

## Improving business processes by Cloud Computing in SMEs

**Summary:** Cloud Computing solutions are nowadays one of the leading issues that small, middle and large enterprises face. The paper presents the benefits of the implementation of cloud solutions in small and medium businesses, factors which can have an influence on the level of the use of cloud systems and appropriate areas in which cloud systems can be used. Moreover, further development of this approach has been described. For academia, the results of the paper can serve as a useful extension for future works in this field. For businessmen, the findings would benefit them in terms of arriving at a decision toward cloud computing implementation and defining better strategies for cloud computing deployments.

**Keywords:** Cloud Computing, Cloud in business, business processes, SMEs.

### **Poprawa procesów operacyjnych przy wykorzystaniu modelu przetwarzania danych w chmurze w małych i średnich przedsiębiorstwach**

**Streszczenie:** Rozwiązania oferowane przez model przetwarzania danych w chmurze stały się obecnie wiodącymi zagadnieniami, którym małe, średnie i duże przedsiębiorstwa muszą stawić czoła. Artykuł prezentuje korzyści z wdrożenia rozwiązań oferowanych przez chmury dla małych i średnich przedsiębiorstw, czynników, które mogą wpłynąć na poziom wykorzystywania systemów przetwarzania danych w chmurze oraz właściwe obszary gdzie takie systemy mogą być wykorzystywane. Ponadto, opisano również dalszy rozwój tego zagadnienia. Dla środowiska akademickiego, wnioski z artykułu mogą służyć do dalszych badań w tym obszarze. Dla przedsiębiorców mogą stanowić podstawę do podjęcia decyzji o wdrożeniu systemów przetwarzania danych w chmurze oraz zdefiniowaniu lepszych strategii rozmieszczania takich systemów.

**Słowa kluczowe:** chmura, przetwarzanie danych, małe i średnie przedsiębiorstwa.

## 1. Introduction

The concept of cloud computing (CC) has become so ubiquitous in economic and social activity that it seems quite reasonable to know or understand what it means. Critical features of cloud infrastructures include on-demand self-service, broadband access to

the network, shared resources, fast flexibility, and tools for assessing the quality of the services offered. Cloud access is concurrently available to a large number of consumers through virtualization technologies with self-scaling and automated provisioning capabilities depending on the number of processing requests.

CC refers to applications and services running on distributed networks that use resource virtualization techniques and can generally be accessed via the Internet using protocols and standard network services. CC ensures the transparency of physical resources and their configurations, with end users having the perception that the resources they have are theoretically unlimited[1].

Essential features of the cloud:

- Massive scalability;
- Ability to efficiently allocate resources;
- A service management platform[2], [3].

Self-scaling, also known as provisioning, provides the necessary flexibility for the correct allocation of processing resources over time. Auto-scaling refers to maintaining a dynamic allocation of processing resources according to the number of real-time processing requests.

From an economic point of view, self-scaling involves a resource-saving mechanism and, implicitly, lower bills. In addition to the main features of CC, researchers identify the new business concepts of multi-tenancy, you use (pay-as-you-go) and self-service. ResourceSharing or Multi-Tenant is different from standard processing (local computing centers), which involve the holding of specialized equipment (servers) configured and insulated by adequately securing. These physical resources can only perform processing operations of their own. In the cloud, physical resources belong to a company that provides cloud services by sharing these resources with its customers(4). As mentioned above, the cloud's economic model is based on the pay-as-you-go principle, referring to the processing and storage power allocated to the execution of a process, as well as to its use. Each contract for the provision of these services contains in detail the price per unit of processing, RAM, applications, storage capacities, or predefined virtual machine packages containing the desired configurations and applications. The cost savings for pre-configured packages are achieved through the technical configuration of self-scalability (5). Given the variety of cloud-based deployment and organization models, it is essential that business decision makers adequately inform about their types and are more likely to be prepared to make a fair assessment of business processes which can be served by cloud providers.

Theoretically, the amount of processing and storage resources that a user can benefit from is unlimited.

