META-ANALYSIS OF ADVANTAGES AND CONCERNS OF CLOUD COMPUTING IN SMALL COMPANIES

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Abstract

As technologies – software, hardware and infrastructure – development gathered up speed interest about cloud computing started to grow fast. The cloud computing can enable access to newest information technologies for companies without large investment possibilities in hardware and software.

Small and micro companies are the most eligible candidates to adopt cloud computing. They can flexible increase or decrease the needed computing or storage extend and pay only for consumed resources e.g. to reduce capital investments. However, there are also many concerns why companies are not ready to adopt cloud computing: policy and organisational risks (lack of standardisation, loss of governance), technical risks (data leakage, loss of data), legal risks (data protection) and other risks specific to infrastructure, network problems.

The aim of this study is to identify the main concerns related to cloud computing in small companies. Methodology was based on the meta-analysis of scientific literature. The search was conducted via 'Scopus' and 'Web of Science' databases.

The results of a meta-analysis show that the most concerns about cloud computing for small companies are related to security and privacy; but the main barriers of cloud computing adoption is related to internal organizational factors.

Key words: cloud computing, service computing, meta-analysis, content analysis, small companies

JEL Code: L20, M15, M21

Introduction

As technologies – software, hardware and infrastructure – development gathered up speed interest about cloud computing started to grow quickly. Ratten (2012) defines cloud computing as "computing platform that is able to dynamically provide, configure and reconfigure servers to address a wide range of needs". Misra and Mondal (2011) cloud computing emphasized "as collection disembodied services accessible from anywhere using

any mobile device with an Internet connection". The US National Institute of Standards and Technology (NIST) defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Brender & Markov, 2013). Cloud computing represents a paradigm shift towards the utmost scalable and flexible IT services.

Small and micro companies are the most eligible candidates to adopt cloud computing. They can flexible increase or decrease the needed computing or storage extend and pay only for consumed resources e.g. to reduce capital investments. Positive effects of cloud computing adoption by organizations go well beyond costs reducing. So Gupta, Seetharaman and Raj (2013) shows that main drivers for cloud computing adaptation by micro and small business (SMEs and SMBs) are cost reduction along with ease of use and convenience, security and privacy. Misra and Mondal (2011) concludes that start-up companies are the most eligible candidates for adoption of cloud computing because of reduced capital investments. Due to the possibility to save the entire costs of running their own datacentre, there is no need to purchase software licenses.

However, the use of cloud computing principle in the organization moves some functions and responsibility away from local ownership and management to a third-party service provider. That brings a set of associated legal, technical and ethical issues, such as data protection, data leakage, loss of data, licensing, intellectual property rights, policy and organisational risks and other risks specific to infrastructure, network problems. Concerns about these problems reduce the companies' readiness for cloud computing adoption regardless to noticeable benefits of it.

There is no doubt about high potential of cloud computing for small companies, but lack of proper understanding of cloud architecture, its pricing models and its suitability to companies' different needs are some of the elements that prevent cloud computing usage spread.

The aim of this study is to identify the main advantages and concerns related to cloud computing in small companies. The research is based on a meta-analysis of scientific literature.

1 Research methodology

In this paper, is presented a quantitative method of literature reviewing and evaluating empirical research by using the meta-analysis. Economics is theory-driven, but there is necessary to learn empirically if economics is to advance like in the case with cloud computing. Meta-analysis offers a more objective statistical method to summarize the empirical knowledge and to explain the wide study-to-study variation in economic research. Originally, meta-analysis was used in medicine and psychology later it found its place in the economics. More on the meta-analysis use in economics can be found, for example, in the article of Stanley (2001).

The meta-analysis of scientific literature has been realised to highlight the cloud computing adaptation advantages and concerns in small companies. The search was conducted via 'Scopus' and 'Web of Science' databases. Scopus is the largest abstract and citation database of peer-reviewed literature owned by Elsevier. 'Scopus' database includes more than 50 million records, more than 21 000 titles from 5 000 publishers and 4,6 million conference proceedings. 'Web of Science' is a database contains the most important scientific information from more than 12 000 journals in natural, social sciences and humanities owned by Thomson Reuter.

The research process was carried out in three steps. First, the most relevant keywords were defined and used for quantitative search in database records searching in article titles, abstracts and keywords fields. Second, unique articles have been selected at the search list about SME to, third, perform it content analysis and to identify advantages and concerns of cloud computing.

