READINESS OF THE CZECH PUBLIC FOR COMMUNICATION WITH PUBLIC AUTHORITIES USING CLOUD SERVICES

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ABSTRACT
Information safety is one of the fundamental problems that the public sector faces nowadays. The primary aim of the paper si to analyze and present the readiness of Czech public (individuals and firms) for the possibility of communication with using public cloud services in the public sector. The data source come from European wide surveys „Community survey on ICT usage in households and by individuals ", „Use of cloud computing services ", coordinated by the Eurostat and authors own surveys. Comparing data from other EU countries, we can express an assumption that situation is very similar in the public administration sector. Based on the information from a survey focusing on health care that was analysed we can presume that a very similar behavior of individuals would take place in case of communication with public administration using cloud computing.

KEYWORDS: *Cloud computing, Public administration, Individuals, Communication, Information safety.*

JEL CLASSIFICATION: *M15*

1. INTRODUCTION

Public authorities are in a difficult situation. On the one hand, they need to cut their budgets and reduce costs as much as possible. On the other hand, though, they are supposed to make sure that they use safer and more easily available infrastructure for their work to offer the citizens, their clients, a higher comfort of electronic interaction, which could seemingly require higher investments, but thanks to Cloud Computing it does not need to be so. Cloud Computing and its use is currently a widely discussed concept. The environment for the development and use of CC services varies country by country. There are differences in the national legislations, but we also need to take into account the availability and possibility of internet connection (or more precisely, the cloud services) and cultural differences. Most of the globally sold products are now adapted (in terms of contents, price, appearance and other parameters) to specific regions so that they comply with the requirements of their customers and legislations. However, this does not apply to CC services, which one vendor very often offers for a uniform price all over the world. Nevertheless, to be able to make a full use of CC it is necessary for the countries to meet certain requirements facilitating appropriate usage and development of the cloud offer. Likewise, we need to bear in mind that the access to IS/IT through a web browser is a more and more required form of provision of information and communication technologies across the entire society, including public

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administration. A key prerequisite for a wider usage of CC by public authorities is to prepare its users for it in an appropriate manner. In this regard, the basic issue is above all the sensitivity of the data to be stored and their safety.
The objective of this article is to focus on the readiness of the public (individuals and enterprises) for the communication with public authorities using Cloud Computing.

2. LITERATURE REVIEW

Information and communications technologies (ICT) represent a considerable potential for streamlining the running of any organization, ranging from the support of provision of services, resource administration to supporting processes. In many developed countries information technologies actively help to improve public sector services and to rationalize its activities. (Anthopoulos, 2012). This makes public administration one of the most important administrators and users of information systems. The public administration thus turns into one of the most important administrators and users of information systems but the safety requirement is as vital as the functionality, price or maintainability. At the same time, however, the proper application of information technologies in public administration offers a great potential protecting the society against various threats. Therefore, it is necessary to explore and develop new, more efficient methods and approaches protecting information systems of public administration against hackers along with a timely detection and identification of the hacker, etc.
In public administration new information systems (or adjustments of the existing ones) are often built separately, limited to the relevant department or the state organization. This leads to the existence of isolated islands of infrastructure which are often underused. Thus, public administration features parallel identical technical solutions for individual information systems, and faces insufficiently defined allocation of competences, which may hinder procuring of ICT services despite the fact that public administration bodies process specific information, whose demand for availability, integrity and confidentiality are very high.
Often, these inconsistencies can be found in those parts of the public sector that are very different in scope (such as municipalities) but need to solve very similar problems arising in the course of their every-day operation.
A current trend noticeable in the private sector is that of sharing and centralization of computational technology means and their use via provided services – so called cloud computing, which is by some authors considered to be the next evolutionary step superseding the model of traditional data centres (Buyya et al., 2011). Cloud computing is not a new technology, but as described by (Jackson, 2011), it is a new way of offering services, taking into consideration business and economic models for providing and consuming ICT services.
The fundamental principal of shared infrastructure is separating the ICT infrastructure (at an optional level) from its user in terms of establishing, running and maintaining the ICT infrastructure while keeping sufficient leeway for managing it and, to a certain extent, sharing the risks related to the availability of infrastructure, and data confidentiality and integrity. Another considerable advantage is the speed at which services are deployed, their variability and scalability with the guarantee of high availability. Benefits of shared infrastructure are primarily defined by more efficient use of resources (hardware, software, human resources, energies). The basic terminology is derived from the standard 800-145 of the National Institute of Standards and Technology USA and a summary can be found in many other authors (Buyya et al., 2011) (Srinivasan et al., 2012) (Marinescu, 2013) (Smoot & Tan, 2012).
The paper (Kavitha et al., 2013) focuses on resource allocation for the parallel data processing, which also occupies a major issue in cloud computing. The paper (Rajendran et al., 2015) attempt to give an overall idea about Cloud computing, Intrusion, types of Intrusion Detection Systems and earlier works done on Intrusion Detection System.

