# Technological enviroment and SWOT Analysis of Cloud Computing in Europe

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***Abstract* :**

*Currently, technological development influences all aspects of human life. In company processes it affects the access to information, speed of information processing, and ways of communication. One of the most current technology trend is cloud computing. The aim of this contribution is to describe the current state of use of cloud computing in Europe, its strengths and weaknesses in the context of topical technological development. The basic methods used are analysis of the external environment and the subsequent SWOT analysis. The external environment involves forces outside the whole ICT sector. The attention is focused on technological environment. The results show low use of cloud computing in Europe. There is low quality of infrastructure in Europe, unresolved problems with legal regulations concerning data handling in the cloud, major cloud computing providers are non-European companies, and research activities often lag behind the fast-changing market environment. Opportunities can be found in coordinated government effort to support the cloud, need for technologies in relation to the growing volumes of data, and use in relation to mobile technologies.*

***Keywords—*** *cloud computing, SWOT analysis, Europe*

## I. INTRODUCTION

Currently, technological development influences all aspects of human life. In company processes it affects the access to information, speed of information processing, and ways of communication. It also increases the flexibility of employees, etc. In order to increase the flexibility and mobility of employees it is necessary to enable them to unlimited access to company applications, files as well as services at any time and from any place. Cloud computing offers a solution to this problem, which is based on already existing tried and tested technologies [17]. Cloud computing should make accessible any element of ICT infrastructure as an on-demand service: virtual computers, applications, Data Staging Area, servers and networking hardware. It thus offers ways of decreasing investment costs and operation costs and of increasing the efficiency of processes.

Cloud Computing was established by John McCarthy, a computer scientist. He described cloud computing as a technology used by thousands to tens of thousands of customers via remote access, by means of a network. His idea was further developed. Rammath Chellap [1997] was the first to use the term “cloud computing” in relation to this way of using ICT. The term “cloud” is only a descriptive expression for a schematic picture of the provider’s infrastructure. Cloud has been used in telecommunication for depicting the telecommunication network [18].

Another step forward in cloud computing development was the year of 1999 when the company Salesforce.com used its websites in order to provide the users with an access to its applications. This solution started to be used by more and more companies. Nevertheless, this way of providing applications was not widely accepted. Another company interested in cloud computing was Amazon, which did not like the fact it used only 10% of its computing capacity while the rest waited unused for cases of emergency or a peak use. As a result, in 2006 the first cloud computing commercial service - Amazon Web Services (AWS) emerged.

A year later Google, IBM, and a number of universities started to work on scientific and commercial programs based on Cloud Computing. Since 2009 Cloud Computing has been seen as a key future technology. HP as well as Microsoft included Cloud Computing among their most important technologies [19]. The interest of companies in Cloud Computing rose dramatically and at the end of 2009 the cloud market was worth USD 2.4 billion [20].

***The aim of this contribution is to describe the current state of cloud computing in Europe, its strengths and weaknesses in the context of topical technological development.***

## II. THEORETICAL BACKGROUND

There are currently a lot of points of view of Cloud Computing. They differ in particular in the way they define this term. One of the first suitable definitions originated in the academic environment, namely at the University of California – Berkeley. According to Armbrust [1]. Cloud Computing embraces applications in the form of services accessible to customers by means of a communication network as well as all hardware and software tools used by data centers providing these services. Forrester [2], a global research and advisory firm, widened the above mentioned definition so that it also covers the standardization of ICT tools on the supplier's side, and self-service principals the user's side. Cloud Computing is in fact a package of standardized ICT capacities (services, software solutions or infrastructure) accessible via the Internet on the basis of selfservice principles and the pay-per-use model. Marks and Lozano [3] consider hardware standardization to be a necessary prerequisite for the formation of Cloud Computing. The Gartner Agency proposes a more compact view of the problem. The whole concept is based on the way of using ICT when scalable and elastic ICT tools are delivered as services to external users through internet technologies. There are five unequivocal pillars of the whole concept [4]:

- services – customer needs and provider needs are separated by a clearly defined interface, which can be called a service,
- scalability and elasticity – service delivery can be progressively increased or decreased according to the topical customer needs,
- sharing by more users – ICT tools are accessible as a service shared by more customers,
- measuring by utilization – the service utilization is measured by means of suitably defined standards of measurement, which enable charging the service based on a number of payment models,
- internet technology utilization – services are supplied to the customer via the Internet.

### *A. Concept of Cloud Computing*

*1) Service Model of Cloud Computing*

Service model is a way of providing cloud computing services to the end user. Similarly to the definition and development of Cloud Computing, there are still certain disputes in this area. The following service models represent a compact view. Many an author, for instance [5], [6], [7], agrees to it.

