

# DEPLOYMENT OF CLOUD COMPUTING IN SMALL AND MEDIUM SIZED ENTERPRISES IN THE CZECH REPUBLIC

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## Introduction

Managers and owners of global and local companies are taking steps to ensure their positions in a changing competitive environment. These include efforts to estimate the future development and identifying significant trends. To watch and keep up with changes in Information Technology is particularly important because this industry can be considered as the most globally open and inter-connected with fast-moving trends.

Today the quality of life is determined by two basic dimensions, the objective dimension is closely connected with demographic and economic indicators, while the subjective dimension depends on the individual assessment of each person. Cloud computing is a cost-effective objective dimension, adaptable way to deliver business applications and services, to help to simplify the creation and management of hybrid cloud computing environments, to offer cloud-based services we can use as a basis for supporting our workload needs and to share risk by limiting capital investments and allowing pay-per-usage policies [53].

Over the past fifty years or so, the deployment of information systems and information and communication technologies (ICT) has become one of the key factors of competitiveness, growth and productivity of current advanced economies. This is mainly due to the fact that ICT create high added value as well as helping to increase the efficiency and effectiveness of development, production, distributional business activities in virtually all sectors of the economy [17].

Therefore, a correct estimation of the future development of ICT in the context of business processes may provide faster access to

information, new ways of communication and increase of employees' flexibility. There are a lot of predictions regarding the future development in the use of modern technology. Significant consultation and information-oriented companies such as Gartner, IDC (International Data Corporation), IEEE Computer Society, Accenture and others deal with these predictions. There are also many technologies to which they assign a great importance and potential for the future. The following list include those, which are common for most estimates of the above (and others) companies in the global and international level [1], [7], [10], [21], [54]:

- mobile technology,
- cloud services,
- shared data services,
- social networks,
- development of tools for processing large amounts of data,
- the connection between the Internet, cloud and mobile technologies.

Companies in the Czech Republic also tend to succeed in the competitive environment and seek to estimate the trends in information technologies for the following years. According to the company T-Systems Czech Republic [48], analytics of Businessworld.cz web [32], and based on the research in the Hradec Králové region [8], the key trends for the future of ICT in the Czech Republic include:

- dynamic network services and cloud,
- mobile technology and mobile commerce,
- virtualisation,
- IT security.

In the following text, the focus is on one of these trends – cloud computing. The aim of this paper is to analyse the possibilities and benefits of the use of cloud computing in Czech enterprises. The aim is also to compare the

extent of its deployment in the environment of the Czech Republic, the European Union and also on a global level. Finally, the paper will be supplemented with selected information from the questionnaire survey, which was carried out among 200 Czech enterprises across all sectors of the CZ-NACE. The enterprises were interviewed about their knowledge of the technology, the extent of its use, and the possible interest in using it in the future.

### 1. Definition of Cloud Computing and Its Use in the Present

The fundamentals of cloud computing were laid by a computer scientist John McCarthy. In the sixties, he stated that in the future the computer technology could be organised as a public service, on the same principle as the share of electricity. He described cloud computing as a technology which is used by thousands to tens of thousands of customers, who connect to it remotely via the network. The next step in the evolution of cloud computing can be described as the year 1999, when the company Salesforce.com used its website in order to make their applications available to users. This solution was gradually applied by more and more companies. However, the rate of adoption of such ways of providing applications was not too high. The company Amazon also dealt with Cloud computing. This company did not like that it uses only 10% of its computing capacity and the rest is used only for cases of binge use (peak times). This resulted in the first commercial service of cloud computing – Amazon Web Services (AWS) in 2006. A year later, Google and IBM joined in and many universities began to work on scientific and commercial programs based on cloud computing. Since 2009, cloud computing has been perceived as a key future technology. It has been included among the most important technologies by the HP and Microsoft companies [14]. Interest of companies in cloud computing grew rapidly and by the end of 2009 the cloud market reached almost 45.6 billion CZK [19].

Currently there are a number of different views that differ primarily in strictness and accuracy with which they define the boundaries of the concept of cloud computing. One of the first properly formulated definitions originated in the academic environment at Berkeley University in California. According to Armbrust [4] cloud

computing includes applications, which are in the form of services made available to users via a communication network and on the other hand it also includes all of the hardware and software tools that are used by data centres providing these services.

Forrester [20] Company extends the above definition by standardisation of IT means on the part of suppliers of services and self-service principles on the part of users. Cloud computing is essentially a set of standardised IT capabilities (services, software solutions or infrastructure) available through the internet on the basis of self-service principles and pay-per-use model. The standardisation particularly at hardware level is indicated by Marks and Lozano [37] as one of the prerequisites for the emergence of cloud computing.

