Chapter 89
Assessing the Effectiveness of Cloud Computing in European Countries

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Abstract Cloud computing is a technology which is considered to be very promising and beneficial in the countries of the European Union. However, its implementation in business is not currently that noticeable, and many companies do not manage to assess and voice its contribution. The introduction of cloud computing not only brings significant benefits but also costs and risks. The aim of this contribution is therefore to propose a topical system of criteria for assessing the effectiveness of cloud computing, which is based on the existing experience with this particular technology. Several methods are used in order to achieve this goal, namely, bibliographic search, interviews with cloud computing experts on the implementation and design of cloud computing, and a questionnaire survey among enterprises in the selected country.

Keywords Cloud computing • Evaluation criteria • Benefits • Risk

89.1 Introduction

Cloud computing is a new technology which is acknowledged to be very beneficial in the companies of the countries of the European Union. Cloud computing can be seen as the form of services accessible to customers by means of a communication network as well as all hardware and software tools used by the data centres providing these services [1]. Forrester Research, a global research and advisory firm, has widened the definition mentioned above so that it also covers the standardisation of ICT tools on the supplier's side and self-service principals on the user's side. Cloud computing is in fact a package of standardised ICT capacities (services, software solutions or infrastructure) accessible via the Internet on the basis of self-service principles and the pay-per-use model [2].

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Within the field of cloud computing, two types of service models can be distinguished: public and private. A service model is a way of providing cloud computing services to the end user. Cloud platforms have been categorised into three main groups according to the type of provided services: infrastructure, platform and service.

The decision whether to implement cloud computing in the organisation is related to benefits and risks. By comparing them, it is possible to come to the conclusion whether or not the technology is suitable for the organisation. In practice, however, there is no accessible device, apart from online calculators, which would make the decision-making process easier before addressing a provider. On the other hand, the problem of decision-making related to accepting cloud computing has been tackled by universities as well as the private sector, mostly with respect to the field of application.

A current review of the cloud computing effectiveness evaluation is available in many sources [3–6]. The literature of cloud computing has explored the costs of using cloud with the help of individual case studies [7–12]. The most frequently mentioned criteria for the decision-making process related to accepting cloud computing is security, confidentiality, backup and recovery, efficiency and performance, elasticity and costs [13]. The next area pertains to performance. Companies and organisations worry about not being able to access their data because of the unavailability of cloud services when they need them. Usually there is little if any forewarning of the possibilities of services being unavailable [14, 15]. Some industry leaders argue that it is still an advantage for businesses to keep services and valuable data in their own infrastructure, to ensure that they can gain access to them at any time. The final challenge for utilising cloud services is cost. This is a quickly evolving field, with rapid reductions in cost. Different vendors have different pricing models, and there is encouraging information that cloud is cost competitive when compared with local server solutions for applications that require very large storage. The overall most frequently used criteria are [16–29]:

- Security
- Efficiency and performance
- Adaptability
- Elasticity
- Legal matters laws and treaties covering the storage, access and transmission of data
- Availability and usage restriction
- Backup and recovery
- Response time
- Usability
- Customisation
- Elasticity
- Interoperability
- Scalable storage
- Hardware cost

- Software cost
- Portability
- Reliability
- Compliance with standards
- Client support

89.2 A Case Study: Criteria for Assessing the Effectiveness of Cloud Computing According to Small and Medium Enterprises in the Czech Republic

In August 2013, a questionnaire survey was carried out in the Czech Republic. Its topic was "Utilisation of ICT in Czech companies". The aim of this survey was to determine current attitudes of companies towards using technologies in order to support financial management, customer relation management (CRM) and cloud computing. Companies from all CZ-NACE categories were addressed, with a focus on SME. A total of 200 questionnaires were collected.

Respondents in the Czech Republic indicated the most significant criteria for successful utilisation of cloud computing: scalability (14 %), elasticity (14 %), scalable storage (12.9 %), availability (12.9 %) and customisation (13.4 %). The problem of data security is dismissed as less significant in cloud computing. It becomes a problem only when respondents are asked about risks linked to the implementation of cloud computing.

