided responses, thus making the self-administration of the questionnaire more efficient. However, the disadvantage lies in the very low response rate, which can be increased through repeated requests. Additionally, the wrong interpretation of the questionnaire by the respondents may result in inaccurate, incomplete or uninterpretable responses. Hence, the key element of questionnaire-based data collection consists in constructing the questionnaire itself, as, after completion of the survey, there is no possibility to correct the mistakes of the questionnaire or to make up for missed questions (Kovács 2013). This is why it is important for questionnaire construction to be preceded by literature review, as presented in the previous chapter.

Mistakes are possible even under the conditions of the most careful questionnaire construction. There can be ambiguous questions and inadequate transitions between the questions. In order to eliminate these lapses, a trial survey should be conducted (Babbie 2013). Hence, before starting our online data collection, we conducted trial surveys with familiar businesses and specialists. On the basis of their feedback, mistakes were corrected in newer versions of the questionnaire in order to eliminate interpretive and structural problems. After getting the final version, we had to select the companies to be included in the sample. The size of the sample necessary for providing reliable justification of research hypotheses is dependent on the methods used to verify the hypotheses and the different assumptions about the multitude (e.g. the normal distribution of the multitude).

Our goal was to reach 100 completed questionnaires. As the questionnaires were to be sent out online, we expected a 10% response rate. Hence, we had to select a sample of 1000 elements to achieve our objective of 100 completed survey questionnaires. We tried to reach representativeness in our sample selection. According to Babbie (2013), a sample is representative of the population if its aggregated characteristics approximate the same aggregated characteristics of the population. In our research, we studied the effects of company size as a variable from multiple perspectives. Therefore, in our selection of sample items, for the sake of representativity, we considered it appropriate to distribute company groups according to employee number.

The classification of micro-, small and medium-sized enterprises (henceforth: SMEs) according to the number of employees and annual turnover is defined in the Hungarian Act XXXIV of 2004. According to this interpretation:

– A micro-company is defined as an enterprise in which the total number of employees is less than 10, and the annual net turnover or balance sheet total does not exceed the equivalent of EUR 2 million.

– A small company is defined as an enterprise in which the total number of employees is between 10 and 49, and the annual net turnover or balance sheet total is at least the equivalent of EUR 2 million, but it does not exceed the equivalent of EUR 10 million.

– A medium company is defined as an enterprise in which the total number of employees is between 50 and 249, and the annual net turnover or balance sheet total is at least the equivalent of EUR 10 million, but it does not exceed the equivalent of EUR 50 million.

We used the KSH database for the representative selection of our sample. Data collection began in 2017. Thus, our research was based on the distribution available at the end of 2016. The KSH database further divides SMEs into groups of companies with 10-19 and 20-49 employees. We pooled the two groups according to Act XXXIV of 2004.

Since the characteristics of the companies may differ according to their specific profiles, the sampling was carried out based on the distribution of the included partnerships according to counties and regions. The KSH database does not have a breakdown by territory and staff count separately for partnership companies, as its data refer collectively to all companies. Therefore, in our sampling, we weighted the territorial (counties and regions) data on partnerships available on 31 December 2016, with their distribution according to size.

The EMIS database provided the opportunity to filter functional partnerships according to the number of workers and county. The elements of the sample for data collection were chosen from these subpopulations on the basis of random numbers generated with an Excel formula. The questionnaires were sent out via e-mails containing the link and requesting individual completion from the companies.

Due to the shortcomings of the form-generating software, we could not determine unique identifiers for the online forms. This may create a problem, since it prevents us from automatically identifying repeated completions of our form. This difficulty can be overcome if the respondent self-identifies using the company data. On the other hand, however, this can lead to a decrease in the response rate. Hence, we handled the issue through the phased sending of the questionnaire. One hundred invitation e-mails were sent biweekly. The low response rate – around 7% in our first round – made it possible to check the questionnaire replies received from the companies and to introduce the data into the SPSS software. Experience has shown that replies usually arrive in about 1 to 5 days after the sending out of the invitation e-mail. The two-week interval thus allowed for resending the questionnaire in order to increase the response rate.