The Gartner Agency suggests a somewhat more compact view of the addressed issue. The whole concept is based on the way of usage of information and communication technologies, where the scalable and elastic IT resources are delivered in the form of services to external users via the Internet technologies. Furthermore, it clearly defines the 5 main pillars of the whole concept [22]:

- *Principle of services* – the needs of consumers and providers are separated by a clearly defined interface that can be described as a service.
- *Scalability and elasticity* – a service performance can be progressively increased or decreased according to the actual needs of a consumer.
- *Sharing by multiple users* – IT resources are made available as a service that is shared by multiple consumers.
- *Measurement according to usage* – the use of the service is monitored on the basis of well-defined metrics, which in turn allows its pricing based on a variety of payment models.
- *The use of Internet technology* – the services are delivered to consumers via the Internet.

The above definitions usually consider cloud computing as a concept which already is established and successfully applied in practice. On the other hand, there has also been criticism of the concept. Larry Ellison, the CEO of Oracle Company, argued that the concept of cloud computing suits virtually any method of

delivering IT services. Also for example Stallman (the founder of the free software movement) stands for the opinion that the whole concept is much more like a fashion trend than the actual technological progress in Information Technologies. IDC Company [30] in 2011, when the growth of cloud computing market was obvious, was more restrained in its criticism. IDC has stated that cloud computing is still relatively new, emerging trend of the development of IT services. It is not possible and to a certain degree it is not appropriate to tie it by a definitional framework which is too strict.

In the context of cloud computing it is essential to specify the possible deployment models and distribution models.

## 1.1 Deployment Model of Cloud Computing

The deployment model means the way cloud computing services are provided to end users. Similarly to the definition and development of this concept, in this area there are also some disputes. A comprehensive view, with whom a number of authors identify [34], [41], [50], is offered and proposed by the following deployment models.

### *Public cloud*

The basic characteristic of the public model is to make cloud computing infrastructure available to the public or production companies. The service provider must be an external entity, as well as the data centres, from which the services are available [41]. In connection with this model the so-called virtual private cloud is also sometimes referred to. It is a solution that enables any organisation to create a set of separate IT resources in a public space. These resources are isolated from the group solely on the basis of the logical arrangement, not physically, so therefore virtual-private identification is used. However, the resources thus defined are accessible only to their landlord, who usually also has full control over them [31].

### *Private cloud*

According to Mell and Grance [41], every model that make services available only to a single entity, can be marked as a private cloud. The entire infrastructure can be managed by a third party or an organisation itself. Armbrust [4] on

the contrary, sees the essence of private solutions in internal data centres, which render their services only to its own organisation, and not to the public or other entities.

### *Community cloud*

This is a model where the cloud infrastructure is shared between multiple organisations or groups of people who use it. These organisations can be connected by a security policy and the same field of interest [41].

### *Hybrid cloud*

Hybrid cloud is a solution composed of multiple mutually disparate cloud computing solutions. A combination of public, private [31] or community model is usually considered.

What is offered within the service is explained by the distribution model. This is typically a software or hardware or combination thereof.

IaaS – Infrastructure as a Service – in this case, the service provider agrees to provide the infrastructure. Any problems with the hardware are taken care of by the provider, which is the main advantage of this approach. IaaS is suitable for those who own software (or their licence) and do not want to worry about the hardware. An example of IaaS is Amazon WS, Rackspace and Windows Azure.

PaaS – Platform as a Service – this service model offers complete a hardware and software platform, therefore, it is sometimes referred to as *cloudware*. PaaS service usually facilitates the creation of user interfaces, it includes the devices and services for application development with the possibility of design, development, testing, implementation and hosting [44]. Users of this service do not have to worry about investment and infrastructure for the development and the subsequent operation of their applications. Examples of PaaS providers are Google App Engine and Force.com (Salesforce.com).

SaaS – Software as a Service – the application is licensed as a service rented to a user. Users can therefore buy access to the application, but not the application itself. SaaS is ideal for those who only need normal application software and require access from anywhere and anytime. An example might be a set of applications Google Apps and Cargo-pass which is a system known in logistics.

## 2. The Use of Cloud Computing Today

In 2010, the largest market with cloud-based technologies was in the USA. European Union countries were in second place. This order is also expected to remain the same for 2014 [33] (Fig. 1). In all EU countries it is expected that the use of cloud computing will increase (Fig. 1). Development in the use of cloud computing in European Union countries is not as fast as for example in the USA. In terms of growth of different distribution models, according to the analyst company of Morgan Stanley Research, it is expected that the biggest growth will be in IaaS, i.e. 33% from 2011 to 2014. In the remaining two models the increase will be a few percent lower. The prediction used a variable of CAGR (Compounded Annual Growth Rate), which is a geometric mean of the predicted values. According to Ed Anderson, a specialist in the predictions of future development in cloud computing at the Gartner Company, the increase in total spending on this technology in the industry is expected to be more than 100% by 2016. Global spending should therefore reach 3,914 billion CZK. In contrast, the growth of the whole IT market is assumed to be by 3% [46].