## 2. Literature Review

A significant number of scientific and professional publications on CC in SMEs (Small Medium Enterprises) have been analyzed in this articles: [6], [7], [8], [9]. The quite remarkable result of research related to CC has been described by Yazn Alshamaila, Savvas Papagiannidis and Feng Li (2012) in a paper titled “Cloud computing adoption by SMEs in the north east of England” [10]. They have admitted that “the last ten years have witnessed some extraordinary innovations, and caused a great wallop on the direction business is performed. Cloud computing services have been defined in many different ways, typically focusing on technical and service characteristics”. According to Buyya et al. (2008) “Cloud computing is a new and promising paradigm delivering IT services as computing utilities.

As Clouds are designed to provide services to external users, providers need to be compensated for sharing their resources and capabilities. In this paper, they have proposed an architecture for market-oriented allocation of resources within the Clouds. They have also presented a vision for the creation of global Cloud exchange for trading services [11]. Sara Trigueros-Preciado, Daniel Pérez-González and Pedro Solana-González (2013) indicate that the security issues and the distrust generated by transferring data to third parties as the two most important barriers to using CC. Thirdly, the ignorance of managers on how to measure the results generated by CC and to establish proper cost-benefit analyses are highlighted as a further barrier. Companies also indicate as barriers, although of less importance, the availability and quality of service, the possible difficulties of changing suppliers and compliance with legal data protection requirements [12]. The literature review of CC states that the research on this issue has mainly concentrated on the CC concept, its features, benefits, services, models and security aspects from a technological point of view. There is not a sufficient number of articles related to methods of implementing CC in SMEs [13], [14], [15].

This paper is organized as follows: Section 1 introduces CC and its role from an economic point of view. Some of the central concepts of CC have been presented. Section 3 explains the methodological approach of a scoping review. Section 4 presents the results/ answers to the questions described in Section 3. Section 5 provides the Conclusions and proposals for future work.

## 3. Research methodology

### Problem Statement

An analysis of the CC in selected SMEs in Poland shows that this kind of solution is used very seldom. The level of implementation depends on many factors. This results from the fact that:

- Owners do not have any strategy for developing CC systems.

- There is a lack of digital entrepreneurial culture in Europe.
- There is not a sufficient level of skills and knowledge related to ICT.
- There is difficult access to finance and investments.
- Owners of SMEs don't have enough knowledge about CC, and not sufficient funds as well.
- There are still unpredictable conditions connected with running a business.

It affects the level of technical problems, limits the employees when implementing innovative changes and finally leads to generating low profits from business activities. In Poland, only some managers are aware of the need for implementing CC systems. Therefore, few of them, when necessary, try to improve the current situation.

### Research gap

It can be noticed that, unfortunately, research in the area of SMEs, and in particular micro-enterprises, is not an interesting area of research for many scientists. SMEs do not have significant funds to conduct research, and it can even be said that in most cases they do not have any at all. Only EU programs seem to be an incentive for joint activities between businessmen and scientists. However, in this case, this does not solve the problem due to the involvement of business owners in the daily duties associated with the company's operations. These factors mean that SMEs from the scientific point of view still seems to be a niche area.

### The Goal of the Study

- To identify the benefits of the implementation of CC in SMEs;
- To identify factors which can have an influence on the level of the use of CC in SMEs;
- To appropriate areas in which CC solutions can be used;
- To appropriate further development of CC in SMEs.
- Research Questions
- Which benefits from the implementation of CC in SMEs may be noticeable?
- Which factors can have an influence on the level of the use of CC in SMEs?
- In which areas can CC solutions be used?
- What further development of CC with particular emphasis on SMEs may be expected?

### Research method

In this paper, information is analyzed from several representatives, IT companies, several ICTs and economic papers concerning the current situation in SMEs in Poland. Additionally, the owners of one Polish SME were interviewed. The dissertation begins by presenting the benefits of the used CC. Subsequently, the thesis reflects on the evolution of the use of CC in SMEs in Poland.

The Internet was for the thesis a source of the latest information, not available yet in the papers. The data for directing the research were also gathered from primary sources: company reports, official websites of the company and secondary sources: books, articles, journals and company reports with data concerning the Polish SMEs. Phone conversations were made by representatives of CC companies responsible for the execution of advanced solutions for SMEs

Moreover, the author's personal experience in running a small IT company constitutes a significant source of valuable, reliable and actual information on the functioning of CC in Poland. Thus, this methodology seems appropriate for the achievement of the objectives of this research.

