Cloud Computing in Polish SME Enterprises

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Abstract. *Currently, it is not possible, for enterprises, to operate without computers or the Internet. Internet has contributed, not only to speed up the transfer of information, or to make available various information sources. With the technologically and economically development, and new needs created among Internet users, the cloud computing was established - a solution which offers a range of tools and applications, that can be used by private users and companies. Due to the increasing popularity of this solution, the authors of this article, created and sent a survey questionnaire to the companies using the cloud, to inquire about their opinion about the cloud. This article presents the results of research conducted among enterprises in the SME sector, on the use of clouds in their activities.*

Keywords. cloud computing, cloud application, SME, enterprise, advantages, disadvantages

1 Introduction

Just 30 years ago, enterprises operating on the Polish market, have been using simple computing machines. Computers were devices not only expensive, but also difficult to access - only banks used its computing power to conduct banking operations. However, since the 90's, this state of affairs has changed, and more and more companies have received its computers and applications. And that resulted in acceleration and overall improve of their performance. Companies operating in the production sector benefited from the MRP systems, ERP or MRP II, companies operating in the trade sector benefited from applications such as CRM and EDI. Today, computers are being used in almost every company, it is hard to even imagine conducting business without a single computer. The following figure shows the stages of development of IT technology - ranging from simple terminals, computer networks, grid and ending with the cloud.
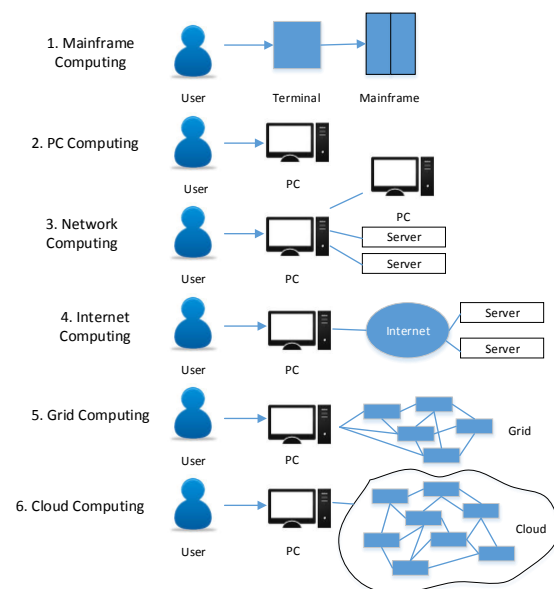

Fig. 1. From mainframe computing to cloud computing.

In the first phase, users benefit from simple terminals and servers, in the second phase, personal computers have enough processing power to meet the demands of a single user. In the third phase, computers and other devices are connected in a network, that provides access to information and applications. The fourth phase is a combination of local area networks into one global network or the Internet. In the next stage, computer networks allow users to use all the power of connected computers and the ability to store information or data. However, in the sixth stage, the cloud provides access to an increased number of information resources and data in a very simple way.

Of course the Internet cannot be forgotten, which spread also significantly contributed to changes in a business activity - the first thing that comes to mind is that, the Internet has changed the way of mail - instead of sending mail by post, mail become an email, which the recipient receives only a few seconds after it left outbox. It caused a significant acceleration in the exchange of information between every company, its supplier or contractor. The Internet has

enabled the linking of computers in the network, which resulted, that several users can work on one system and even on a single file. Initially, the company had several branches, sometimes located in another city or country, and had so many computer networks as branches, and the information and data exchanged between the branches were sent via the Internet . Also, all data and information were placed on the so-called. primary server, with which all the computers were connected.

It was a good solution, until the company have been using computers connected in a network. However, today, firms also use portable mobile devices such as smartphones, PDAs, tablets or readers. And as far as a person working at a computer in the office, can quickly download the necessary data from the server or file, employee staying outside the company may have trouble with this, or to download the file may take a long time.

In addition, the popularity of computers and the Internet also contributed to a significant increase in the amount of information used by the company, which often results that the company's server has not enough free space to store all this information.

These two above factors (but not only) gave rise to the so-called. Cloud computing - the technology which is often defined as a new direction in computer technology. In which, there has been integration and virtualization of sources and Internet services. Currently cloud computing is being treated as a technological trend with significant meaning, and which in the future, may change the current form of information technology, in terms of applications and the entire IT market.