Resending could be filtered simply through colour-coding. In our chosen sample, we highlighted the companies which had already received the invitation twice with green and those which had received it only once were yellow-coded, while those to be invited to participate were marked with red. In approximately six months, we were able to introduce data from 98 completed questionnaires into the SPSS software. Data analysis could thus begin.

***Methods of data analysis***

The collected data were analysed with the SPSS software. According to Fliszár–Bollók (2014), a frequent issue with this method is the low, nominal or ordinal scale measurement level of the variables. Often, there are no variables available that are measured on the ratio or interval scale. Thus, parametric tests cannot be applied to the analysis. In our view, measurement levels are not determined by the data collection method, but by the research objective. In our study area, we applied ordinal scale variables. Hence, we had the possibility to principally apply non-parametric statistical methods from the catalogue of statistical analyses. Additionally, we also used binary-coded (0,1) dummy variables that can be interpreted as dichotomous variables (Hastie et al. 2009).

The literature contains opposite interpretations of the scale classification of dichotomous variables. Although dichotomous variables are nominal variables, there are some authors who argue that they can also be regarded as orderly, ordinary variables whose frequency is that of a non-normal distribution. In fact, they believe that, for certain purposes, dichotomous variables can also be treated as if they were of scale value (Morgan et al. 2013). This interpretation can be found in several authors who treat dichotomous variables as simultaneously nominal, ordinal and interval-ratio variables. In our view, dummy variables are nominal variables.

We used cross tabulation analysis for examining the validity of our hypotheses, showing the interrelation and associative relationship between ordinal and nominal variables. The minimum requirement in SPSS for the cross tabulation prepared on the basis of the two criteria is that the number of cells in which the expected frequency is lower than 5 cannot exceed 20%. Our investigations have met this condition, so the tests performed are interpretable. The SPSS software allows for calculating several indicators to analyse the relationship between the variables. Pearson's chi-square statistics show whether there is a significant association between the variables (Fliszár–Bollók 2014). According to the null hypothesis ($H_0$), the variables are independent: there is no associative relationship between them. If the level of significance does not exceed 5%, i.e. the Asymptotic Significance value (AS) <= 0.05, then the null hypothesis must be rejected, as there is a significant relationship between the variables. The strength of the association is measured by the Cramér's V coefficient (on a scale of 0 to 1). The closer the indicator value is to 1, the closer the relationship between the variables. The lambda index measures the extent to which the independent variable is capable of predicting the dependent variable, expressed as a percentage (Sajtos–Mitev 2007). The adjusted residual (AR) value that is calculated in the cross tabulation analysis also shows the attraction and the repulsion between variables. If the AR is greater than or equal to 2, the variables attract each other. If it is less than minus 2, there is repulsion between them.

Our research form included questions for which the companies could rate how much they agreed with the statement on a Likert scale of 1 (complete disagreement) to 5 (complete agreement). The higher score means a more favourable and positive attitude. Hence, negative statements have to be re-coded in order to attain a consistent interpretation. The construction of the Likert scale is dependent on the condition that it has to consist of several related items for the same objective or topic (Carifio–Perla 2007). Thus, we formulated eight interrelated assertions regarding a topic, i.e. the cloud services, to be evaluated by the respondents.

Non-parametric tests are used for the statistical analysis of the Likert scale as an ordinal scale. Kendall's tau-b rank correlation coefficient can be used for the analysis of the connections between data on the rank scale (Csíkos 1999). This indicator provides the means for analysing the attitude of the companies included in our sample toward the statements. Instead of Likert values, we used rank numbers for calculating the statistical values. Kendall's index of rank concordance is used for comparing the concordances of several rankings.

According to some views, the Likert scale may also be interpreted as the highest level of measurement if, instead of scale values, averages are applied to the analysis. In the interpretation of Morgan et al. (2013), the frequency of the Likert scale is that of an approximately normal distribution, so it shall be considered a metric scale. This enables us to conduct an analysis of variance (ANOVA) in order to establish whether there is a difference between the averages of two or more groups. Thus, we analyse the effect of one or more independent variables on one or more dependent variables. The condition is that independent variables should be nominal and categorised variables and that dependent variables should be metric (Sajtos–Mitev 2007).

## Data processing and results

### *Sample selection*

We received 98 completed questionnaires. As a first step in their processing, we identified the errors and inaccuracies in the responses by analysing the relations between the questions. The objective of representative sampling was not achieved, as the distribution of the companies which filled out the questionnaire survey differed from the distribution of the population, as shown in Table 4.