In 2012, 4,000 PC users were approached across nine EU countries, they were asked about their knowledge and use of cloud computing [26]. This survey was realised by the Association Business Software Alliance (BSA), which brings together companies operating in the field of software. In the survey, it was found that although cloud computing is one of the most rapidly developing technologies, cloud services are used in the European Union by less than a quarter of computer users. The EU is therefore below the world average, which constitutes 34%. Most computer users also stated that they do not know about cloud technologies – 65% of the respondents have "never heard of it" or "only heard the name". The largest user acceptance (39%) were demonstrated in smaller European economies such as Greece and Romania. In contrast, the rate of adoption of cloud computing in the UK was 21%, in France 19% and 17% in Germany. This situation reflects the global trend of faster adoption of new technologies in emerging economies.

The low level of use of cloud computing in the EU corresponds to the situation in the Czech Republic. It is evidenced by the survey

of the Aspectio Research Agency (September 2011), which was implemented in co-operation with Czech Google and the Association of Small and Medium-Sized Enterprises and Self-employed people of the Czech Republic (ASME of CZ). The survey was carried out among 345 respondents who were owners or managers of small and medium-sized companies, i.e. up to 250 employees, all over the Czech Republic in the sectors of: services, trade, agriculture and mining, institutions, manufacturing, science and research. It confirmed that the greatest obstacle to the use of new technologies in the cloud is the lack of information about what this term means [3].

- Nearly 70% of the survey respondents had not heard about cloud computing and only a quarter knew the correct meaning of the term.
- 16% of companies do not know the term "cloud computing", but have already been using it without knowing.
- After clarification of the term, 40% of the entrepreneurs and companies involved in the research were interested in trying cloud computing.
- 92% of users of cloud applications from small and medium-sized enterprises are satisfied and especially appreciate the flexible access to information.

However, according to the latest forecast by IDC, the use of cloud in the Czech Republic is on the rise. Dynamics of growth will depend on a number of factors. We can mention for example the willingness of companies to adapt their IT processes, prices of licenses of providers and data security in the cloud [40]. On the basis of surveys conducted among EU countries, in the coming years it is expected that there will be an increase in the investments in cloud solutions. For example, a survey in the implementation of ERP systems shows that 14% of companies have implemented the system in cloud [19]. Half of the managers of large ICT companies believe (according to KPMG 2012) that cloud is a major technological driver of future changes and innovations in the industry. Within the public sector, 73% of the surveyed public sector representatives stated that mainly because of the savings for their organisation they should move to the cloud solutions. The biggest obstacle is concern about data security and the growing interest is in private cloud [35].

## 2.1 The Benefits of Cloud Computing

Many managers and owners of companies in the Republic for which cloud computing could be beneficial, do not know the possibilities of its use, or have not even heard of it (see the survey

of Aspectio Research Agency). The frequently mentioned benefits include cost reduction of companies in the IT department, the possibility to flexibly change the requirements for services and access to data from anywhere. There are many more benefits (Table 1).

**Tab. 1: Benefits and costs**

Benefits	Authors
Reduced investment and operating costs	Armbrust et al. [4], Linticum [34], Sarna [50], Marks and Lozano [37], Goncalves and Ballon [23], Velte et al. [55], Marston et al. [39], Hogan [26]
The use of network services and the Internet, the speed of implementation	Linticum [34]
Innovative approach	Velte et al. [55], Sarna [50], Linticum [34], Marks and Lozano [37], Goncalves and Ballon [23], Marston et al. [39], Hogan [27]
Environmentally friendly approach	Linticum [29]
The lower number of IT staff or reduction of the cost of IT	Sarna [49], Marks and Lozano [37], Armbrust et al.[4], Rosenthal et al. [49], Goncalves and Ballon [23], Velte et al. [55], Marston et al. [39]
Elasticity and scalability	Armbrust et al. [4], Rosenthal et al. [49], Marston et al. [23], Hogan [27]
Safety	Velte et al. [47]
Support for business processes	Marks and Lozano [36], Rosenthal et al. [49]
Faster access to the market	Goncalves and Ballon [23]
Shorter delivery time	Goncalves and Ballon [23]
Process automation	Velte et al. [55]
Current version of applications	Velte et al. [55], Marston et al. [39]
Energy Saving	Marston et al. [39]

Source: author

The use of cloud computing also brings some risks. **Project risk** is related to the mixing of technologies and scope of development makes implementation difficult to manage. Testing will not be done completely, and it will affect the quality and time of completion [5]. In Cloud Systems, some portion of applications run on the server side and some on the client side, therefore, ensuring the correct running or performing of application is unpredictable and difficult [2].

**Access** means that users can access data wherever and whenever they want. The vendors should provide connection in such a way that interruption and disconnection does not

happen because cloud computing requires a reliable internet connection [42]. In fact most cloud providers prepare a redundant connection to prevent this problem and it is more likely to see a broken connection on the customer's side.