2 "Cloud" in a nutshell

There is no single definition of "cloud", depending on the nature of its use, or its users, the concept of defining the cloud take different form. In the simplest sense refers to cloud applications and services, that operate over the Internet and use virtual resources data and information[1]. Many people understand the cloud as nothing more than Internet, but under a different name. This is due to the fact, that many systems and services based on the Internet can cause, that the Internet can also be understood as a cloud. This causes that lot of users treat web applications as a cloud applications. Cloud is a concept based on the abstraction of physical changes in the virtual sources. It is a model of access to sources of data and information, both for applications and platforms - independent users. Cloud has many types, offers a variety of services and applications, which may or may not be provided by the cloud operator.

Cloud can be defined as: „*Cloud is a parallel and distributed computing system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers"*[2]. Another cloud definition describes cloud as: "*large pool of easily usable and accessible virtualized resources. These resources can by dynamically reconfigured to adjust to a variable scale, allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service Level Agreements"*[3]. And the definition given by the National Institute of Standards and Technology characterized cloud as: "*a pay-per-use model for enabling available, convenient, on-demand network access to a shared poll of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction"*[4]. As can be seen in the cloud definition, very often appears the "pool" term - open and accessible to all users. Sometimes the pool is limited only to users who purchase access to the applications offered by the cloud provider (tools offered by Microsoft), and sometimes it is a public pool - each user has unlimited access to applications (applications offered by Google). Besides "pool" term, in cloud definitions repeat the terms such as pay-per-use, flexible capacity and the illusion of infinite resources and self-service desktop. But the simplest way to show the essence of cloud is being presented in the figure below.

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[2] Buyya R., Broberg J., Goscinski A., "*Cloud computing. Principles and paradigms",* John Wiley&Sons, UK 2011, p. 45

[3] Vaquero L.M., Rodero-Merino L., Caceres J., Lindner M., "*A break in the clouds: towards a cloud definition",* in: ACM SIGCOMM Computer Communication Review, vol. 1/2009, p. 51.

[4] Mell P., Grance T., "*The NIST definition of cloud computing",* NIST, US 2011, p. 2.

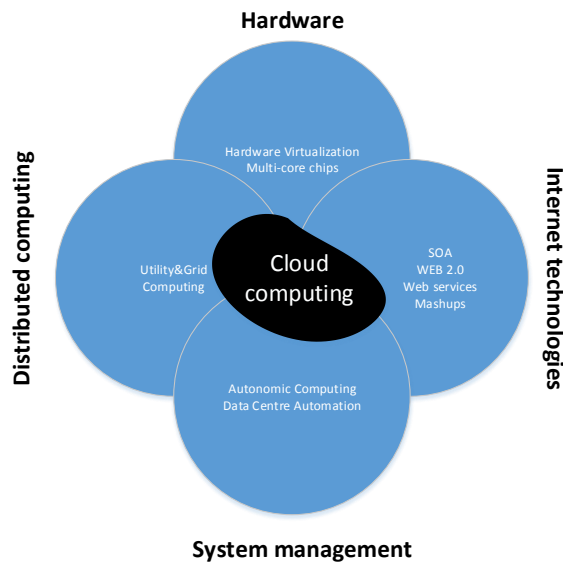[1] Sosinsky B., „Cloud Computing Bible", Wiley Publishing, US 2011, p. 3.

Hardware

Fig. 2. The essence of cloud computing.

The cloud is a kind of measure and the final form of the continuous development of individual technologies, services and applications. Cloud uses virtual tools, that use multiprocessor chips or computers in a network. While Internet provides the cloud the right tools that ensure correct operation and dedicated management systems allow to not only for information storing in one place, but also for their quick transfer and change.