2 Main findings of research

At the first step the most relevant search words were defined (see Tab. 1, the first column) after which the quantitative search in databases has been performed by article titles, abstracts and keywords. The search results were filtered by subject area "Business, Management and Accounting":

$$(TITLE\text{-}ABS\text{-}KEY(\text{"search words"}) \\ AND\ (LIMIT\text{-}TO(SUBJAREA,\ \text{"BUSI"})) \tag{1}$$

As the aim of this study is to identify the main advantages and concerns related to cloud computing in small companies there is one more filter used "SME":

$$((TITLE\text{-}ABS\text{-}KEY(\text{"search words"})) \\ AND\ (SME) \\ AND\ (LIMIT\text{-}TO(SUBJAREA,\text{"BUSI"})) \tag{2}$$

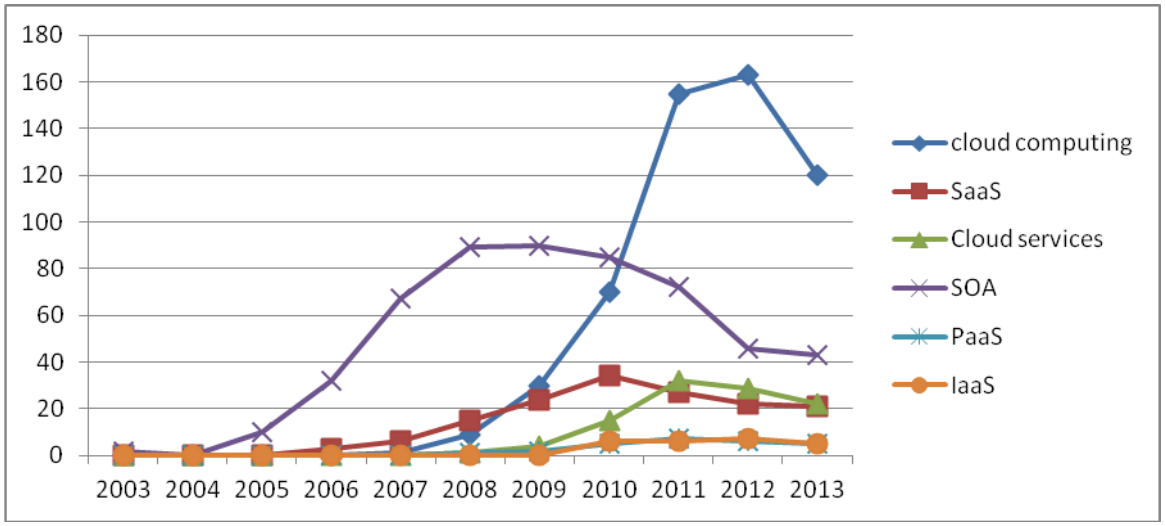
Tab. 1: Search results for cloud computing related articles in databases

Search term	Number of results	… limited to subject area business, management and accounting	… and "SME"
"cloud computing"	18030	579	17
"service computing"	49756	1343	19
"Software as a Service"	1534	157	8
"Platform as a Service"	474	26	1
"Infrastructure as a Service"	42443	24	1
"cloud resource management"	58	3	-
"cloud-hosted applications"	14	2	-
"cloud sourcing"	2	2	-
"cloud services"	3207	108	1
"distributed technology"	225	12	1
"cloud data management"	71	15	-
"service oriented architecture"	10993	539	11
"service level agreement"	6748	272	1

Source: authors' calculations based on search in databases „Scopus" and „Web of Science"

The search result shows a significant interest about cloud computing in general, but the number of studies pertaining to small companies is relatively small (see Tab. 1). That can be explained both by the unavailability of data for micro level analysis and the fact that the technology developed very rapidly in a short period. The interest in the topic is mainly determined by development of technology possibilities also in the area of business, management and accounting (see Fig. 1).

Fig. 1: Dynamic of publications related to cloud computing (limited to subject area business, management and accounting)



Source: authors' calculations based on search in databases „Scopus" and „Web of Science"

The Figure 1 exposes development of the cloud computing concept: initially increase the interest about the principles of service based architecture (SOA) what comes on a cloud computing.

At the next, from the search list was selected articles related to SME and was performed contents study to identify advantages and concerns of cloud computing, in total 18 articles. Krippendorff (2004) defines the content analysis as a research technique for making replicable and valid inferences from texts to the context of their use. Broadly described content analysis is research methodology that examines words or phrases within a wide range of texts. Since one of the main protocols of the content analysis is the exploitation of a systematic data abstraction method that assembles data into a structured form with predefined items and formats (Karanja, 2013), there is employed a coding scheme containing entries in a table format.

In the Table 2 has been summarised results of conceptual content analysis showing identified unique advantages and concerns about cloud computing discussed in selected articles (in the table is shown just those with at least one different characteristics).