Some managers perceive the following obstacles: data security, dependence of operation on Internet access, insufficient knowledge of cloud computing and its possibilities, low priority of perceiving cloud computing as necessary, the related lack of time for analysing strengths and weaknesses and financial burden.

All in all, the implementation of cloud computing in SME in the Czech Republic is quite low (only 9 % of addressed companies). The main reason for the low utilisation of cloud computing in Czech companies is the fact that companies do not perceive the need to implement this technology (68.5 %) and do not have sufficient knowledge of its possibilities (14.5 %).

89.3 System of Criteria for Assessing the Effectiveness of Cloud Computing

The criteria mentioned above for the utilisation of cloud computing also serves as a starting point to create a cloud computing model. The proposed model has three basic levels (Fig. 89.1) based on the relation of the given criteria to the technical characteristics of the technology and on the relation to customer needs. The proposed levels are:

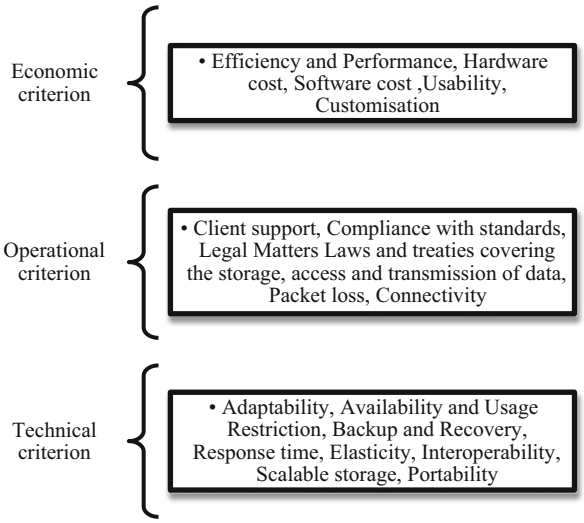

Fig. 89.1 System of criteria for assessing the effectiveness of cloud computing

- Technical
- Operational
- Economic

The model is based not only on the literature review but also on the opinions of five experts in the field of implementing this technology in the Czech Republic.

Economic criteria are related to the effectiveness of application, costs and the user friendliness of cloud. These criteria include costs of hardware and software. Overall, these are investment costs. These items should be then compared with the qualitative benefits. However, this causes difficulties in numerical formulation of effectiveness of cloud computing. Nevertheless, even for these purposes, there are well-established methods (cost-benefit analysis).

Operational criteria are related to determining the service-level agreement (SLA). SLAs are part of service contracts and are agreements usually between two parties (service provider and customer), which formally define the services. Service contracts use the percentage of service availability as a unit [30]. SLA is a specification of services [31]. The company Cisco Systems, Inc. implements the agreement on the quality of service in its devices under the name Cisco IOS IP [32].

Finally, the last group consists of *technical criteria*. The success of cloud services depends on the required functionality and other characteristics such as availability, respond time, latency, performance, timeliness, scalability and high availability. All of these characteristics can be covered by the term Quality of Cloud Service (QoCS), which comes from general QoS [33]. QoS (Quality of Service) is used in computer science for booking and control of data flows in telecommunication and computer networks. QoS can set, for example, a top or low transfer zone for certain data, prefer some operations or divide the operations into categories

according to the set parameters. Thus, QoS attempts to provide its users with the services which can guarantee quality in advance in order to avoid any delays, loss-making or waste [34].

Conclusion

Currently, a growth is predicted in the area of cloud computing utilisation in Europe in the following years. At the same time, the economic situation in many countries makes companies consider every new investment. Cloud computing is a technology that is related to costs and benefits, many of which are difficult to grasp and express.

The aim of this contribution is to propose a system for assessing the effectiveness of cloud computing. The described system is based on the study of relevant literature and on the opinions of experts. This research suggests that the basic criteria for assessing the effectiveness of cloud computing is a set of technical, operational and economic criteria.

The created model for the time being only specifies the basic levels at which subjects implementing cloud computing could identify their requirements and expectations (using both soft and hard metrics). The model is expected to be further developed with the intention to propose concrete methods for measuring individual levels. The model is expected to be further tested in real practices.

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