The primary and essential reason for introducing cloud computing in the public sector is potential savings in the long-term financing of the running and development of information systems. A study (Harms & Yamartino, 2010) shows that total costs of owning one server are inversely related to the number of servers administered in cloud. The proportion of total costs over a 13-year ownership and operation of 1,000 virtual servers in cloud computing to ordinary non-shared infrastructure, according to another study (Alford & Morton, 2010) represents 0.5 for a private cloud, 0.37 for a hybrid cloud and 0.33 for a public cloud. Migrating servers to private and to public clouds may reduce the total ownership costs by up to one-half and two-thirds, respectively. Practical experience (Marinescu, 2013) with migration of several information systems to an integrated infrastructure show a significant reduction in peak load compared to the total of individual systems' peak loads. E-mail and office productivity applications, data storage, and disaster recovery services are typical of the way public-sector organizations are using cloud services. (Olsaker, 2011) Nevertheless, according to (Powell, 2011), it is necessary to proceed differently from the private sector when introducing cloud computing in the public sector.

The European Commission has adopted the European Cloud Computing Strategy within the Digital Agenda for Europe initiative. The Strategy is designed to speed up and increase the use of cloud computing and the Commission believe there will be a net gain of 2.5 million of new European jobs and an annual boost of € 160 billion to the European Union GDP (around 1 % EU GDP) connected to cloud computing. In related documents, the European Commission appealed to member states to fully use the potential of cloud computing. Besides Europe-wide projects such as Trusted Cloud for Europe, a range of national initiatives are being launched for the use of cloud computing in the public sector, and numerous authors deal with that theme in their papers. (Diez & Silva 2013) explains the impact and benefits for public organizations of cloud services and explore issues of why governments are slow to adopt use of the cloud. (Marešová & Kacetl, 2015) in her contribution specified when to deploy cloud computing in the public sector and compared the situation in the Czech Republic and elsewhere. The report (Weiss, 2010) examines fundamental differences in the policy and funding models for public sector information.

3. METHODS AND DATA SOURCES

In the paper were used methods of descriptive statistics. The purpose is to compile a data file into a simpler form for easier orientation. However, its significant disadvantage is a big loss of information; but on the other hand, you can get a better overview of the data. Basic concepts are: absolute frequency of a phenomenon, defined by the number of favorable observations. Dividing this quantity by the data file size we get the relative frequency, which is close to the corresponding probability. Basic statistics of one-dimensional data are position characteristics (various means, mode, median) and variability (dispersion estimate, inter-quartile span, average median deviation, etc.). Considering several dimensions, we can observe the previous characteristics for each dimension separately, and/or what is the mutual effect of the dimensions.

In our paper, a standard user – individual – will mean a person using cloud services for his/her personal purposes. Services for these customers need to be simple and intuitive enough so as not to discourage them. Although customers in this group are willing to pay for a decent service, they often do not want to spend money on services if they do not know whether they will bring a benefit to them. Therefore, we need to get at least a part of the functionality free of charge for them so that they can test the service free. These customers expect a complete and fully functional service of an easy configuration they will be able to start using relatively quickly.

The data source for a comparison of EU member states in terms of ICT use is the Eurostat – the statistical office of the European Union. Data come from a Europe wide survey „Community survey on ICT usage in households and by individuals ", coordinated by the European Statistical Office (Eurostat, 2016) every year. The subject matter of the survey is the spread and usage of information

and communication technologies in households and by individuals. The article is based on 2014 data in the following items:

- Use of cloud services by individuals;
- Problems experienced when using cloud services by individuals;
- Awareness about cloud services and reasons for non-use;
- Percentage of individuals who used internet but not cloud services;
- In all cases, the percentage of individuals refers to the age group 16 - 74.

Moreover, a comparison of data about the CC usage in corporations (save for the banking sector). Data come from a Europe wide survey „Use of cloud computing services ", coordinated by the European Statistical Office (Eurostat, 2016) every year. The article is based on 2014 data.

In survey, organized by the authors of the article in 2015, a questionnaire with twenty-five questions was submitted via the Internet to the citizens of the Czech Republic. 479 fully completed questionnaires were returned, the return rate of questionnaires was 82%.

In the survey, (among others) two hot topics now being discussed in the area of health care were included, namely the obligatory introduction of electronic prescriptions and the issues relating to the introduction of central electronic patient documentation accessible to the doctor and patient through the Internet. The solution of both issues is expected to use the potential of cloud services.

4. RESULTS OF DATA ANALYSIS

The comparison of the use of CC by individuals and enterprises in selected countries and their comparison with the Czech Republic may give us an idea of how the Czech public is prepared for the communication with public administration using CC services in the context of other EU countries.

For the comparison of the public readiness in the Czech Republic, we have chosen data from the V4 countries, where you expect a similar historical development and find a similar development in the area of eGovernment, as well (Luhan & Neuwirth, 2014), Germany and Austria as our neighboring countries and Denmark and Estonia as representatives of high eGovernment level in the EU (Luhan & Neuwirth, 2013).