*a) Public Cloud*

The basic characteristic of public cloud is cloud computing infrastructure accessibility to individual users or companies. The service provider must be an external entity. The same applies to the data center from which the service is accessible [7]. In relation to this model the so-called Virtual Private Cloud is sometimes mentioned. It is a solution that enables any organization to create a group of separate ICT tools in public space. These sources are isolated from the group only by means of logical configuration, not physically, which justifies the label "virtual private". Nonetheless, it is only the lessor who has an access to such tools and controls them fully [8].

*b) Private Cloud*

According to Mell and Grance [7] Private Cloud is every model which makes services accessible to the only entity.

The whole infrastructure can be administered by a third party or the given organization. On the other hand, Armbrust [1] can see the essence of the private solution in internal data centres, which make their services accessible exclusively to their own organization, not to the public or to other entities.

*c) Community Cloud*

This model makes the cloud infrastructure accessible to several organizations or to a group of people who use it. These organizations may share the field of interest or security policy [7].

*d) Hybrid Cloud*

Hybrid Cloud is a composite solution involving several mutually incompatible cloud computing solutions. The most usual is the combination of public and private models [8], sometimes community model is involved, too.

*2) Distribution Model*

Distribution Model deals with what the service offers, usually software or hardware, or their combination.

*a) IaaS – Infrastructure as a Service*

In this case the service provider pledges to provide the infrastructure. The main advantage of this approach is the fact that all hardware problems are solved by the provider. IaaS is suitable for those who own software (or a license to it) and do not want to care for hardware. IaaS examples are Amazon WS, Rackspace or Windows Azure.

*b) PaaS – Platform as a Service*

This service model offers a complex hardware and software platform. It is therefore sometimes called cloud ware. The PaaS service usually facilitates the creation of user interfaces and includes devices and services for application development which enable designing, development, testing, implementation and hosting [20]. The service users do not have to care for investment or building the infrastructure for development and subsequent operation of their applications. An example of PaaS providers are Google App Engine or Force.com (Salesforce.com).

*c) SaaS – Software as a Service*

This application is licensed as a service leased to the user. The users purchase an access to the application, not the application itself. SaaS is ideal for those who need only ordinary application software and require an access from any place at any time. An example is the well-known set of Google Apps applications or the Cargopass System, known in logistics.

## III. METHODOLOGY

The basic methods used are analysis of the external environment and the subsequent SWOT analysis. The external environment involves forces outside the company or, in this case, outside the whole ICT sector that can potentially influence the use of cloud computing. Analysis of the external environment and the characteristics of the technology has been described in detail in the context of previous work and internal research. Given the scale of this paper is only the technological environment analysis described and then directly so-called SWOT matrix (Strengths, Weaknesses, Opportunities, Threats), where are summarized strengths, weaknesses, opportunities and threats of the given segment. Technological environment was chosen because it provides an overview of the overall level of the situation in Europe.

## IV. CURRENT STATE OF CLOUD COMPUTING IN THE EU COUNTRIES

### *A. Trends in ICT sector*

ICT sector companies, including their suppliers, buyers, or those interested in entering this market, should closely watch the expected future development. It still holds true that well-functioning ICT can constitute for the company an important competitive edge or even a decisive factor for its survival. Current technological trends are described in the table no. 1.

TABLE I. TECHNOLOGICAL TRENDS IN ICT

| **Technological trends** | |
|---|---|
| ***Cloud computing*** | The whole system (called cloud computing) shares sources in order to achieve returns to scale, higher efficiency and productivity. The users can hire SW (SaaS), databases (DaaS), platforms (PaaS), data storage (STaaS) as a service. Providers mange and organize platforms and infrastructure, where these applications run. The users gain admission to cloud applications by means of the Internet or mobile applications. Half of the managers of large ICT companies believe (KPMG, 2012) that cloud is the main technology driver of future changes and innovation in the industry. |
| ***Mobile technologies and mobile commerce*** | Mobile technologies will be used for services like e.g. mobile commerce – purchase, payment, money transfer by means of mobile devices, mobile ticketing. |
| ***Social network platforms and sociallydriven ICT*** | Social networks will serve not only as gateways but also as ways how people use new technologies and trends of interaction with the surrounding world. |
| ***Change of technological innovation HQ*** | According to 40% of ICT company managers, the main world technology centre will move from Silicon Valley elsewhere, probably to China. |
| ***Shared data services*** | Data will not be owned but shared in order to better use their potential. |
| ***New data security*** | Data platforms will enable to decrease security risks. Doubling security tools and controlled security sources. Data platform will enable to better cope with big volumes of fast changing data. |
| ***New ways of analyzing data*** | The future belongs to technologies enabling new views of the aggregation and analysis of big volume unstructured data. |

| | |
|---|---|
| ***Breaking down the barriers between consumer and corporate technologies*** | Mutual penetration of technologies and solutions between end-user market and the market of company technologies.<br>It will be possible to use company or personal platform on a single device (tablet, smart phone). |

[a.] *Source: KPMG, 2012, Accenture, 2012b*

Surveys in the EU countries show that in the following years there is expected an investment increase in cloud solutions. For example, a survey of ERP (Enterprise Resource Planning) system implementation proves that 14% of companies have already been implementing a system in cloud [21]. Half of large ICT companies' managers believe (see KPMG 2012) that cloud is the most important technology driver of future changes and innovations in this field. 73% of addressed public sector representatives stated that their organizations should embrace cloud solutions in order to economize. The biggest obstacle is their concern about data security and therefore private clouds are more in demand [22].