**Table 4. The number and distribution of registered partnership companies according to staff number categories in the Hungarian population (KSH) and in the sample**

| Staff number categories (persons) | In the population on 31 December 2016 | | In the sample |
|---|---|---|---|
| | Number of employees (persons) | Distribution (%) | Distribution (%) |
| 0–9 | 505 679 | 93.5 | 40.8 |
| 10–19 | 18 943 | 3.5 | |
| 20–49 | 10 141 | 1.9 | |
| ***10–49*** | ***29 084*** | ***5.4*** | ***18.4*** |
| 50–249 | 4 899 | 0.9 | 18.4 |
| 250 and above | 923 | 0.2 | 22.4 |
| **Total** | **540 585** | **100.0** | **100.0** |

*Source: Own compilation*

The analysis of the territorial and company profile-based distribution of completed questionnaires reveals that the majority of respondents were from the Western Transdanubia (Nyugat-Dunántúl) region of Hungary (55%) and from Budapest (29%), representing all sectors of the national economy.

Although the representativeness requirement was not met, statistical analyses and conclusions are possible on the basis of sample size and element selection. The sample used to verify our hypotheses, consisting of 98 elements, counts as large.

***Results***

*Hypothesis 1 assumes that company size influences the usage of ERP systems*. We used a cross tabulation analysis to examine this relationship. The null hypothesis ($H_0$) states that there is no link between the two variables. Pearson's chi-square statistics show that the null hypothesis has to be rejected, as the calculated significance value = 0.00. Hence, it does not reach a significance level of 0.05, which is to say that there is a significant connection between company size and ERP usage. Cramér's V Index reflects an associative link of moderate strength between company size and ERP usage (0.574). Thus, our hypothesis is accepted.

Based on the measure of association lambda, if the company size is known, in 48.9% of the cases it can be predicted whether it uses an ERP system.

Micro-enterprises characteristically do not use ERP – the variables specifically attract each other, as indicated by the adjusted residual = 4.4. If the value is above 2, then there is attraction, and if it is below -2, there is repulsion between the variables. It can be established that medium-sized and large enterprises characteristically use ERP systems (Table 5). On the basis of our sample, there is no significant attraction or repulsion between the two variables for small enterprises.

These findings may seem obvious, since it is generally accepted that the smallest companies, i.e. micro-enterprises, do not even use business software. The usage of integrated systems is thus even rarer. However, a somewhat deeper analysis may provide us with a more interesting result. According to the responses to our questionnaire (40 companies), 30% of micro-enterprises (40 companies) are actually also using an ERP system. The micro-enterprises which do not use integrated corporate governance systems (Enterprise Resource Planning, ERP) have mentioned their small company size as a reason for that. Nevertheless, these companies are also using (or planning to introduce) business software (about

**Table 5. Company size according to staff number * ERP presence cross tabulation**

| Company size according to staff number | ERP presence | | |
|---|---|---|---|
| | No | Yes | Total |
| Micro-enterprise item number | 29 | 11 | 40 |
| ERP frequency % | 64.4% | 20.8% | 40.8% |
| Adjusted residual | 4.4 | -4.4 | |
| Small enterprise item number | 11 | 7 | 18 |
| ERP frequency % | 24.4% | 13.2% | 18.4% |
| Adjusted residual | 1.4 | -1.4 | |
| Medium enterprise item number | 4 | 14 | 18 |
| ERP frequency % | 8.9% | 26.4% | 18.4% |
| Adjusted residual | -2.2 | 2.2 | |
| Large enterprise item number | 1 | 21 | 22 |
| ERP frequency % | 2.2% | 39.6% | 22.4% |
| Adjusted residual | -4.4 | 4.4 | |
| Total | 45 | 53 | 98 |
| ERP total % | 100.0% | 100.0% | 100.0% |

*Source: Own research*

90%) and office software packages (about 60%), as well as, to a smaller extent (about 30%), SCM and CRM systems, internal networks and database management software. At this level, the least used software are virtual assistant and expert systems. One can note a marked improvement when comparing these results with Sasvári (2013). At the time of that previous study, the usage of ERP systems was not at all characteristic of micro-enterprises. Furthermore, the usage rate was much lower for business (34%) and office (40%) software packages.