## 4. Results

### 4.1. The benefits of the implementation of CC in SMEs

Cloud computing will dominate for a long time how business will run in the context of information technology support. So it can be said that the ability to make decisions is now based on the power of IT tools to collect, process and deliver information for decision-making. The early days of cloud computing announced Clouconomics that has dictated to date how cloud-based services are delivered [16].

The main economic benefit of cloud computing solutions is the lower total cost of ownership, due to the efficient use of resources through their pooling (multi-tenancy) and innovations in the field of technology [17].

Cloud computing as a business model is considered to be efficient because it transforms capital expenditures into operating expenses, thus facilitating the availability of financial funds for ongoing business operations [18].

It also has the role of transferring some of the operating risks from the organization to the cloud provider. Companies often lose sight of the indirect costs associated with the purchase, installation, and use of services on their own IT equipment, which sometimes exceed the cost of purchasing the hardware. When cost analysis is carried out, companies must include all cost elements, including staff involved and electricity costs. See figure 1 below:

There are several reasons why organizations consider CC to be a viable alternative to using information technologies. Thus, in the near future, the vision of the role assigned to IT departments will be different, while with a series of service distribution models and the establishment of traditional organizational structures, it could be remodeled to be consistent with cloud computing power. Among these reasons are the following:

- Low cost of cloud solutions;
- Speed of response and increased flexibility;
- IT costs correspond to the actual volumes traded;
- Business users have direct control of decisions regarding the technologies used and their volume.

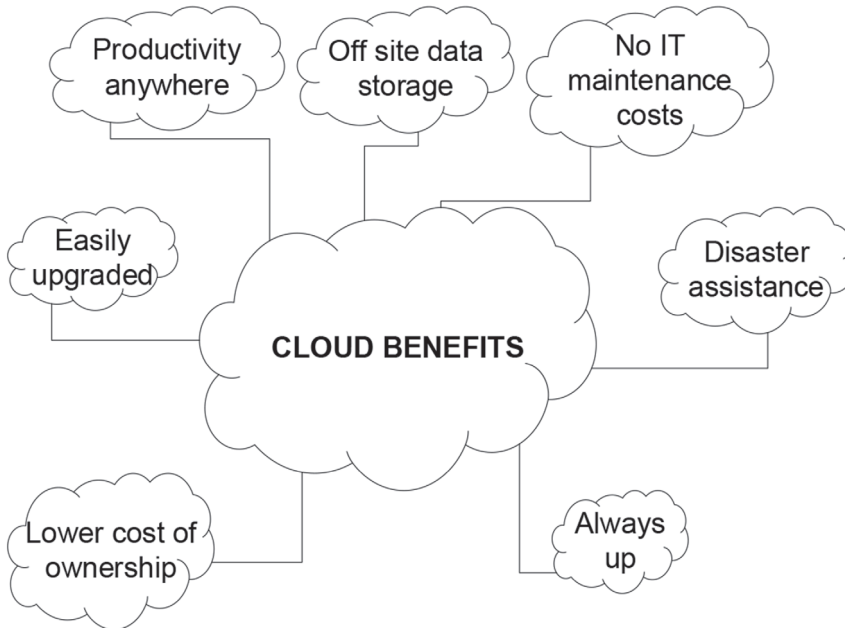


Figure 1. Cloud benefits [19]

The delimitation between user-driven and in-house applications tend to fade through the widespread use of web technologies in providing information services.

- The advantages of implementing the services using CC are as follows [20]:
- The time required to implement new services;
- Real-time cost control;
- Scalability in line with demand;
- The ability to adapt the resources used.

Each of the listed benefits is closely related to the architecture on which the cloud service is built, but also to the practices used in the cost management process and information storage services. Despite the substantial benefits involved in using these technologies, there are also a number of economic risks that they bring with them:

- It affects business continuity indicators;
- Changes that may result in many cases in CC provider proprietary technology [21];
- Low portability of cloud-based services;
- Low interoperability between cloud providers;
- Problems related to events such as natural disasters and not only.

By compiling more studies and articles over time, it has been noticed that there is a pattern of companies that adopt cloud technologies for the whole IT business or just for some of their sectors:

- Applications for electronic communication (email or IM) and collaboration;
- Enhancement of the physical infrastructure of old servers through virtualization;
- Social media companies;
- Companies working in the electronic business field;
- Processing and analyzing large volumes of data;
- Mobile apps,
- CRM applications,
- Creating pilot platforms for testing specific applications;
- Backup services or file persistence.