Cloud can be also seen as a group of services (figure), which can be divided into different types.
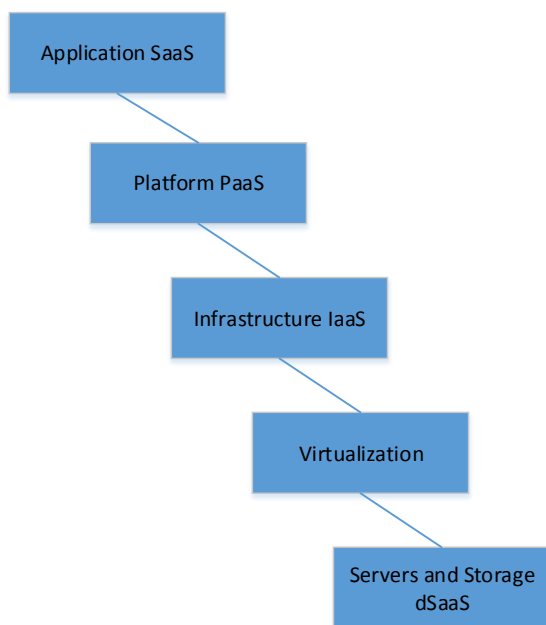

Fig. 3. Cloud's layered architecture

These services are treated as a simple layers of cloud, and each of them fulfill different task or offer different tools to individual users[5]:

SaaS (Software as a Service) applications – usually cover IT services, which can be used by user through the Internet.

IaaS (Infrastructure as a Service) refers to computers resources as a tool. It includes virtual computers, which provide a guaranteed speed and limited space for information or data.

PaaS (Platform as a Service) includes operation systems and requires single application tools. In other words PaaS is an IaaS with additional software package.

dSaaS (Data Storage as a Service) provides the space for file storage.

Cloud can be divided into 3 types:
- public cloud,
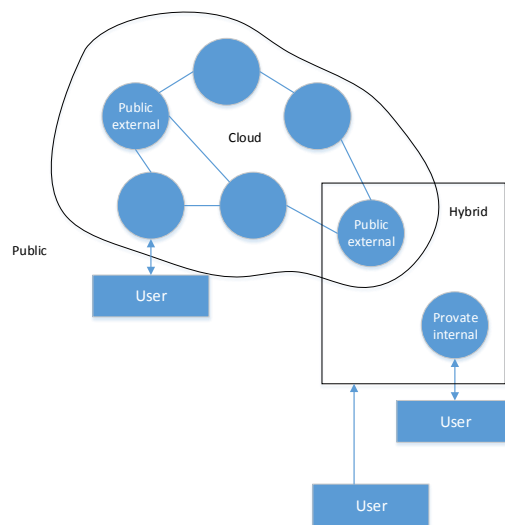- private cloud,
- hybrid cloud

Fig. 4. Cloud's types

Public cloud resources are constantly available via the Internet or web applications. Private cloud most commonly refers to a private computer networks. Private cloud is most often created for individual user, providing full control over the data, protecting and providing high-quality services. Most often it is a property of the company and its employees have only access to it. In turn, hybrid cloud is a mix of public and private - some of it is widely available, while individual resources are only available to individual users

3 The cloud in company

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[5] Furht B., Escalante A., „*Handbook of Cloud Computing*", Springer Science-Business Media, LLC 2010, p. 7.

In 2012, the number of companies registered in Poland, amounted to more than 4 million, with more than 3.8 million were micro-enterprises, over 170 thousand - small businesses and more than 31 thousand medium-sized enterprises. Total businesses in the SME sector accounted for 99.9% of all businesses operating in the Polish market. As was mentioned above, today's company could not, or it would be significantly impeded, operate without the use of modern information systems, computers and the Internet. Initially, the company bought a single computer on which, they performed simple calculations or to create business documents. The next step was to combine a number of workstations in a network, which in turn has enabled for faster data transfer, and access to the same document from different computers. The Internet connection was a milestone, which enabled rapid exchange and acquisition of information from the external environment. There have also been integrated management systems that streamline and significantly accelerated all processes in the enterprise. One of the effects of dynamic technological development was the rise of cloud, and offering its solutions. Due to the often repeated statement, that the cloud is a solution specially dedicated to small and medium-sized enterprises, this article presents the result of research that was conducted among Polish companies from the SME sector. For the study, a survey was created containing questions about the use of clouds by enterprises. The purpose of the survey was to investigate whether and to what extent Polish companies benefit from the cloud - whether it is a term known in theory only, or Polish companies long time ago have recognized the benefits of cloud application and use the cloud for their own purposes. The survey was sent to more than 70 companies operating in the city of Czestochowa , however, only 47 questionnaires were back completed. The next section presents the results of the study .