These prognoses correspond with a prediction by IDC concerning the growth of European cloud service market. The development of this market will be significantly faster if it can count on government support. Fig. 1 compares these two alternatives and their development to the year of 2020 (in EUR billions).

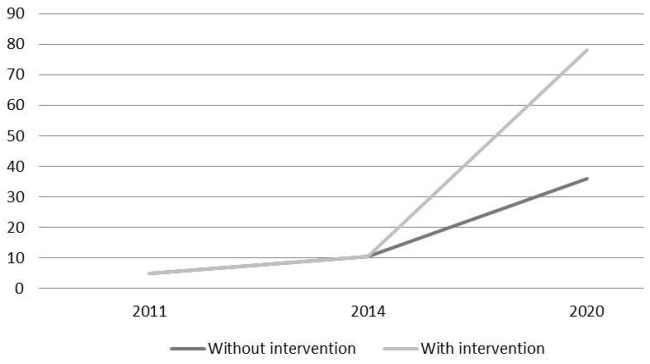


*Fig. 1. Growth of cloud technology market (EUR billions), source: [11]*

Cloud computing utilization development in the EU countries is not nearly as fast as in the U.S.A. In 2012, 4,000 PC users were addressed in nine EU countries. They were asked about their knowledge and utilization of cloud computing [12]. The survey was done by Business Software Alliance (BSA), which is an association of companies engaged in the field of software. The survey has found out that although cloud computing is a rapidly developing technology, cloud services are used by less than a quarter of computer users in the EU. The EU is therefore below the world average, which is 34%. Moreover, most computer users stated they did not know cloud technologies. 65% of respondents had never heard of them or had only overheard the term. The highest rate of cloud technology acceptance by users, namely 39%, was proved in small European economies, particularly in Greece or Romania. On the other hand, the rate of acceptance in Great Britain is 21%, in France 19%, and in

Germany 17%. According to experts, if the EU strengthens this field, then governments, companies as well as consumers may spare software costs and use computer technologies more efficiently.

Therefore, in the autumn of 2012 the European Commission submitted a strategy proposal for implementing the unified cloud computing use measures. The European enterprises should be more motivated to use this technology. The strategy sets four main objectives [13]

- to ensure that users can transfer the stored data among clouds, or erase them from clouds altogether,
- to introduce a certificate for trustworthy cloud service providers that would be valid in all EU countries,
- to make a template contract for providing cloud services, which would clearly determine the rights and duties of both parties,
- to create a European partnership for cloud computing that would facilitate cooperation between public sector and industry. It should strengthen the position of European enterprises towards foreign competitors, particularly those from the U.S.A.
- by the end of 2013 it should be clear whether it is necessary to take legislative or other measures to support cloud computing.

## V. TECHNOLOGICAL ENVIRONMENT

Technological Environment is represented by new production technologies, globally accessible and rapidly developing ICT and all related factors. Their utilization increases the economy's competitiveness, enables distance problem solving, accelerates processes, and initiates the necessity to reassess management. The moving force of their development is investment in innovation. However, there are a lot of other factors that contribute to their effective utilization. The analysis of European technological environment monitors factors related to new technologies:

- governmental expenditures in research and development, innovation, performance, patents, technology transfer, the society's technological facilities, electronic public administration.

The situation of some of them will describe in this paper.

### *1) Research and development (R&D) Expenditure*

Research and development hold an irreplaceable position in developed societies. The economic significance of innovation activities has been growing. Topical information about the state of research and development in the Europe is depicted in the following graph (Fig 2). This graph compares the proportion of R&D expenditures in relation to GDP among the EU member states, regardless of whether these expenditures come from private or public sector..