**High availability** is a key area of interest for organisations. Cloud applications are delivered without delay, especially when travelling over latency-sensitive connections, users can become frustrated waiting for "available" resources.

The aforementioned risks are coincided by many experts, which can be seen in the following table (Table 2).

Tab. 2: Risks of cloud computing	
Project risk	Azarnik et al. [6], NISA [43], Chen et al. [28], Chou et al. [29], Bisong and Rahman [9]
Availability	Grimes [24], NISA [43], Peyiu and Dong [45]
Access	Shayan et al. [52], Azarnik et al. [6], Grimes [24], Queensland Government [47]

Source: author

The basic criterion for decision-making regarding which application shall be kept internally and which shall be moved to cloud, is the nature of the data that are maintained within the application. According to some opinions, critical data and functions should preferable be left within the company.

### 3. Survey of Cloud Computing Use in Czech Enterprises

In August 2013, a questionnaire survey on "ICT usage in enterprises in the Czech Republic" was carried out. This survey aimed to map the current attitudes of enterprises towards the use of technologies to support financial management, customer relationship management (CRM) and cloud computing. The survey was conducted in co-operation with the University of Hradec Králové and consulting firm Datank, s.r.o., which carried out the data collection. Companies in the Czech Republic across all sectors of CZ NACE Rev.2 with a focus on small and medium-sized enterprises, were addressed. The questionnaires were placed on the website and the respondents who belong to a panel of co-operating enterprises of the consulting firm Datank, s.r.o., were approached via email. Overall 208 completed questionnaires were ensured. As respondents were approached managers and CEOs and IT department Executives.

The questions from the questionnaire survey were divided into four major areas. Three areas correspond to the three above-mentioned technologies (CRM, cloud computing and technologies for financial management), the last group of questions were aimed at evaluating the efficiency of business processes in relation to the technologies used by the company. Part

of the questionnaire in each field was an explanation of the basic concepts (cloud computing, types of distribution models: PaaS, SaaS, IaaS, deployment models: public and private cloud).

The structure of questions for each technology were similar, namely cloud computing was related to these questions.

- Are you planning to implement (possibly When did you implement) cloud computing?
- What deployment model of cloud service do you use/consider using?
- What distribution model do you use?
- Which of the following cloud services do you use/consider using?
- What are the benefits of cloud computing for your company?
- Can you please describe the major obstacles to the introduction of cloud computing?

The respondents could choose from several options, some of the questions offered a rating for each of the options on a scale of 1–4.

The second set of questions was concerning the financial management of a company. The main aim was to find out what financial indicators are used by companies in relation to information technologies.

- What initial investment costs are acceptable, according to you, for the introduction of specific information technology in your company?
- What method of performance evaluation do you use or plan to use in your company?
- What evaluation method do you think is suitable for assessing the performance of the information system?

The last group consisted of identifying questions.

#### 3.1 Characteristics of the Respondents

In terms of business type relationships, the survey was participated by 56.3% of companies of the type B2B (Business to Business), i.e. business relationships and interactions between two companies. Furthermore, the most represented companies were in the type of B2C (Business to Customer) and a combination of these two types (Table 3).

**Tab. 3: Structure of the respondents by type of business relationship**

Type of relationship	
B2A (Business to Administration)	7.2%
B2B (Business to Business)	56.3%
B2C (Business to Customer)	17.3%
Combination of B2A+B2B	2.4%
Combination of B2A+B2C	0.0%
Combination of B2B+B2C	11.5%
Combination of B2A+B2B+B2C	5.3%

Source: author

Structure of the respondents divided by the size of turnover is presented in Table 4.

**Tab. 4: Structure of the respondents by size of turnover**

Structure by Turnover	
Up to 999,000 CZK	30%
1–4.99 million CZK	28%
5–29.9 million CZK	27%
30–99.9 million CZK	15%

Source: author

In terms of business scope, all basic groups according to the classification of CZ-NACE were represented. The larger group of companies were from the construction industry, wholesale and retail trade, information and communication activities (Table 5).

The sample corresponds to the distribution of enterprises in the economy by the sectors listed in the Statistical Yearbook 2012 [15]. Only in the sector of Information and communication technology and professional activity are there more businesses represented than are in the economy. In contrast, a small deviation in the opposite direction can be found in the wholesale market.

The representatives of companies who responded to the questionnaire, were the owners and Chief Executives of companies (60%), or the heads of selected sections (e.g. IT department, financial management, etc.). Most respondents were from Olomouc, Hradec Králové, Liberec and Karlovy Vary regions (it exceeded the limit of 10%). The least respondents were from the Southern Region (1.9%). The number of respondents from other regions ranged between 2.5–9%.