*Hypothesis 2 assumes that ERP systems do not fully integrate horizontal and vertical functions and levels.* 70.6% of the 51 companies using integrated corporate governance systems also use other software, alongside the ERP system.

Thus, our hypothesis is accepted. Specialised software is used in the area of payroll and human resource management. Additionally, one can also find individual systems supporting the demand-planning, production and service activities of the companies. Since ERP systems are based on the enterprise-specific model, they cover the general functions. However, every enterprise has activities and data that are specific to it. On the basis of our sample, we have come to the conclusion that companies overwhelmingly request IT companies to build their needs into the ERP systems. Nevertheless, they may also choose to ask their own IT technicians to build specialised programmes to be used alongside the integrated system. This alternative was found in 25% of the companies.

*Hypothesis 3 assumes that company size influences the usage of the IT application.* The null hypothesis ($H_0$) states that there is no link between the two variables. We calculated chi-square statistics in our cross-tabulation analysis. The calculated significance value was 0.041, which is lower than the established 0.05 level. Thus, we must reject the null hypothesis, i.e. there is a significant relationship between company size and the usage of IT applications.

Based on the analysis which looks at the strength of the relationship between the two variables, it can be stated that there is a weak to medium association, as shown by the Cramér's V value (0.263). Thus, our hypothesis is accepted.

The analysis of cross tabulation frequencies (Table 6) reveals that the implementation of 'canned' systems and self-developed software is rather characteristic of micro-enterprises, and the integration of specific company needs into the framework systems is becoming increasingly important with the growth in company size. In the case of micro-enterprises, software development by IT companies incorporating the client company's needs is completely uncharacteristic. That is to say, the variables specifically repel each other, as shown by the value of the adjusted residual = -2.2. This development mode is specifically a characteristic of large enterprises, i.e. the variables specifically attract each other. We have come to this conclusion based on the adjusted residual value = 2.5. On the basis of our sample, there is no significant attraction or repulsion in the case of small and medium enterprises.

*Hypothesis 4 assumes that company size determines whether an IT specialist is needed.* In order to explore the relationship, a cross tabulation analysis can be used here as well. The null hypothesis ($H_0$) states that there is no link between the two variables. According to Pearson's chi-square statistics, the null hypothesis must be rejected, because the calculated significance value of 0.00 is lower than the acceptable level of 0.05. Hence, there is a significant relationship between company size and the need for IT specialists. Thus, our hypothesis is accepted.

According to the adjusted residual value (-4.6) calculated in the cross tabulation frequency analysis, the need for IT specialists and the micro-entrepreneurial size specifically repel each other, while there is explicit attraction for the large company size, where the adjusted residual value is 5.0. On the basis of our sample, there is no significant attraction or repulsion in the case of small and medium enterprises.

**Table 6. Company size according to staff number * IT system development cross tabulation**

| Company size according to staff number | IT system development | | | |
|---|---|---|---|---|
| | Own (in-house) development | Development by an IT company incorporating the client company's needs | Implementing 'canned' software of the IT company | Total |
| Micro-enterprise item number | 11 | 10 | 16 | 37 |
| % Size based on staff number | 29.8% | 27.0% | 43.2% | 100.0% |
| Adjusted residual | 0.6 | -2.2 | 1.8 | |
| Small enterprise item number | 8 | 6 | 4 | 18 |
| % Size based on staff number | 44.4% | 33.3% | 22.3% | 100.0% |
| Adjusted residual | 1.9 | 0.7 | 1.0 | |
| Medium enterprise item number | 2 | 9 | 7 | 18 |
| % Size based on staff number | 11.1% | 50.0% | 38.9% | 100.0% |
| Adjusted residual | -1.6 | 0.9 | 0.6 | |
| Large enterprise item number | 4 | 14 | 4 | 22 |
| % Size based on staff number | 18.2% | 63.6% | 18.2% | 100.0% |
| Adjusted residual | -1.0 | 2.5 | -1.6 | |
| Total | 25 | 39 | 31 | 95 |
| Total % Size based on staff number | 26.3% | 41.1% | 32.6% | 100.0% |