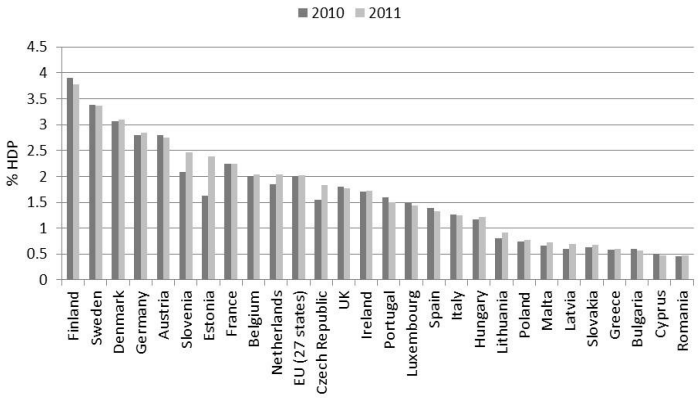


*Fig.2. Research and development expenditures (%) of GDP in the EU member states, source: the author according to Eurostat*

Another key factor of R&D development is risk capital investment, which is private investment in companies dealing with the development of new products and technologies, usually in the initial phase (start up and seed) or in the expansion phase. The level of these investments (expressed in % of GDP) in individual EU countries in 2012 is shown in Figure 3.

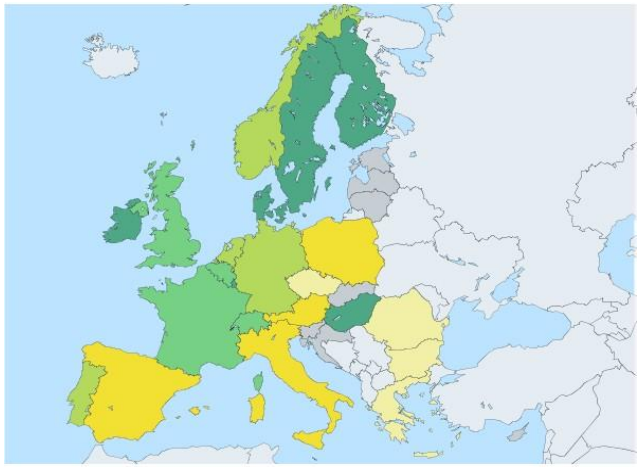

*Fig. 3: Risk capital investment in 2012, source Eurostat, 2013*

The highest level of these investments is depicted in dark green colour, the lowest in light yellow. Luxemburg disburses by far the most risk capital investment, followed by Denmark and Hungary.

*2) Innovation*

Innovation Union Scoreboard (IUS) is a system of assessing innovation activity that may show how successful countries are in this field. The mentioned system combines 25 indicators assessing the performance of national systems of research and innovation. Among the monitored indicators belong [25]:

- private as well as government expenditure on research, development and innovation,

- innovation of small, medium and large enterprises (internal as well as in cooperation with other entities),
- the amount of scientific publications and their citation index,
- the number of inhabitants with finished tertiary and higher education,
- the number of patents, industrial samples and trademarks, including resulting profits, employment in knowledge-intensive industries, high-tech production exports.

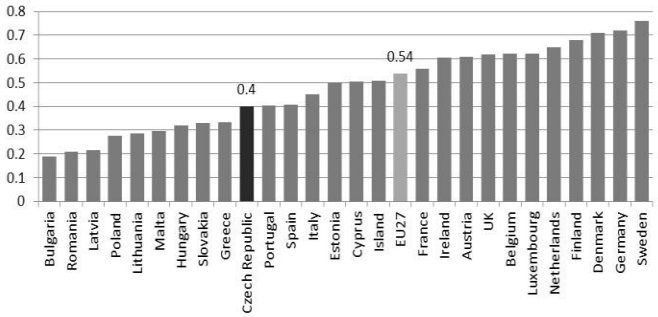


*Fig. 4. Innovation output of the EU member states in 2012, source: the author according to Eurostat*

Based on the above mentioned system of assessing innovation activity the innovation output in 2012 is in figure no. 4. The best companies are Sweden, Germany, Denmark and Finland. The average value of Europe is 0.54.

*3)* ***Patent Applications***

The data refers to the ratio of patent applications made directly to the European Patent Office (EPO) or via the Patent Cooperation Treaty and designating the EPO (EuroPCT) and patent application count by the year of applying. Figure 5 shows a comparison among Europena countries in 2011.

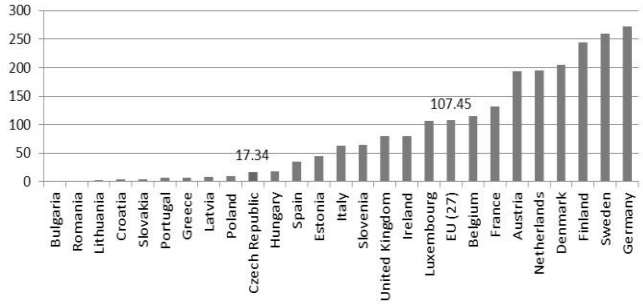


*Fig. 5. Number of patent applications in chosen EU countries in 2011 (per million inhabitants), source: the author according to Eurostat*

*4)* ***Chosen Technologies in Households and Companies***

Modern technologies offer improvements of possibilities in communication, speed and ways of spreading information. Not everyone has the same opportunities and skills to use the Internet. Consequently, the inequality causes the socalled digital divide among people [26], which privileges the users of modern technologies in various ways, for instance in looking for a job, in their communication with authorities, or in accessing any kind of information.