**Tab. 5: Structure of the respondents by CZ-NACE group (A higher level of aggregation SNA/ISIC A 10/11 [16])**

Scope of business	
Agriculture, forestry, fishing	5.3%
Manufacturing industry	13.0%
Construction industry	19.7%
Wholesale and retail trade, repair and maintenance of motor vehicles	15.9%
Transport and storage	1.4%
Accommodation, food and service activities	1.4%
Information technology and communication activities	6.3%
Financial intermediation	0.5%
Real estate activities	1.4%
Professional (legal, archit., consulting), sciences and tech. activities	3.8%
Other activities	31.3%

Source: author

### 3.2 Current and Planned Use of Cloud Computing in Enterprises in the Czech Republic

The respondents were first asked whether they use at least one of the three technologies, namely software for financial management, software for customer relationship management and cloud computing. 29.8% of respondents answered positively.

As for the actual use of cloud computing, the percentage share of firms that use it or are thinking of using it, is very low (8.17%). This technology is not currently used by enterprises and, what's worse, they do not plan to launch it in the future. This expectation is contrary to the estimates of the consulting firms Gartner and IDC [22], [30], which expect significantly greater increase in the use of this technology in the Czech Republic.

The year 2003 was listed as the first of those, during which cloud computing was adopted by the respondents of the survey. Overall, however, the introduction has occurred more since 2008. In terms of types of cloud solutions, private cloud dominates (62.5%) over the public cloud (25%) and hybrid (12.5%). In terms of the distribution model, the most prevalent service was SaaS (50%). Table 5 shows the

total interest for the various cloud solutions with regard to the provider. This is the sum of the respondents who have cloud, or some of those planning to implement it within the company (see table 6).

**Tab. 6: Interest in various types of cloud services**

Google Apps	36.4%
Microsoft Windows Azure	18.2%
Google App Engine	13.6%
Amazon Web Services	4.5%
Private cloud from VMware	4.5%
Other	22.7%

Source: author

### 3.3 The Benefits of Cloud Computing

The expected benefits, which managers and chief executives of companies are aware of and which they expect from cloud computing (whether they are planning to introduce it or not) include: scalability and flexibility of services (26%), online technical support available in case of problems (25%), work from home (24%), and access to corporate data from anywhere (Fig. 1).

The above benefits will take on even more importance in the future due to the experience

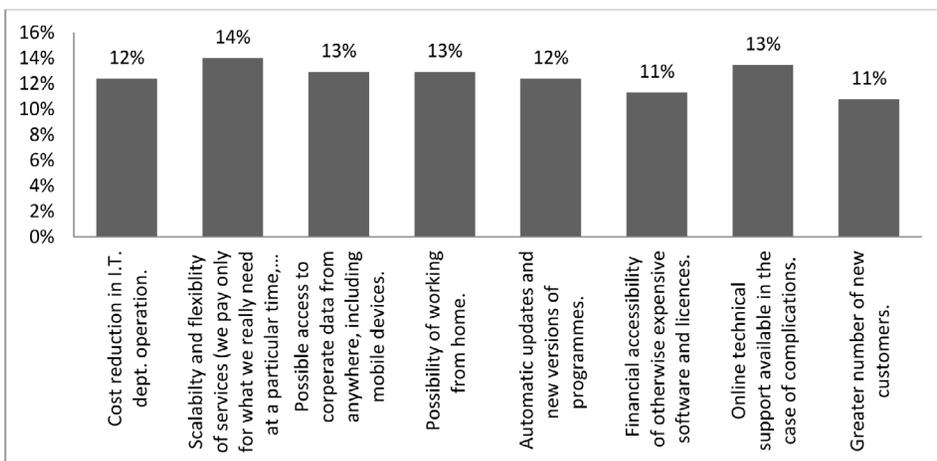
of increasing usage of mobile technologies. Many employees already use their own mobile devices within the work process. Opportunity to showcase a product to a customer, as well as quickly finding adequate information will contribute to higher customer satisfaction. What benefits cloud computing will have for the enterprise depends purely on the business itself and its approach to the use of this technology. The potential which exists here in relation to cloud computing is at a high level.

### 3.4 Barriers to the Introduction of Cloud Computing

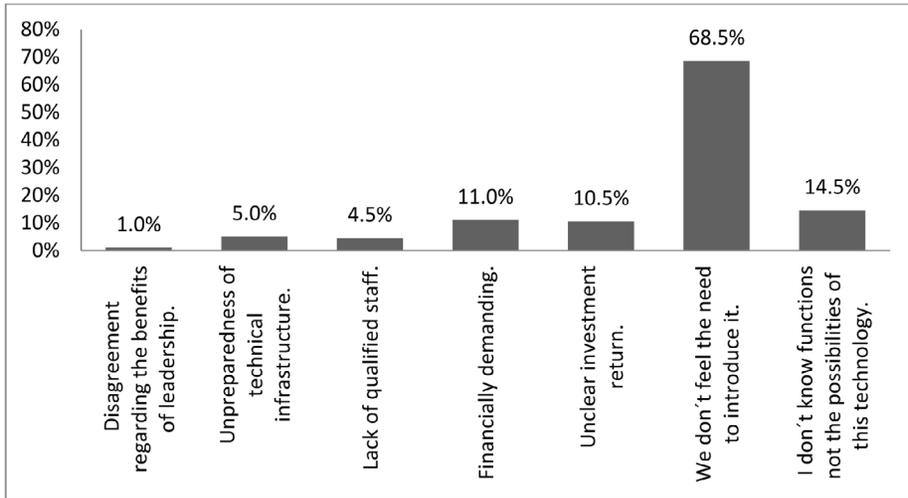
The introduction and use of cloud computing also involve some risks and some corporate managers perceive certain barriers to the implementation. The respondents stated for example:

- data security,
- dependence on the operation of the Internet connection,
- lack of knowledge regarding cloud computing options,
- set low priority of the perception of the necessity and usefulness of cloud computing and the associated lack of time to analyse the strengths and weaknesses,
- the financial burden.

**Fig. 1: The benefits of cloud computing in enterprises in the Czech Republic (in %)**



Source: author

**Fig. 2: Barriers to the introduction of cloud computing**

Source: author

In terms of options, the major cause of the lack of cloud computing in companies is that companies do not feel the need to introduce this technology (68.5%), ignorance of its capabilities (14.5%), financial demands and unclear return on investment (about 11%). Other barriers to the introduction are shown in Fig. 2.

### 3.5 Financial Expenses on Cloud Computing and Performance Assessment Methods in Enterprises

From the above answers it can be assumed that the willingness to invest certain amounts of money into cloud computing will not be too high. 83.2% of respondents would be willing to invest a sum up to 10,000 CZK and 10% would invest the amount in the range of 11 to 100,000 CZK.

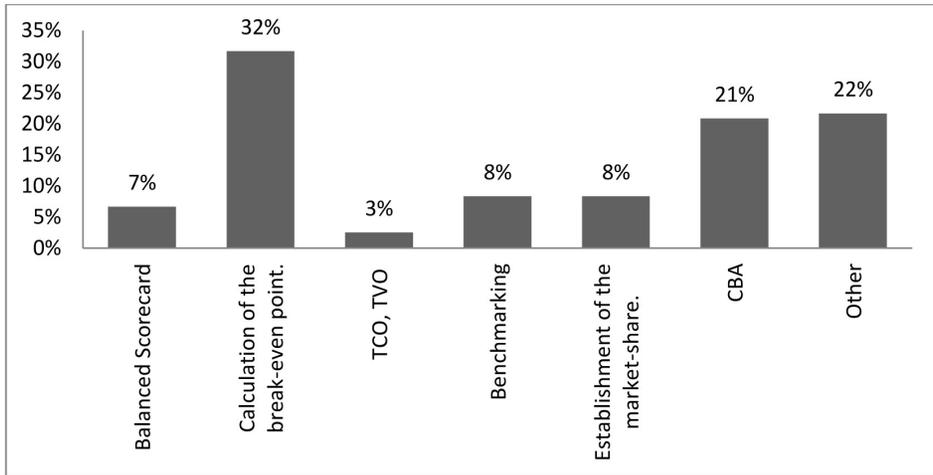
Another area of the research was the relationship and attitude of companies towards the performance assessment methods of enterprises. In the event that companies want to invest in IT in the future, one of the criteria for the selection of the technology is the return on investment. The following graph (Fig. 3) shows

the use of the methods within enterprises. 87 companies replied, the other companies did not identify any of the methods. Based on the experience of the author with relatively low use of specialised methods to calculate the performance of companies in the Czech Republic [36], methods that evaluate the performance of companies only as its part (such as the Balanced ScoreCard) were also included.

Quality of now used systems of financial analysis is in direct correspondence with complexity. In spite of the fact, that the basic process of input data processing does not have necessary declaring ability, those are used frequently without desired result. Complicated systems, that provide results describing state of analyzed company more accurately, are usually for users of financial analysis unclear [25].

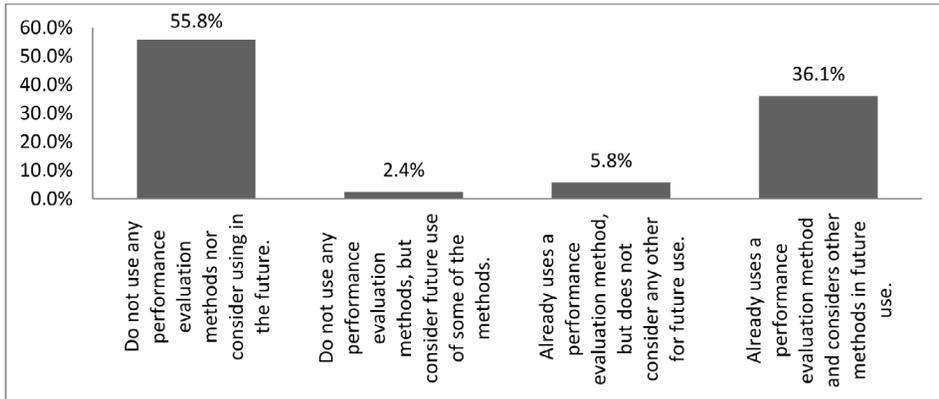
In the future, 38% of the companies are planning a change in approach, it is more likely to be a change regarding the selection of the assessment method. 56% of the companies stated that they are not planning to use any method of performance evaluation in the future.