*Source: Own research*

However, if we want to answer the question whether company size determines the needed expert groups – system developers or operators, or even both –, it can be established that the significance value of Pearson's chi-square statistics, as calculated via cross tabulation analysis, is 0.465, which exceeds the allowed 0.05 level. The null hypothesis, i.e. the independence of the variables must therefore be accepted. *We may thus conclude that a micro-enterprise can have the same need for IT developers and operators as a large enterprise.*

As part of our research, we also sought to answer the question regarding the possible relationship between the usage of an ERP system and the need for an IT specialist. It may be stated as self-evident that the more complex the IT system applied at the company, the greater the need for IT specialists. The associative relationship of medium strength between the usage of ERP systems and the need for IT technicians can also be demonstrated through cross tabulation analysis. Furthermore, Cochran-Mantel-Haenszel statistics may also be applied to examine the relationship between two dichotomous variables (Fliszár–Bollók 2014). The index reflects a significant relationship. Our calculated significance value is 0.00, which is lower than the allowed 0.05 level. Thus, the null hypothesis must be rejected.

However, companies may satisfy their need for IT specialists not only through staff recruitment but also by using the services offered by IT companies. The emergence of cloud services allows for bridging inequalities as well. In the next part, our investigation will extend to the way in which the IT services used influence the need for IT technicians.

First, it is worth considering whether company size influences the form of the acquired services.

The cross tabulation analysis reveals that it is not significantly dependent on company size whether the companies make use of IT or cloud services, and if so, of what type. The significance value of Pearson's chi-square is 0.085 for the relationship between company size and the IT services used, which exceeds the 0.05 level. Hence, we have to accept the null hypothesis, the independence of the variables.

On the basis of the breakdown according to the cross tabulation analysis, it can be established that it is not characteristic of large enterprises to only employ the services of IT specialists. We have come to this conclusion on account of the adjusted residual value (-3.2).

The examination of the relationship between company size and cloud services shows no significant link. The significance value of Pearson's chi-square is 0.960, which exceeds the 0.05 level. Hence, we have to accept the null hypothesis, the independence of the variables. That is to say, micro-enterprises may use cloud services of any type just as well as large enterprises do. The cross tabulation analysis does not show any significant attraction or repulsion.

It should also be analysed how the type of the IT or cloud service affects the need for specialists. More specifically, it is to be examined whether there is any need for IT specialists as an employed service, and if yes, of what type. It can be assumed that, if the enterprise outsources IT activities to external service providers, then there will be no need for an IT professional.

*Hypothesis 5 assumes that the recourse to IT services influences the need for IT specialists*. The cross tabulation analysis of the sample reveals no significant relationship between the employed IT service and the need for an IT professional.

The significance value of Pearson's chi-square is 0.292, which exceeds the 0.05 level. Hence, we have to accept the null hypothesis, the independence of the variables. The null hypothesis, i.e. the independence of the variables, has to be accepted also for the type of the IT service used by the company and the need for system developer and operator expert groups. The significance value of Pearson's chi-square is 0.130, which exceeds the 0.05 level. Our assumption that there is no need for IT experts if IT activities are outsourced has proven to be false.

If we examine the frequency values for the types of IT services used by the company, then it can be established, based on the sample, that the exclusive need for the operator is more typical of the enterprises that only use the services of an IT specialist. This conclusion is supported by the adjusted residual (2), while in the case of the employment of both developers and operators there is actual repulsion, as the value of the adjusted residual is -2.3.

The cross tabulation analysis shows similar results if the company employs a cloud service. There is no significant relation between the use of the cloud service and the type of the IT service used by the company or the need for an IT expert.

However, if we turn to examine the relationship between the type of the cloud service and the required group of IT experts, then we will get different results.

Based on our sample, it can be stated that there is a close associative link between the type of the cloud service and the required group of IT specialists. This conclusion can be established on the basis of the Pearson index and Cramér's V value of 0.609. The significance level of the Pearson index is 0.009, which is lower than the allowed value of 0.05. Hence, we reject the null hypothesis and determine there is a significant relationship between the two variables. The analysis of distributions on the cross-table reveals that the companies who "lease" all their IT services from the cloud typically only require a system operator. The attraction between the two variables is shown by the adjusted residual value of 3.7. It is definitely not typical for this group to require IT developers and operators. The repulsion between the two variables is shown by the indicator (-3.3).