***a) Internet in Households and Companies***

The internet connection of chosen europena households has significantly changed in the last five years. There has recently been a fast outset of technologies offering much higher volume of transmitted data and thus further possibilities of utilizing the Internet. In 2012 there were on average 76% internet-equipped households in the EU (fig. 6).

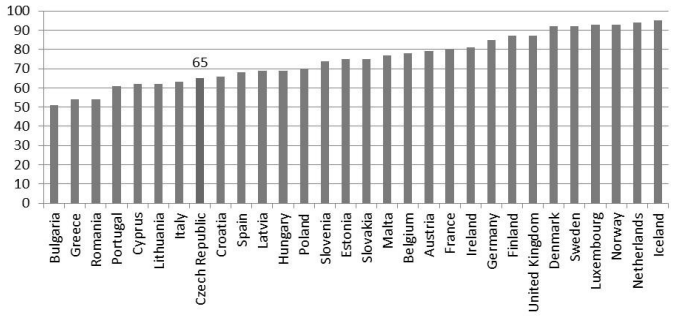


*Fig. 6. Percentage of households with the internet access in 2012 (%), source: the author according to Eurostat*

In 2012, the EU27 Internet use by individuals average was 74%. In Scandinavian countries, Iceland, the Netherlands and Luxemburg 90-plus% of the adult population were internet users. In case of individuals who have never used the Internet, the EU average is 22% (see Fig. 7). The highest number of those individuals who have never used the Internet is in Romania, Greece and Bulgaria, where it is almost half of the adult population.

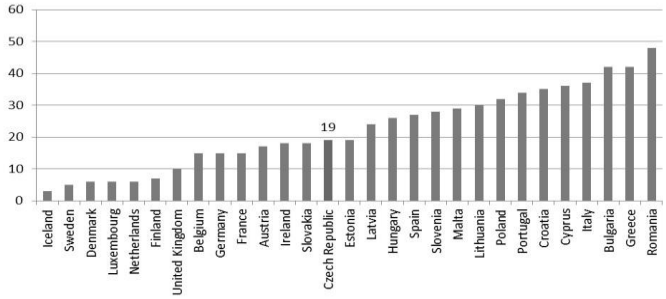


*Fig. 7. Individuals never having used the Internet as of 2012 (%), source: the author according to Eurostat*

The number of internet-equipped companies is significantly higher than that of households. Romanian and Bulgarian enterprises are the least internet-equipped with 76%. In Finland it is 100%. 92% corresponds to the EU average (Fig. 8).

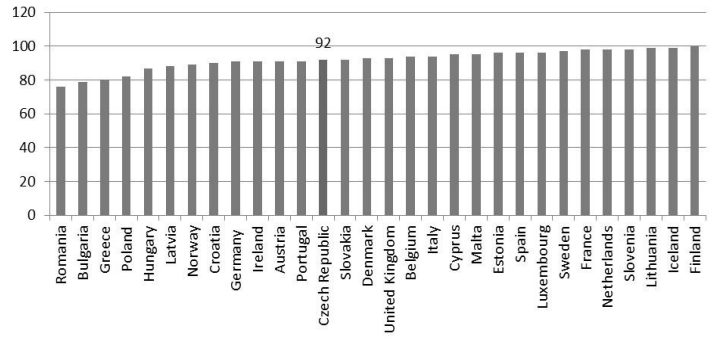


*Fig. 8. Enterprises with broadband internet access (fixed or mobile) in 2012 (%), source: the author according to Eurostat*

***b) PC-equipped Households***

In the EU27 internet-equipped households was 78%. Most PC-equipped households are in the Netherlands, Luxemburg, Iceland, Scandinavian countries and Germany. The percentage of PC-equipped households in these countries was above 85% as of 2012 (fig. 9).

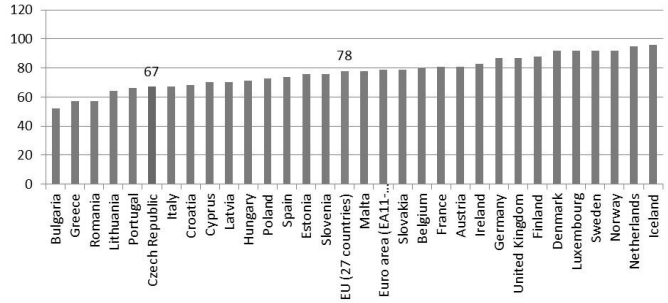


*Fig. 9. Households – availability of computer in 2012 (%), source: the author according to Eurostat*

*5) eGovernment* **:** eGovernment is defined [27] as the transformation of inner and outer relationships of public administration by means of ICT in order to optimize internal processes. This transformation should lead to faster, more reliable and cheaper providing the services of public administration and self-administration.. The eGovernment is vital for wellfunctioning services in the information society. In 2007 the following problems were identified by means of analyses [28]:

- low rate of and insufficient coordination in utilizing modern ICT methods and tools,
- low degree of standardization, integration and few kinds of used programm facilities,
- duplication and inconsistency of data and databases, fragmented and unambiguous data sources,
- non-existent or insufficiently elaborated models of well-functioning services of information society.