4 The results

At the beginning, the main characteristic of surveyed companies is presented – size, profile and range.
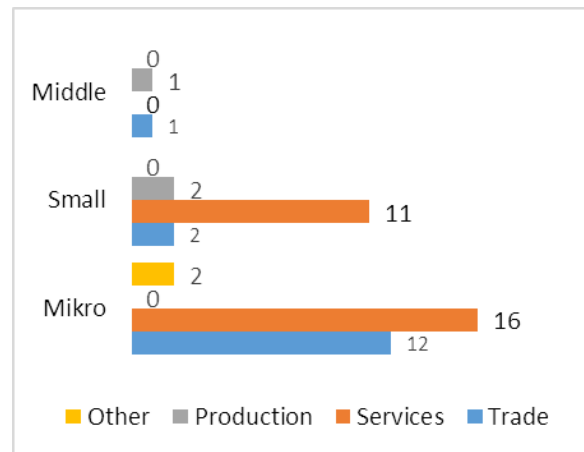

Fig. 5. Size and profile of the companies.

Among the selected companies, were 30 micro-enterprises (employing up to 10 persons), in second place were 15 small companies (employing 10 to 50 people) and only two medium-sized enterprises (employing more than 50 persons). Under consideration trade, industries, services and production sector were taken, but two microenterprises reckoned its activities to another industry - in their case was production-trade sector and trade-service sector. Both, the greater part of the micro and small enterprises operate in the service industry, 14 companies operate in the retail sector and three companies in the manufacturing industry – pushchairs, footwear and stationery production.
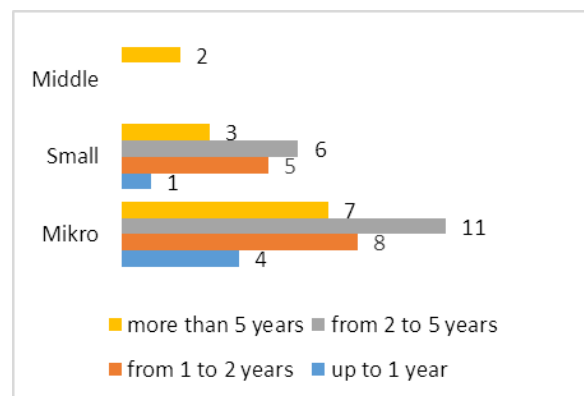

Fig. 6. Duration of operating on the market

The highest percentage of surveyed companies operates for more than two years and less than five years. Among the very young companies that operate in the market less than a year, were four micro and one small companies. Among the companies operating on the market more than five years, there is seven micro, three small and both companies included in the medium. Generally, it can be assumed that the investigated companies are young companies, continuously trying to get a strong position on the market, and consequently, being up to date with the so-called. technological innovations and informatics. Because quick response to changes or new solutions

implementation can contribute not only to improve their situation, but also to achieve greater stability in the market.
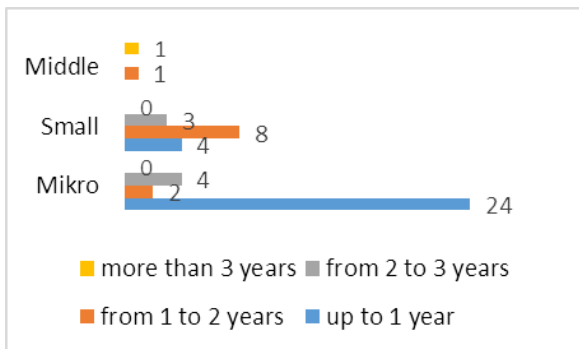