Therefore, the analysis of the need for IT professionals has led to different conclusions for enterprises resorting to the services of IT companies and for those using the cloud (via the Internet). So, the question arises as to whether the enterprises possess adequate knowledge about cloud services.

*Hypothesis 6 assumes that the spread of cloud-based technologies is slowed down by the incomplete knowledge of the companies regarding this IT service.*

This question is significant also because a German research confirmed that the lesser the knowledge, the greater the fear regarding the issues of IT safety and data loss (Repschläger–Zarnekow 2011).

In order to confirm our hypothesis, we determined opinions that might provide reasons for the refusal of the cloud service. The respondents to our questionnaire had to rate on a five-graded Likert scale, ranging from complete disagreement to complete agreement, how much they agreed or disagreed with the statements. Due to the negative statements, the recoding of the ratings was required for the sake of a uniform interpretation. Thus, the highest score was assigned to complete disagreement and the lowest to complete agreement as the expression of a negative attitude. We calculated ranking values from the ratings using weighted averages.

Kendall's concordance coefficient is used for comparing the concordance of several rankings. First, we conducted an overall examination of the respondent companies (80). The results are presented in Table 7.

**Table 7. Ranking of enterprises according to their attitudes towards cloud services**

| Statements | Ranking values |
|---|---|
| Access to the cloud service is slow. | 5.50 |
| I do not trust this type of service. | 5.28 |
| It is too difficult to transpose my own applications. | 4.76 |
| There is a risk of data loss and unauthorised access. | 4.54 |
| Data safety will not be any greater and related costs will not be reduced. | 4.31 |
| No major IT investment is needed. | 4.09 |
| Operational costs do not decrease with the outsourcing of IT services. | 3.86 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 3.67 |

*Source: Own research*

The high values of the ranking show that the companies do not agree at all with the negative statements. That is to say, the high values of the ranking reveal that the companies completely disagree with the negative statements, or to put it differently, the attitude towards cloud services is positive. The statements that received the lowest scores were: "operational costs do not decrease" and "there may be interruptions in the access to the service". The low significance value

(0.00) does not exceed the level of 0.05. The concordance of the ranking is thus significant and not the product of chance. However, Kendall's W value (0.089) shows a very low level of agreement, i.e. the rank scales of the respondents are not concordant.

In order to achieve more accurate results, the comparison of the rankings according to company size should be examined in groupings based on the cloud service recipients and not on the users. Although the number of elements belonging to each group thus decreases, the number of elements required for robust tests (minimum 5) is secured for each group.

The analysis was first applied to the group of cloud users (39), with results shown in Tables 8 to 11.

**Table 8: Ranking of micro-enterprises using cloud services**

| Statements | Ranking values |
|---|---:|
| I do not trust this type of service. | 5.94 |
| It is too difficult to transpose my own applications. | 5.09 |
| Access to the cloud service is slow. | 4.88 |
| There is a risk of data loss and unauthorised access. | 4.68 |
| Data safety will not be any greater and related costs will not be reduced. | 4.62 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 4.00 |
| Operational costs do not decrease with the outsourcing of IT services. | 3.44 |
| No major IT investment is needed. | 3.35 |

*Source: Own research*

**Table 9: Ranking of small enterprises using cloud services**

| Statements | Ranking values |
|---|---:|
| I do not trust this type of service. | 5.33 |
| Data safety will not be any greater and related costs will not be reduced. | 5.33 |
| Access to the cloud service is slow. | 5.25 |
| It is too difficult to transpose my own applications. | 4.83 |
| There is a risk of for data loss and unauthorised access. | 4.33 |
| Operational costs do not decrease with the outsourcing of IT services. | 3.75 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 3.67 |
| No major IT investment is needed. | 3.50 |

*Source: Own research*

**Table 10: Ranking of medium enterprises using cloud services**

| Statements | Ranking values |
|---|---|
| There is a risk of data loss and unauthorised access. | 6.29 |
| I do not trust this type of service. | 6.21 |
| Access to the cloud service is slow. | 5.50 |
| It is too difficult to transpose my own applications. | 4.00 |
| No major IT investment is needed. | 3.79 |
| Data safety will not be any greater and related costs will not be reduced. | 3.71 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 3.43 |
| Operational costs do not decrease with the outsourcing of IT services. | 3.07 |