Tab. 2: Advantages and Concerns about cloud computing in SMEs

Source	Advantages	Concerns
Brender and Markov (2013)		1. information security 2. regulatory compliance 3. data location 4. investigative support 5. provider lock-in 6. disaster recovery

Source	Advantages	Concerns
Gupta, Seetharaman and Raj (2013)	1. the ease of use and convenience 2. improved security and privacy 3. the cost reduction	1. sharing and collaboration 2. reliability
Carcary, Doherty and Conway (2013)		1. security concern 2. data ownership and protection concerns 3. compliance concerns 4. lack of awareness of cloud benefits 5. lack of sufficient IT skills 6. lack of sufficient financial resources 7. unsuitability of cloud for the business's product/service 8. inadequate broadband speed
Ratten (2012)	1. reduced information technology overhead 2. flexibility and on-demand services 3. independence of location	
Alali and Yeh (2012)	1. lowers the barrier to conducting information process intensive activities 2. no need of maintenance of their own technology infrastructure	1. ethical issues including privacy, security, anonymity, liability, reliability 2. government surveillance
Christauskas and Miseviciene (2011)	1. reduced costs 2. security 3. respond to business (adding new software is very simple) 4. easier administration 5. compliance 6. global access 7. try before buy	1. fear for safety 2. internet failures 3. control loss 4. dependency
Marston, Li, Bandyopadhyay, Zhang and Ghalsasi (2010)	1. lowers the cost 2. immediate access to hardware resources 3. lower IT barriers to innovation 4. ability to scale up services	1. the loss of physical control of the data 2. threat to their corporate IT culture

By using the relational (content) analysis, what is built on conceptual analysis results, the relationship among concepts in a different text is examined. The relational (content) analysis of articles shows that the same factors by different authors could be assigned to both advantages and concerns. For example, Gupta et al. (2013) states that SMEs do not consider cloud as reliable, wherewith Marston, Li, Bandyopadhyay, Zhang and Ghalsasi (2010) emphasise that use of cloud computing improves greatly the efficiency and reliability of the system. In another example Christauskas and Miseviciene (2011) state that "major clouds application providers offer higher levels of security" and "web based systems are actually as or more secure and have equal or better internal controls than similar in-house based software". However, Brender and Markov (2013) to note security as the most important risks related to the information on the cloud specific cloud solutions EDoS-attack.

There were identified 33 different concerns for the cloud computing by SMEs. To identify most important principal concerns that would discourage SME from the cloud computing, first, all concerns has been classify into four broader groups:

- security and privacy risks (information security, the loss of physical control of the data, fear for safety, security risks including the adequacy of segregation etc.),
- provider, vendor risks (reliability, provider lock-in, vendor failures, performance, third party management, dependence on the Internet etc.),
- internal factors (cultural factors, negation to sharing and collaboration, the risk of conflicts, loss of independence, threat to organization corporate IT culture,) and
- lack of regulation and standardization.

Second, there was analysed number of articles by years and group of concerns to take in account tendencies, if any, as cloud computing popularity increase (see Tab.3).

Tab. 3: Dynamics of concerns about cloud computing by years

Group of concerns	2010	2011	2012	2013	Total
security and privacy risks	3	8	6	7	24
provider, vendor risks	1	8	5	9	23
internal factors	2	3	1	9	15
lack of regulation			1	1	2
Total	6	19	13	26	

Source: authors' calculations based on search in databases „Scopus" and „Web of Science"

The shift from just technical problems of cloud computing to the social factors is noticeable. If at early stage of cloud computing more articles was focused on its possible benefits, later in small companies and not only start increase concerns about reliability, privacy and security of the cloud computing. As cloud computing becomes more and more available for small companies, there starts to increase concerns about internal factors that could affect companies culture. It can be stated that availability and benefits of cloud computing for small businesses will further develop as a result of integration of cloud computing and production - SME-oriented cloud manufacturing service platform (Huang, Li, Yin and Zhao, 2013).

Conclusion

The aim of this study was to identify the main advantages and concerns related to cloud computing in small companies using the meta-analysis of scientific literature. As a result of content analysis of selected paper all identified different concerns about cloud computing was classified into four broader groups: security and privacy risks, provider, vendor risks, company's internal factors and lack of regulation and standardization issues.

The results of a meta-analysis show that, for small companies, the most concerns are about security and privacy of cloud computing. In line with technology development there increase concerns about the company internal factors, for example, how cloud computing could affect organization corporate IT culture. Furthermore, the shift from just technical problems of cloud computing to the social factors is noticeable. It is also observable that the same identified factors by different authors could be assigned to both advantages and concerns of using cloud computing concept by company. That also can be seen as a paradigm shift that has to investigate further.

There is no doubt about high potential of cloud computing for small companies but as it evident from the study the concerns about usage of cloud computing from year to year increase. It could be explained by the lack of proper understanding of cloud architecture, its pricing models and its suitability to companies' different needs.

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