Fig. 7. Duration of cloud use

The overwhelming part of the surveyed companies, use the cloud shorter than a year, only one medium-sized enterprise use the cloud for more than three years. Less than 20 surveyed companies have used the cloud for two years. This is due to the fact that cloud - both from the technical and application, is still kind of a novelty on the Polish market. And most companies only heard about the possibilities that it offers. However, in the case of one company - it has operated on the market for more than five years, has a fairly strong position, hence - its IT structure is so extensive, that more than three years ago, the company decided to place their information resources in the cloud. This was caused not only by the amount of information, but above all, the possibility of facilitating access to information for persons, who are outside the company, and with using any device other than a computer (sales representatives use smartphones , customer who wants to check the availability of certain products, or download document) . It can be assumed that with the growing popularity of cloud in the next few years, the percentage of enterprises using cloud at intervals from one to more than three years, will increase.
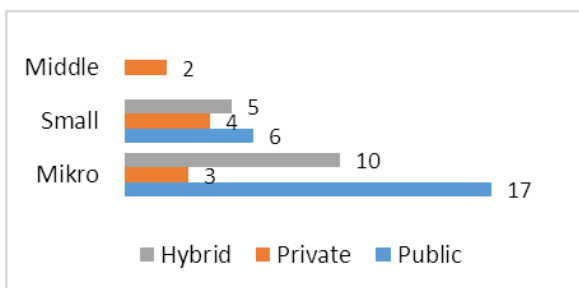

Fig. 8. The use of cloud types

Enterprises which use private clouds those that arise under a specific system and are dedicated to a particular company, are the smallest part in the survey. Among the surveyed companies - all medium-sized companies use private cloud , and small and micro enterprises – in total only 7 companies use this

type of cloud. Most of the surveyed companies use the open-type clouds - a collection of applications that are accessible via the Internet. In contrast, 15 companies use hybrid cloud - in which some parts are widely available (a sales representative has access to the public part, at the moment when it is away from the office and accountant has access to the financial data stored in the part of private cloud). Among the micro-enterprises, 17 of them use public clouds - due not only to the availability of applications but most of all for the cost. Most applications are widely available for free or for a small fee. In the case of the hybrid clouds - the company benefit from it, admit that in the case of less important information, but their large amount, use publicly available applications. However, in the case of financial or accounting information, they are stored in the part of the private cloud .
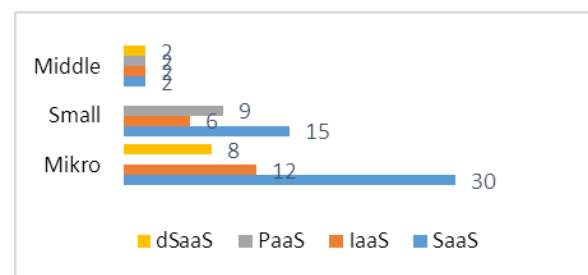

Fig. 9. The use of cloud layers

Among microenterprises, all of them use the SaaS layer - applications that are accessible via the Internet, and only 12 micro use IaaS layer - the virtual machines offered by the cloud, and only 8 use dSaaS - layer that allows to store large amounts of information and data. At the same time, these companies benefit from applications that are widely available, and thus free, usually keep on them a big amount of information or data, but they are not very important (eg catalogs, offers or advertisements). In the case of small businesses – all of them use the SaaS layer as well. Six companies use an additional layer of IaaS and 9 of them - PaaS layer - operating systems platforms, which software is specially dedicated to those companies. In contrast, both medium-sized enterprises benefit from all layers of clouds, ranging from applications and virtual machines to the platform operating with space for data storage. In addition, as shown in the previous charts, both of them use the private clouds.
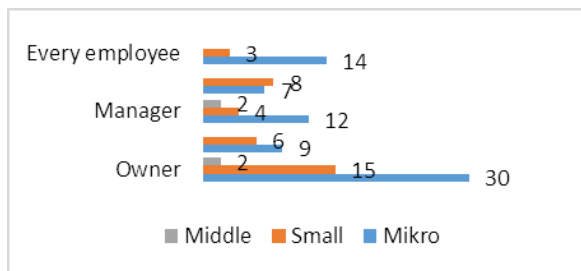
Fig. 10. Access to cloud

In every surveyed enterprises, full access to the cloud has the owner. In the case of micro-enterprises, in almost half of them, in addition to the owner, also every employee has access to the cloud. And only in three small companies an every employee also has access. In 12 micro companies the manager only has access to the cloud. In most small businesses - either a special employee or IT administrator has access to the cloud.