Cloud migration, using an implementation model is not just a simple decision, both technically and economically. Many SMEs don't have their own procedures and working methods that have ensured real existence of large IT & C business.

The present and the extent of the cloud phenomenon somewhat surprisingly affects such businesses because they have to adapt or lose their customers in the absence of concrete flexibility.

## 4.2. Factors which can have an influence on the level of the use of CC in SMEs

There are many reasons that lead to SMEs' difficulty in implementing of CC. Extant theories imply that managers, employees, customers, ICT, type of business, company, location, government support and financial resources have a positive or negative effect on SMEs' ability to implement CC.

As far as SMEs in Poland are concerned, our empirical study finds which factors mentioned above play an important role. See figure 2.

The result is disappointing, and it proved the existence of information problems and that banks had taken a simple way to protect themselves. Most SMEs are in a growth phase, with a small or medium size, and by themselves cannot provide sufficient and qualified collateral for CC, so it's natural that many SMEs' CC solutions do not bring the expected results. Based on this research, it is essential to find an answer to many questions. Abubakar, A.D.Allison, Ian (2014), in a paper titled "Cloud Computing: Adoption Issues for Sub-Saharan African SMEs" have prepared the survey. The selected essential questions have been presented below:

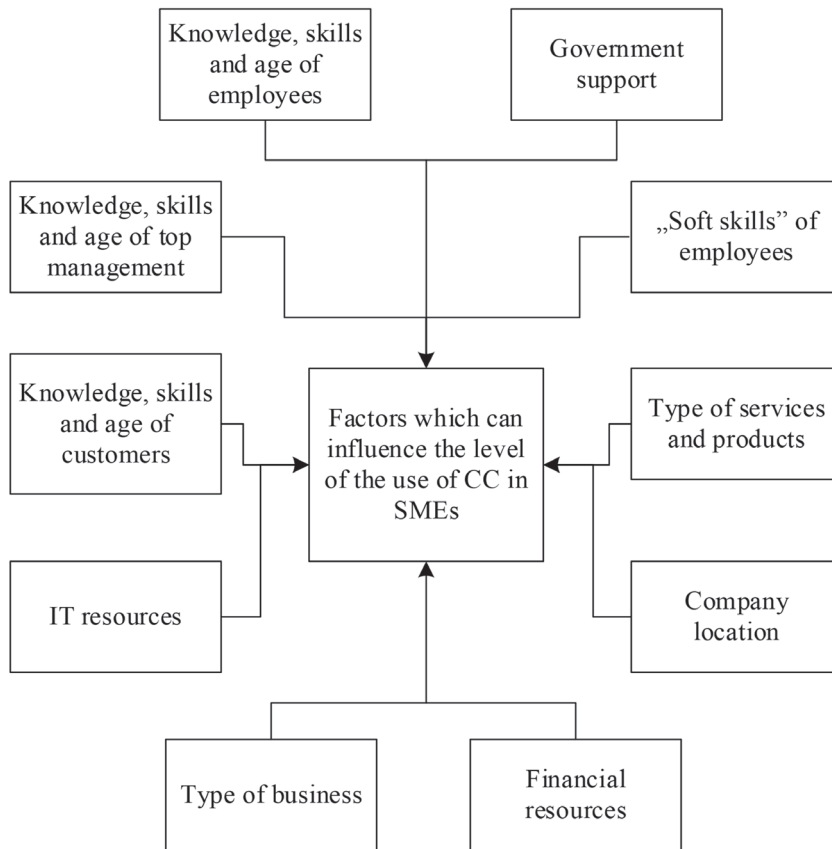


Figure 2. Factors which can have an influence on the level of the use of CC in SMEs, own elaboration

#### About SaaS Cloud use:

1. Do you use (or have you previously used) any software applications to support the services you offer and management of daily schedules? e.g., billing or accounting, emails, etc.
2. Do you use any software applications remotely on (via) the internet?
3. How secure do you think any information/data you keep on the internet is?
4. What about privacy and trust issues?
5. Can you briefly compare the experience you've had in using software apps delivered remotely on the internet to when these apps were installed in houses? (e.g., in managing software upgrades and maintenance, cost, etc.)
6. What are some of the things that you have really liked about the use of these new apps and how they are deployed?
7. How useful or efficient do you think the use of software apps hosted in the cloud has been to your enterprise?