*Source: Own research*

**Table 11: Ranking of large enterprises using cloud services**

| Statements | Ranking values |
|---|---|
| Access to the cloud service is slow. | 6.44 |
| I do not trust this type of service. | 5.67 |
| There is for a risk of data loss and unauthorised access. | 5.06 |
| No major IT investment is needed. | 4.78 |
| It is too difficult to transpose my own applications. | 4.00 |
| Data safety will not be any greater and related costs will not be reduced. | 3.94 |
| Operational costs do not decrease with the outsourcing of IT services. | 3.06 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 3.06 |

*Source: Own research*

The tables reveal that the ranking values are high among the users of cloud services also in the grouping according to company size. That is to say, the attitude towards the cloud service is positive, and the respondents do not agree with the negative statements. However, in the case of small enterprises, the calculated significance value (0.595) exceeds the allowed 0.05. Therefore, it can be concluded that the concordance of the rankings is random.

For the other company sizes, the agreement is significant, as reflected by the lower than allowed calculated significance value. The concordance of the rankings is not a chance occurrence. Kendall's W value is low among the rankings of micro-enterprises (0.166) and shows a medium-low (0.365 and 0.291) coincidence measure between the rankings of medium and large enterprises.

However, all rankings reveal that the attitude is less positive for the statements “operational costs do not decrease” and “there may be interruptions in the access to the service”. So, the surveyed enterprises tend to agree more with these statements.

The picture becomes more divergent for the companies that do not use cloud services. In the case of the analysis according to company size, the calculated significance value exceeds the level of 0.05 for every group. So, there is no significant agreement, and the concordance of the rankings is only due to chance.

Hence, in the analysis of the enterprises not using cloud services (41), it is appropriate to consider all size groups together. It can be established that the concordance of the rankings is not due to chance, which is reflected by the significance value of 0.007. Nevertheless, the measure of agreement is quite weak, as Kendall’s W value is very low (0.067). The ranking reveals a positive attitude here as well (Table 12). The companies do not agree with the negative statements, as reflected by the high values. At the same time, the assessment of the cloud services is uncertain for the risk of “data loss and unauthorised access” and “interruptions in the access to the service”.

**Table 12. Ranking of enterprises not using cloud services**

| Statements | Ranking values |
|---|---|
| Access to the cloud service is slow. | 5.59 |
| It is too difficult to transpose my own applications. | 4.90 |
| I do not trust this type of service. | 4.76 |
| No major IT investment is needed. | 4.38 |
| Operational costs do not decrease with the outsourcing of IT services. | 4.35 |
| Data safety will not be any greater and related costs will not be reduced. | 4.21 |
| There is a risk of data loss and unauthorised access. | 4.11 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 371 |

*Source: Own research*

The rankings reveal that micro-enterprises and those that do not use the cloud service have lower scores. That is to say, they are more unsure in their assessment of the IT services of this type. This image is well reflected among those who do not use the service, for whom the issue of data loss and the safety of the IT system appear as problems. Thus, the results of the German research (Repschläger–Zarnekow 2011) have been confirmed in Hungary as well. The spread of cloud service usage is hindered by the lack of knowledge precisely among the companies with the greatest potential.

For the Kendall tests, the analysis of the Likert scale was carried out at the level of the ordinal scale, with the application of rankings. However, according to the bibliography presented in the previous chapter, it can also be interpreted as a metric scale if we were to calculate not rank numbers but averages based on the scale values. The analysis of the Kendall tests confirmed the divergences between the assessments of cloud service adopters and those who do not use them. These divergences may be demonstrated by variance analysis (ANOVA). According to the null hypothesis ($H_0$), the category averages match. In our case, this means that the evaluation of the statements concerning cloud services is not dependent on whether the service is adopted. We tested the null hypothesis with the test function F presented in Table 13.