Table 1. Sectors influenced by cloud

Sectors	Micro	Small	Medium
	Big influence - 4, Influence - 3, Small influence - 2, No influence - 1		
Media&Entertainment	1	2	2
eCommerce	4	3	3
Mobile	3	4	3
Social, Collaboration	1	2	2
Data Analysis	4	4	4

In the opinion of micro-enterprises, cloud has the greatest impact on eCommerce, Data Analysis, and then has an impact on the Mobile, but do not affect the Media&Entertainment or Social and Collaboration. This is due to the fact that micro businesses treat the cloud as a tool for the management of the organization, but do not see the benefits for the Media&Entertainment or Social and Collaboration. A bit similar opinion have small businesses - the biggest impact cloud has on Data Analysis and Mobile, a little less on eCommerce and the smallest on the Media&Entertainment and Social and Collaboration, but in contrast to the micro, they believe that occurs a certain effect. Medium-sized companies also believe that the greatest impact cloud has on Data Analysis, a little less for eCommerce and Mobile, and again the smallest on the Media&Entertainment and Social and Collaboration. As shown above, there is a certain consensus among the surveyed enterprises. The only differences arise mainly in the perception of clouds influence on different sectors.

Table 2. Cloud implementation reasons

Reasons for cloud implementation	Micro	Small	Medium
	Very important - 4, Important - 3, Less important - 2, Indifferent - 1		
Security	4	4	4
Accessibility	4	3	3
Ease of use	3	4	2
Flexibility	4	4	3
Better collaboration	3	2	4
Cost reduction	3	3	4
Better productivity	3	3	4
Quicker reaction	3	4	4
Fullfilling customer demands	3	4	4
Integration	1	3	4
Scalability	1	2	2
User control	3	3	3
Speed	3	4	4
Infinity Storage Space	2	1	4
Safe Backup	2	2	1
Easy Sharing	1	2	2
Editing and organizing on the go	1	1	3

The most important reasons for clouds implementation, the surveyed companies indicated: Security, Flexibility, Quicker reaction, Fulfilling customer demands, Speed and Accessibility. The second group of reasons include: Ease of use, Better collaboration, cost reduction, Better productivity and User control. In contrast, the least reasons for the clouds implementation, companies recognized Infinity Storage Space, Integration, Safe Backup, Easy sharing, Editing and Organizing on the go and Scalability. Among the first group, there was almost 100% agreement among all companies. In the second group, only medium-sized enterprises would include most of these reasons into the first group. And for the third group, there was the greatest disparity of reasons - where it can be seen, that in the case of medium-sized companies, most of the reasons were deemed important. Only Safe Backup was a reason not to be taken into account when implementing the cloud. Ease of use, Easy sharing and scalability were the reasons, that were considered less important. In contrast, micro-enterprises highlighted four reasons which, according to them, do not affect the cloud implementation - Integration, Easy Sharing, Editing and organizing on the go and Scalability. And among small businesses, only two reasons received the lowest score - Infinity Storage Space and Editing and Organizing on the go.

Table 3. Cloud in company's departments

Company's departments	Micro	Small	Medium
IT department	4	11	2
Production	21	4	2
Marketing	26	8	2
Customer service	22	7	2
Top management	6	10	2
Human Resources			
Finance		3	1
Logistics	16	13	2
Transport	13	9	1

The vast majority of businesses, use the cloud not only in all aspects of their business, but also in all sections and departments. But the Human Resources was the department pointed to a section that does not use the cloud, which use only the information system and computers in the enterprise. The most common reason for this, was the lack of need to use the cloud by this department. Mostly, this department bases on personal folders or text documents, stored on a corporate server. The remaining sections, use of the cloud greater or lesser. In micro-enterprises, the main departments benefiting from the clouds, are production, marketing and customer service. In small businesses, the cloud is mainly used by IT, customer service, marketing, logistics and transportation departments. However, in the case of medium-sized companies, the cloud is used by all departments, except Human Resources.