**Fig. 3:** The percentage representation of the use of different performance evaluation methods



Source: author

**Fig. 4:** Representation of the number of companies according to their relation to the use of the performance evaluation methods



Source: author

This result can be described as very negative. Due to the current time when there is a pursuit of more effective management of enterprises and their development, feedback is very important (Fig. 4).

### 3.6 Analysis of Responses in Relation to the Type of Enterprise

The respondents' answers were also analysed in relation to company size, focus of the scope and by type of business relationships. All the answers in relation to the above factors, however, are not described in detail, because

the structure of the responses was not affected by this breakdown. As an illustration, table 7 outlines the willingness of companies to invest in cloud technologies. As it is evident from the

absolute expression of the responses, most companies regardless of their business scope would be willing to invest a maximum of 10,000 CZK.

**Tab. 7: Interest in various types of cloud services**

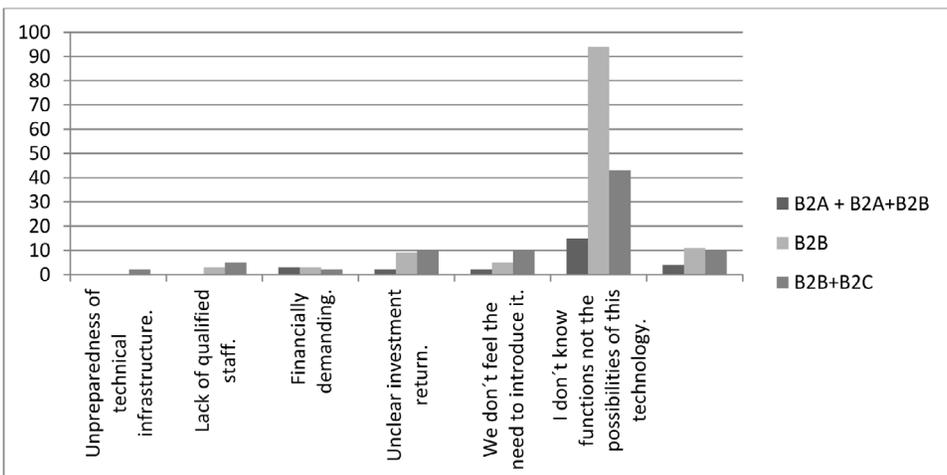
	0 (freeware)–10,000 CZK	11–100,000 CZK	101–200,000 CZK
Agriculture, forestry, fishing	11	0	0
Manufacturing industry	23	3	1
Construction	37	4	0
Wholesale and retail, repair and maintenance of motor vehicles	27	3	3
Transport and storage	3	0	0
Accommodation, food and service activities	2	0	1
Information technology and communication activities	8	5	0
Financial intermediation	0	1	0
Real estate activities	2	0	0
Professional (legal, archit., consulting), sciences and tech. activities	6	1	1
Other activities	54	4	6

Source: author

Figure 5 describes the barriers to the adoption of cloud computing in relation to the type of company business relationship. The structure of the answers is constant. Firms

agreed that they do not feel the need for change other problems were financial difficulty and unfamiliarity of the technology options.

**Fig. 5: Barriers to the adoption of cloud computing in relation to type of company business relationship**



Source: author

### 3.6 Summary

In August 2013, a questionnaire survey was carried out among small and medium-sized companies, which aimed to map the use of the selected information technologies. Specifically, it was the software for financial management, software for relationship management with customers and cloud computing. This paper summarises the results of the questionnaire survey focused on cloud computing.

Only 8.7% (i.e. 17 respondents) stated that they have or are planning to implement cloud computing. This result is quite different from the predictions of consulting firms such as IDC, which predicts that spending on cloud services and hosting in the Czech Republic should grow in future years by the annual growth rate of 43%. The research corresponds with the results of the Aspectio Research Agency [3], which took place in the Czech environment at relatively similar sample of firms (small and medium-sized). The similarity is particularly in the large proportion of respondents (70% of firms) who did not know the term at the time of the research. The company also expressed an interest in the technology, after introduction to this concept (40% of the respondents within the survey [3]). That fact however, does not correspond with the investigation carried out by UHK two years later, when the effective increase in users did not occur.