Basic strategic document concerning the development of information society is the State Information and Communication Policy [27], which defines the following objectives of eGovernment:

- to prepare legislative measures for data exchange among public administration bodies and for the role of basic registers of public administration,
- to link up basic information systems of public administration bodies in a sufficiently effective, reliable and safe way,
- to enable an access to authorized extracts from public administration registers that citizens need for running an errand from public administration contact points and Czech Post Office branches,
- to do away with the duty of citizens to put in paper documents to public administration bodies in case these bodies can provide the documents to each other in the electronic form,
- to ensure the communication of public administration with citizens and enterprises,
- to implement electronic entering of public contracts (eProcurement).

The EU supports the strife to achieve the above mentioned objectives because the development of eGovernment is one of its strategic objectives for the following years.

***a) Level of eGovernment in the EU***

On the European level the development of eGovernment is one of the objectives of the strategic document Digital Agenda for Europe (A Europe 2020 Initiative), specifically the 7th pillar – ICT-enabled benefits for EU society [29]. Another strategy of the European Commission for the development of eGovernment is eGovernment Action Plan 2011–2015 [30]. Its main objective is the extension of eGovernment services. Till 2015 these services should be used by at least 50% of citizens and 80% of companies. Graph 41 depicts the level of utilizing eGovernment in individual European countries. These services are used most in Denmark, Great Britain and Sweden, where electronic public services are used by about 60% of citizens (fig. 10).

According to the eGovernment Benchmark 2012 survey almost half of the EU citizens (46%) use the Internet to approach public services [30]. Despite that, the satisfaction with electronic public services is perceptibly lower than that with online banking or online shopping. A large part of respondents stated they would welcome widening the portfolio of online public services. The citizens praise eGovernment for its greatest benefits. It is time-saving as well as money-saving, and the whole process of providing services is easier and more flexible. Surprisingly, in comparison with commercial electronic services, the citizen satisfaction with eGovernment services has been falling.

Therefore, some motions have been proposed, in particular, an improvement of public services design, better utilization of social media for addressing difficult-to-reach groups and stronger focus on the customer. Another future objective is to interconnect the respective eGovernment systems of individual EU countries.

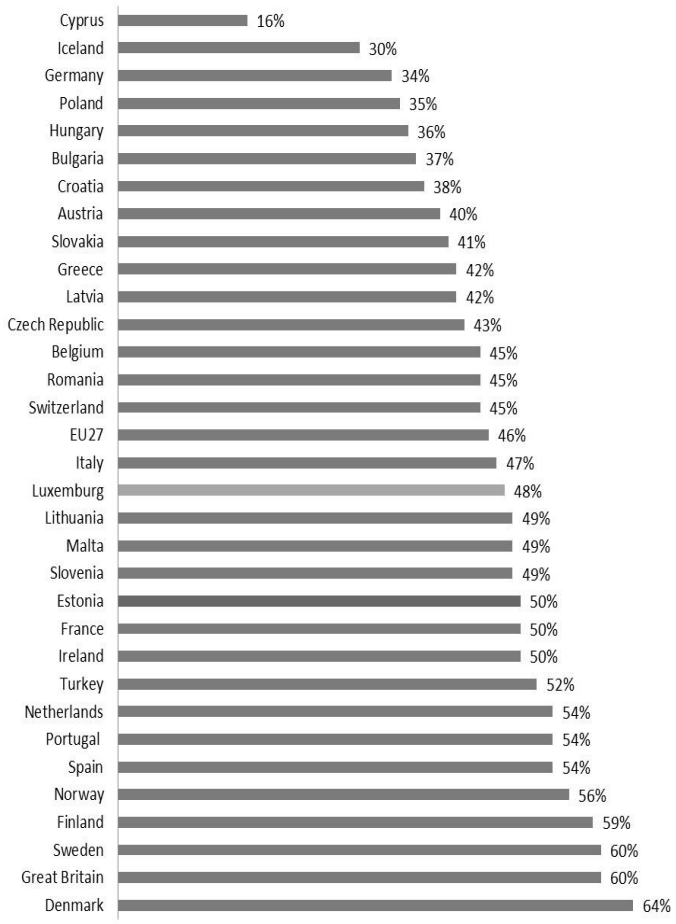


*Fig. 10. Use of eGovernment – average percentage of users, source: EC, 2013d*

## VI. BENEFITS AND RISKS OF CLOUD COMPUTING FOR ENTREPRENEURSHIP

A lot of managers and company owners who can potentially benefit from cloud computing do not know the possibilities for its utilization or even have never heard of it [32]. The knowledge and utilization of this technology could help many a company striving to increase its competitiveness to improve its position on the market.