**Table 13. Variance analysis of the ranking values of cloud services**

| Statements | F | Sig |
|---|---|---|
| Access to the cloud service is slow. | 5.628 | .020 |
| It is too difficult to transpose my own applications. | 5.571 | .021 |
| I do not trust this type of service. | 19.887 | .000 |
| No major IT investment is needed. | 1.408 | .239 |
| Operational costs do not decrease with the outsourcing of IT services. | .891 | .348 |
| Data safety will not be any greater and related costs will not be reduced. | 5.310 | .024 |
| There is a risk of data loss and unauthorised access. | 18.134 | .000 |
| There may be interruptions in the access to the service, e.g. due to Internet failures. | 8.590 | .004 |

*Source: Own research*

Table 13 shows that the significance values of the statements related to the F trial are lower than 0.05 – with the exception of two values –, hence, we reject the null hypothesis. This means that the adopters of cloud services evaluate the service differently from those who do not use it. However, the two groups agree in their evaluation of the effect on the operational costs of the service and on IT investment, since the significance level exceeds the value of 0.05 for these two statements.

**Conclusions**

The building of their IT system, the applied information technology and the way in which the IT professionals necessary for its operation and development are ensured are of essential importance to companies in order to operate and to fully exploit their potential. Some of our research issues have been partially touched on by other studies as well. Some authors have discussed the IT systems employed by the different companies and the factors influencing their development, while other have studied the need for IT experts. However, we conducted our research to answer the question on how these two areas were related.

We set up hypotheses, some of which were confirmed, whereas others were not (Table 14).

**Table 14. The results of hypothesis testing**

| Hypothesis number | Content of the hypothesis | Accepted/ Rejected |
|---|---|---|
| 1. | We assume that company size influences the usage of ERP systems. | Accepted |
| 2. | We assume that ERP systems do not fully integrate horizontal and vertical functions and levels. | Accepted |
| 3. | We assume that company size influences the usage of the IT application. | Accepted |
| 4. | We assume that company size determines whether an IT specialist is needed. | Accepted |
| 5. | We assume that the recourse to IT services influences the need for IT specialists. | Rejected |
| 6. | We assume that the spread of cloud-based technologies is slowed down by the incomplete knowledge of the companies regarding this IT service. | Accepted |

*Source: Own research*

Starting from our empirical survey, we first analysed the information system used by the companies. We established that its design was influenced by company size. Comparing our results with previous research studies, it can be concluded that our results were similar. However, it can be noted, as a positive trend, that the usage of IT applications, including ERP systems, is also increasing among micro-enterprises.

The results of our data collection were also used for the purposes of conceptual interpretation. We found that ERP systems neither cover all functions of the enterprises nor adequately service all the management levels. In other words, one cannot speak of complete horizontal and vertical integration. However, in our view, this does not cause a problem if the software covering the missing area is integrable, i.e. capable of communicating with the ERP system.

We also examined whether company size influenced the development of the IT application (application software) and our results confirm the relationship. As a trend, the usage of "canned software" and own developments are both decreasing. These design forms mostly appear among micro-enterprises.

However, the solutions that further develop the frameworks of IT companies, integrating the special needs of the company, are increasingly often found among micro-enterprises as well.

We have also concluded that, although company size influences whether an IT specialist is needed, it does not influence whether this need is for a developer or an operator. In other words, there may be a demand for both professional groups, both at smaller companies and larger corporations.

Based on our research concerning the relationship between IT services and the need for IT specialists, we have established that the employment of services does not influence whether IT specialists are needed. At the same time, on the basis of more detailed examinations, it can also be stated that, if a company seeks the services of an external IT professional, then its need is only for operators. However, if the usage of the IT service is cloud-based, then it does influence the type of the IT professional who is needed. If the company leases a complete cloud service, also procuring the application software of the operator from the cloud, then it typically only demands the service of IT operators.

Based on our research, the assessments of cloud services differ among companies. In general, the attitude of the companies is positive; they consider this type of service to be a good option. However, the companies lacking appropriate knowledge about this solution are uncertain. They are afraid of losing their data, unauthorised access and problems with IT systems. All this slows the spread of cloud services. Nevertheless, both those who use cloud services and those who do not use them agree that this service does neither put an end to IT investments nor significantly reduces costs.

Our research findings indicate that IT businesses are expected to offer companies such integrated systems that, besides boasting the conventional data content and functions, allow for meeting special requirements as well. A further perceivable trend is that, instead of selling products, rendering services, with cloud-based services among them, is gaining importance. Therefore, IT service providers are forced to implement the required technology to ensure that such services are available.

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