One of the biggest obstacles to the use of cloud computing (in the event that the companies consider using it) is the unclear return on investment, ignorance of cloud features, financial requirements. All these barriers show the ignorance of the concept of cloud computing. Unclear return on investments is related to the fact that less than half of the companies use the performance assessment methods. If the companies were engaged in calculating the return on investments in IT, most commonly they would use the method of tipping point and the cost-benefit assessment (CBA). To improve this situation it would be appropriate to make businesses more focused on familiarisation with the methods of providing information regarding the effectiveness of such technologies. For instance, the service contracts between providers and beneficiaries of the technology can include the so-called Service Level Agreement (SLA). This can be a legally binding formal or an informal "contract" (for example, internal department relationships). SLAs commonly include segments to address:

a definition of services, performance measurement, problem management, customer duties, warranties, disaster recovery, termination of agreement [39]. The company Cisco Systems, Inc. implements the agreement on the quality of service in its devices under the name Cisco IOS IP and among the monitored metrics are: Delay, Jitter, Packet loss, Packet sequencing, Connectivity, Server or website download time [11].

On the other hand, managers and executives of the companies are aware of and would expect from cloud computing (whether they are planning to introduce it or not) certain benefits that include: scalability and flexibility of services, available online technical support, the ability to work from home and access to corporate data from anywhere.

A fundamental aspect of the extent to which firms in the Czech Republic use or are planning to use cloud computing, is the need for change, which in the context of information technologies they argue that they do not need it. Due to the rapid development in mobile technologies and predicted domestic and global trends, it is expected that this attitude will change leading to a greater use of cloud computing.

### Conclusion

The aim of this paper was to characterise the capabilities and benefits of the use of cloud computing in Czech companies, the current state of its use, to compare the degree of its deployment in the Czech Republic, European Union environment and on a global level. The aim was also to assess the validity of the hypothesis: "Czech enterprises consider cloud computing as an important technology for their business and they plan its implementation in the near future".

Based on the analysis of the available resources that characterise the prediction of future development in use of cloud computing on a domestic and on a global level, we can say that there is a rise expected in the use of this technology. Currently it is mainly used in the USA, followed by Europe. World agencies expect an increase in market share of cloud computing in Europe by 5%. In the USA there is already a decline expected. For the Czech Republic a much higher increase in the use is predicted (according to IDC by 43% year-on-year). But the questionnaire survey, which was conducted in 2013 among 200 Czech firms,

talks about the interest in cloud computing in units of percent. Czech companies do not know this concept (91%, i.e. 191 of the total 208 respondents) and are not interested in the introduction of cloud computing.

In 2012, the European Commission established a strategic document entitled "Strategy for the Integration of cloud computing in the European Union" [18] which supports the introduction of cloud computing in European companies and in government institutions. The potential of cloud computing and its potential benefits, especially in the area of cost savings, are nationally known. Its implementation, however, is mostly prevented by an ignorance of the possibilities of this technology in Czech enterprises. The surveyed hypothesis of "Czech enterprises consider cloud computing as an important technology for their business and they plan its implementation in the near future" cannot be confirmed.

*This paper is published thanks to the support of the internal projects of University of Hradec Kralove: Economic and Managerial Aspects of Processes in Bio-medicine and "Smart Solutions in Bio-informatics" Grant Agency of Excellence, University of Hradec Kralove, Faculty of Informatics and Management.*

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## **DEPLOYMENT OF CLOUD COMPUTING IN SMALL AND MEDIUM-SIZED ENTERPRISES IN THE CZECH REPUBLIC**

**Petra Marešová, Vítězslav Hálek**

*Globalisation is a phenomenon that is reflected in all spheres of social life. Information technologies have a key role in globalisation. Thanks to them is possible to divide labour on a global scale, monitoring and use of comparative advantages (for the raw materials, cheap labour sources, effective demand) in their – that offer advantageous conditions. The technologies, which are predicting significant future growth in cloud computing. Cloud computing is a set of information and communication technologies in which IT resources are delivered in the form of services to external users via the Internet.*

*The aim of this paper is to describe the use of cloud computing in Czech companies and compare its deployment to other countries. Characteristics of the use of cloud computing in Czech enterprises are based on surveys conducted by local and international agencies and on their own research. Their own research was conducted in the autumn of 2013. There were 200 respondents from small and medium-sized enterprises across all sectors of CZ – NACE. Enterprises were asked about their knowledge of the chosen technologies, the rate of utilisation, the expected benefits of these technologies, or if they are interested in its deployment in the future.*

*As revealed from the results of this survey, many managers and business owners do not know the term cloud computing and do not know which specific services and benefits can be expected. Managers also do not feel the necessity to change the state of the IT department, so currently there IS only a small proportion of companies that plan to implement cloud computing.*

*Implementation of cloud computing is supported ON a national and international level, savings and benefits from the deployment of this technology are also evident. In this context, lack of knowledge of this concept and low deployment of cloud computing in Czech enterprises is a negative phenomenon.*

**Key Words:** *Cloud computing, business, research.*

**JEL Classification:** *M15, M21.*

**DOI:** *10.15240/tul/001/2014-4-012*