### *1) **Cloud Computing Benefits***

Among the frequently mentioned cloud computing benefits for companies belong lower costs of ICT departments, an ability to flexibly change requirements for provided services and access to data from anywhere. There are, however, a lot more benefits.

#### *a) Fast Providing of Services and Flexible Scaling*

The provider offers an immediate access to a wide range of services. Thanks to the provided flexibility it is possible to react easily and flexibly to changing business requirements.

#### *b) Optimization of ICT Services*

The implementation of ICT capacities usually requires a substantial initial capital investment, particularly in hardware. Providers often offer an accounting model based on how many system resources were used. They charge the companies according to how much time they spend in the cloud system or based on how many sources (connections, transmitted data, filling the storage space) they use.

*c) Cooperation and Skill Sharing*

Cloud computing provides new ways of cooperation and sharing. For example, it can be the email system general overhaul, the utilization of Wikipedia, virtual desktop, and online conferences. Not only do such forms of cooperation accelerate and improve communication among individual companies as well as within a single company but they also increase the productivity of labour.

*d) Lower Management Costs*

ICT services are placed at the provider, who cares for them within the centralized administration. The overall ICT costs are reduced.

*e) Focus on the Essential*

Providers will administer competence and services that are not the key ones for most companies and their business. Consequently, the companies will be able to pay more attention to strategic objectives and technologies, which are vital to business and achieving business objectives, and not to problems like, e.g., incessant software rectification.

*f) Environmental Considerations*

The virtualization of several server application leads to the better utilization of computing performance and lower losses caused by inactivity. Computers can be moved to computing centres using low energy appliances powered by green energy, e.g. solar or thermal. These measures contribute to lowering negative impacts on the environment.

Cloud Computing providers, both large enterprises like Amazon, Google or Microsoft, or small ones agree on the following benefits of Cloud Computing [3], [33], [34]:

- lowering or optimizing the costs,
- accessibility of company data from various locations,
- fixed costs become variable costs,
- shortening the time needed to launch a product, support for start ups and innovative companies,
- fast and easy spread of ICT infrastructure,
- the utilization of ICT infrastructure – thanks to the possible virtualization of ICT sources the utilization of servers, which sometimes reaches only 10%, can be improved by means of using cloud computing approaches up to 50% to 65%, or even more [3]

- better utilization of assets – in Cloud Computing the assets are people and knowledge,  the provider's responsibility – the company delegates part of its responsibility for a possible power failure to the provider [34].

*2)* ***Obstacles and Risks of Implementing Cloud Computing***

On the other hand, apart from benefits Cloud Computing can pose certain risks, too. Data security is the most frequently mentioned one. In a survey conducted by IDC [34] 74.5% of respondents were alarmed over data security. In relation to data security it holds true that Software as a Service is often better secured than the solution run on the client side. The supplier has to in their own interest keep their solutions in the data center, which is both physically and virtually secured. Moreover, it is secured to a higher degree than a common company can afford. Apart from the data security problem there are a lot of other fields that have to be solved prior to the cloud implementation.

*a)* *Insufficient Transparency and Accord with the Law* Every company must be able to prove who is permitted to access the information and how they prevent the unauthorized access. If a company wants to comply with these requirements, it has to ask the provider for an independent audit report and examine it carefully before it starts to use the provider's services. The provider should maintain sufficient monitoring and a record of accesses to the system.

*b)* *Data Ownership and Personal Data Protection*

The risk must be taken into account that service providers may use the data in a different way than originally intended. It includes unauthorized searching and profiling. It is therefore vital to decide what data is essential for the company. This data should then be kept inaccessible to the third party. Another problem emerges if intellectual property of the company is spread geographically across several countries or even continents. Several EU countries' governments forbid passing some personal data outside host countries. If it happens anyway, it can have various legal consequences.

*c)* *Limited speed and accessibility*

Internet connectivity is a prerequisite for using cloud services. The network overload or badly designed application may cause delays, which negatively influences the service. It is therefore necessary to agree with the provider on the maximum length of acceptable delay.

*d)* *Limited Warranty on the Level of Services* Most sellers provide certain compensations for service failures but inflected damage can be serious and irreversible. Once again, it should be clearly defined how to settle potential arguments.

*e)* *Licence Models and Charging*

There are a lot of models how to license and charge Cloud Computing (one license, shared license, temporary use, payment according to use). The customer organization must decide on the suitable model.

*f) Dependence on the Only Provider* Data portability is not commonplace in the cloud. It is therefore necessary to ensure that the provider is able to supply data backup in a transmittable form.