8. How have government policies on enterprises like yours affected the ability to use (or not) cloud-hosted software applications (outsourced) from foreign companies? (e.g., In terms of support, restrictions, etc.)
9. Where do/did you get information about new technologies from?

### About your Enterprise

1. What is the size of this enterprise?
2. What is the name of your department and how many people do you work with?
3. How is the decision making organized?
4. Who is in charge of design/implementation/deployment of Information Systems in the enterprise?

### About the manager

1. How old are you?
2. What is your role/position in this enterprise? (Management/technical staff)
3. How long have you been working with your current organization (in this position)?
4. What experience or formal qualifications do you have?
5. When did you qualify for this role? [22].

## 4.3. Areas in which CC solutions can be used

### 4.3.1. Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP) is specialist software in business management that finds, stores, manages and interprets data. It provides a view of a business process through the use of databases that are being taken care of by a management system. ERP systems are tools supporting the management of a modern enterprise. Modern ERP has sophisticated software modules characterized by such features and capabilities as the ability to work in “cloud computing” and virtualization.

Also, there are modules more frequently used, which have specific features of BI and can very efficiently transform data from the ERP into information for the decision-maker. Some systems also have dedicated modules for employees and customers, accessible through the Internet. You can specify example areas of the business management of ERP systems such as supply, production, sales, marketing, distribution, after-sales services, finance, HR.

### 4.3.2. Customer Relation Management (CRM)

There is no precise definition of CRM. In the literature, you can see the many interpretations of the same issues, but all these definitions have one common denominator – it is customer oriented. You can treat CRM as an application system or software which allows increasing profitability by automating fundamental processes

taking place in the company. The idea of CRM from a technical point of view is to replace human activities while striving to achieve optimal results.

The technology is intended to improve the work of a man, which in perspective is the most straightforward channel to reduce costs. The company can manage customer relationships in line with the philosophy of CRM and the need to change existing activities. You can specify example areas of the business management of ERP systems such as marketing, sales, orders, support.

### **4.3.3. Supply Chain Management (SCM)**

Supply Chain Management software is now readily available for small and medium-sized businesses. That's because Enterprise Resource Planning (ERP) systems have come a long way in their ability to help small and medium-sized enterprises (SMEs) achieve growth through Supply Chain Management. You can specify example areas of the business management of SCM such as Supply Chain Strategy, logistics management, procurement, information management, supply chain planning.

### **4.3.4. Other systems**

You can specify example areas of other systems functioning in CC such as telecommunication systems, monitoring of employee activities, tracing of company cars, electronic document flow, electronic signature, social media, mobile solutions.

## **5. Conclusions and future work:**

It could be admitted that each SME has quite specific purposes and requirements, which mean that the implementation of CC in SMEs must be managed cautiously to avoid any problems. Many analyses have indicated that CC could be a significantly cheaper alternative to purchasing and maintaining a private system infrastructure. Besides, this technology improves business process efficiency, reallocating resources (IT systems, employees) and reducing the cost of running a business.

Although the results of research and analysis have demonstrated the benefits of the use of CC, they could be further developed in a number of ways by testing more available solutions and testing the systems taking into account the key factors which can have an influence on the level of the use of CC in SMEs. An exciting direction for further research may be the search for an effective method assessing to what extent and to what extent CC solutions can be successfully applied in SMEs.

At a macroeconomic level what should be emphasized is the role of CC in accelerating globalization processes by how implementation and service models provide another dimension of working beyond the physical boundaries of a country and the global marketing market for the implemented applications.

This article presents many areas where CC can be used. However, it cannot be forgotten that the degree of use of this technology is strictly dependent on many factors that affect the validity of the solution. This means that there may be situations where the use of CC will not be justified. Likewise, there may be cases when virtually all business processes can be implemented using CC. A significant problem is the lack of developed methods for implementing CC solutions in SMEs.

For this reason, further research will focus on developing an effective method of improving business processes with CC, taking into account such factors as managers, employees, customers, ICT, type of business, company, location, government support, financial resources.

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