Table 4. Cloud advantages

Cloud advantages	Micro	Small	Medium
	Very significant - 4, Significant - 3, Less significant - 2, Indifferent -1		
Cost reduction on IT maintenance	3	3	4
No need to buy a software	4	3	3
Applications consolidation	2	2	3
Cut back on system software	4	2	2
Easy integration	2	2	3
No time and money needed for updates	4	3	3
Easy access to date from different computers	4	4	4
Speed up business development	3	3	4

The greatest advantage of the clouds, all the companies recognized the easy access to data from different computers, which is to say - the essence of cloud and pillar of its actions were considered to be the largest of its advantage. A large range also gained advantages associated with financial savings, for example no need to purchase a new software or acceleration in business development. For less important clouds advantages were considered: application consolidation and easy integration. And the micro recognized that the biggest advantages of cloud are those bounded with the savings, not only financial but also timing with accessibility features. Small businesses recognized, as the greatest advantage, easy access, and the least important advantages: application consolidation, integration and cut the back of the system software. In the case of medium-sized companies - the biggest advantages of cloud are - cost reduction, easy access and speed up on business development.

Table 5. Cloud disadvantages

Cloud disadvantages	Micro	Small	Medium
	Very significant - 4, Significant - 3, Less significant - 2, Indifferent - 1		
Dependent on reliability of Internet connection	3	3	2
Security issues	3	4	4
Costs	4	3	4
Inflexibility	2	2	1
Lack of support	4	1	2

In contrast, the greatest disadvantages of cloud were considered those related to safety, cost and lack of support. In case of the cost, a paradox occurs here - because, as seen from the previous table, cost reduction is treated as an advantage of cloud and in the case of defects – costs are the biggest disadvantage. This can only be explained by the fact, that in the case of advantages - companies have in mind the costs associated with the example of the information flow or the ability to use free computer applications. However, in case of disadvantages – it is probably about the costs associated with the development of dedicated platform or purchase the appropriate software for the use of the private cloud. Also, the security issue is still regarded as a defect - it can still result from a low level of trust to the cloud, especially public. Micro-enterprises, in particular complain of insufficient support in the implementation and management of the cloud, still, most of the problems they must solve themselves and learn how to use the cloud. In contrast, less important drawback is being dependent on Internet connection - this follows from here that, however, most companies

have a fast and powerful internet connection, which breaking is mostly caused by some serious, quite rare failures, and if they occur, most companies can use alternative Internet connections, for example, through telephone subscription or AERO.

Table 6. Recommendation for cloud

Overall insight on cloud implementation	Micro	Small	Medium
Strongly recommended	19	8	2
Recommended	4	3	
Not recommended			
No opinion	7	4	

When it comes to recommending clouds, the majority of the surveyed companies strongly recommend it. Seven companies simply recommend it, and 11 has not developed yet opinion. As a new clouds users, they do not have an open mind, they observe advantages of using the cloud, but also they see some disadvantages, and it causes them to refrain from expressing any opinion. In contrast, companies that use the cloud for more than a year, strongly recommend cloud, as this is a solution that can really help the company's operations and even contribute to its further development.

5 Conclusion

Among the results obtained by the company, it may be a surprise, that all of the surveyed companies use the cloud and there was no company, that does not use this solution. It is because, survey questionnaires were sent to companies that have just been using the cloud - because the objective of the study was to examine not how many companies use cloud, but what opinion about cloud they have, companies using tools or applications offered by the cloud. The studies suggest the following conclusions:
- Most of the surveyed companies are the new users of cloud and use the solutions offered by it for less than a year,
- The most commonly used type is public clouds and mixed,
- All companies use SaaS layer, sometimes in conjunction with the IaaS layer,
- In all enterprises, access to the cloud has the owner of the company, and apart from him, also managers, individual employees and IT administrators have access,
- Most companies believe that the cloud has the greatest impact on data analysis, and the smallest on the Media & Entertainment and Social and Collaboration,

- The main reasons of cloud use is security, accessibility, flexibility and speed,
- Mostly cloud is used by all departments of the company, the only department not using the cloud is Human Resources,
- easy access to date from different computers and cost reduction (on software , IT maintenance , software and updates) are considered as the biggest cloud advantage,
- While the biggest drawback of cloud is security and costs of its implementation, and lack of support ,
- In general, the majority of companies strongly recommend cloud in the company.
In conclusion it can be assumed that at the moment, cloud, its tools and applications, is still an innovative product for polish companies, but over the years, it should become more popular. Not only because of the technological development, but mainly due to the fact that the number of information will continue to increase, which will increase the demand for disk space, eg, in the case of security issues, the cloud may become so called safe outside the company, on which important data can be kept.

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