To sum up, the company should solve with the service provider the following problem areas:

- physical safety – of servers, data centers, network infrastructure,
- the provider's personal policy – the level of authorization, creation and termination of user accounts, etc.,
- technical support,
- service monitoring,
- long-term data storage,
- data migration, standards and interoperability,
- exit management – data migration procedures on contract termination or the solution for the case of the termination of provider's business operation.

The basic decision-making criterion for what application should retain internal and what should be moved to the cloud is the nature of data in the given application. Some experts (e.g. Velte, [34]) guess that only a quarter of company applications contain critical data or functions that should remain internal.

## VII. SWOT ANALYSIS OF CLOUD COMPUTING

Cloud Computing is a technology that can bring a lot of benefits to the company. On the other hand, it is necessary to solve some problem areas, too. The following SWOT analysis illustrates strengths, weaknesses, opportunities and threats of cloud implementation in the Europe's conditions. It is based on the above mentioned data as well as the already existing SWOT analyses [14], [15], [23], [24]. The aim was to achieve the greatest possible objectification of the assessment, SWOT analysis was discussed with multidisciplinary team consisting of IT specialist, business economy specialist and macroeconomics specialist. The role of each of them was to build partial strengths, weaknesses and the potential opportunities and threats in their area of work.

All factors in the individual parts of the SWOT analysis are divided in to two subgroups in order to make them clearer. The first subgroup of factors characterizes the Europe's background with respect to the introduction of cloud computing. The latter focuses directly on this technology.

**Strengths**

***Macroeconomic factors – conditions of entrepreneurial environment***

- Existing strategies for cloud computing support on the EU level,
- good accessibility of quality internet connectivity,
- low barriers of entry,
- □ interest.

***Qualities of the technology***

- Ensuring complex processes as services,
- efficient use of computing and other sources of data centres,
- lowering the complexity of computing background of the company,
- transparent price,
- delegation of responsibility and the shift of some risks to the service provider,
- server power saving – lower ecological burden,
- fast launch of the application,
- low initial costs and simultaneous making accessible an advanced software solution,
- it is suitable for small enterprises and micro-companies,
- no need of HW investment or license investment,
- high accessibility of applications,
- flexibility / scalability,
- data security – data is often better secured at the provider than in the company,
- lower implementation risks,
- lower operational risks,
- no need to pay ICT experts,
- updated version of software,
- data centralization,
- mobility, independence of concrete locality,
- traceability of activities, accesses and changes,
- data backup and renewal after breakdown.

**Weaknesses**

***Macroeconomic factors – conditions of entrepreneurial environment***

- In comparison the the U.S.A. a relatively slow development of new advanced technologies,
- low quality of infrastructure in Europe,
- unresolved problems with legal regulations concerning data handling in the cloud,
- major cloud computing providers are non-European companies, research activities often lag behind the fast-changing market environment,
- managers and company owners do not know and trust cloud computing,
- low expert knowledge of cloud computing

***Qualities of the technology***

- Dependence on the provider, difficult migration among individual cloud computing providers,
- it is connectivity-demanding,
- loss of control over data,
- weaker user support, often in the form on online forum,

- increased financial and time costs of big volume data portability,
- difficult integration with peripheral devices (printers, secured accesses, etc.),
- problems with potential recovering damages from the provider.

Cloud computing is a technology that has been rising to prominence in EU since 2009. The advent of cloud computing offers opportunities for an organization to evaluate its current practice and restructure its IT infrastructure. It is a new technological model to replace client/ service computing. Despite this fact, its current use is still relatively low. The weaknesses are low quality of infrastructure, unresolved problems with legal regulations concerning data handling in the cloud and managers and company owners do not know and trust cloud computing. The most important disadvantages from a technological point of view are: dependence on the provider, difficult migration among individual cloud computing providers, loss of control over data and problems with potential recovering damages from the provider. On the other hand, important advantages from entrepreneur's point of view are: better accessibility of new applications, background for own applications, independence of internal sources and their fluctuation, returns to scale and opportunity to use mobile technologies for distant connection.

The rise of this technology should be the more significant, the more it will be supported by governments and their interventions. The potential of this technology is known to all European countries.

## VIII. CONCLUSION

Support to this technology comes from the EU, which has already approved of a strategy whose objective is to support better use of Cloud Computing and to create unified rules for its use by European companies. Cloud Computing in SME can generate a competitive advantage that will enable these companies to operate on the global market and to compete with larger companies. In order to increase the acceptance of Cloud Computing, it is necessary to take certain measures [12]. Namely:

- clear rules on service provider accountability,
- guaranteeing data and application portability between cloud services providers,
- better and more reliable internet connectivity,
- EU-wide security certification,
- fostering EU-wide standardization and interoperability of cloud and cloud services.

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