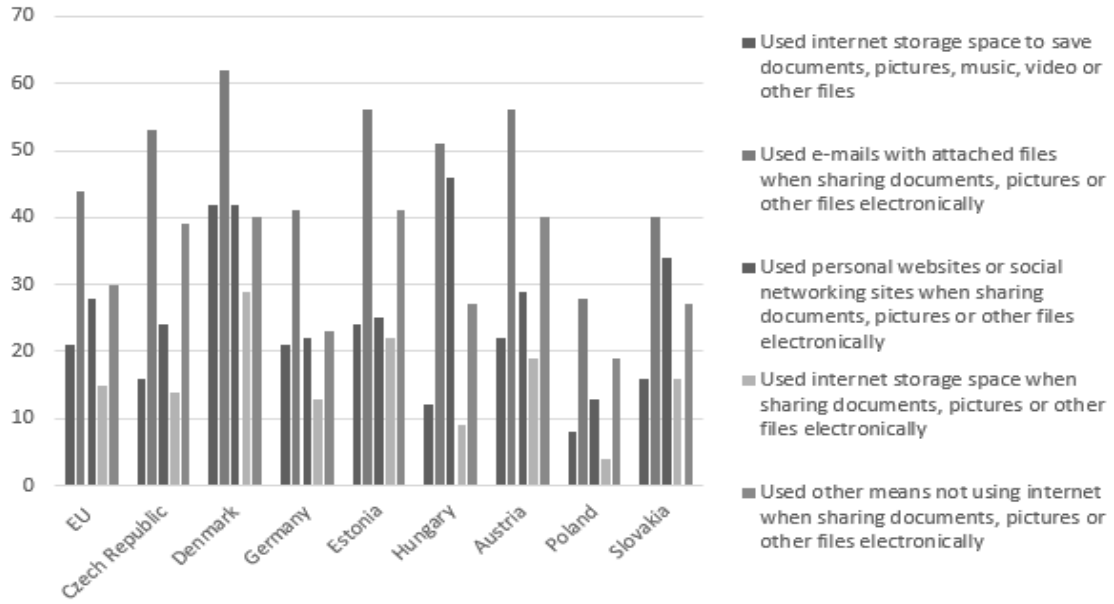

Figure 1. Use of cloud services by individuals
Source: adapted from Eurostat (2016)

Compared to the other countries, individuals are not backward in the usage of CC services. The trend that we can find across all of the countries surveyed is that individuals have become used to using e-mail as the main tool for sharing data. Very popular is also data sharing by means of personal websites and social networks. In the latter two areas, however, there were problems in the past caused by insufficient security of these communication platforms, primarily on the part of the users. Likewise, in data storage and sharing through Internet storages individuals in the Czech Republic are not lagging behind the EU average and the countries observed. The year-to-date increment between 2014 and 2015 was 1% higher in the Czech Republic than in the EU.

For the CC use, it is important for the customer to trust the provider in that he is able to assure a functioning service. Often, it is very difficult or even impossible for the customer to check where there was a data leakage, and therefore the trust in the provider is vital. The trust is most often built on the recommendations from the other customers satisfied with the provider's services.

The issue of data abuse, unauthorized data usage on the grounds of security problems was not observed to be significant in either of the countries and the EU average is about 1 percent. The question remains, though, whether data abuse or unauthorized data usage can be discovered or whether first of all the hackers are interested in this kind of data. Problems of technical character, such as service availability or connection/service speed can be evaluated as very good in the Czech Republic, both in relation to the countries observed and the EU average. But we can certainly expect some changes in respect of a more massive use of these technologies by the public.

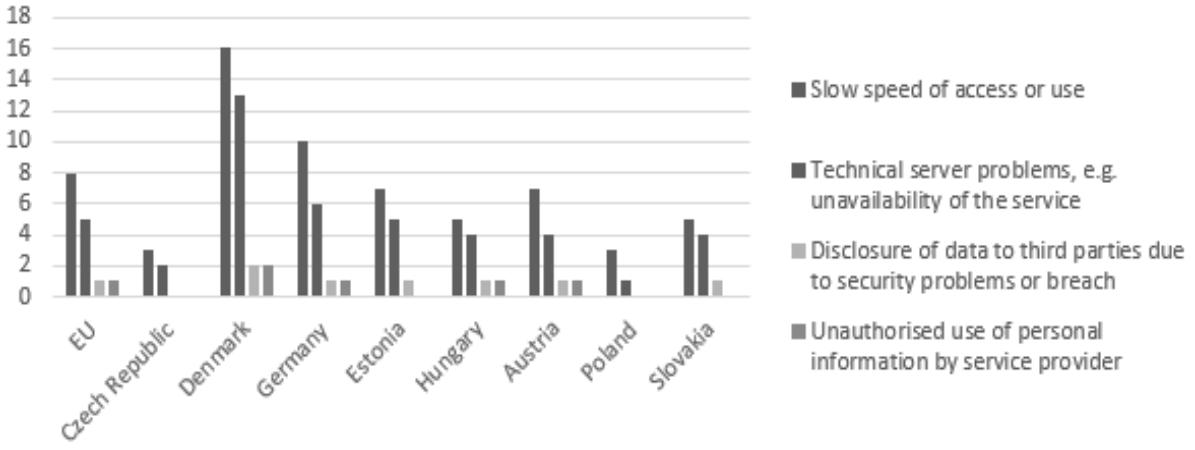

Figure 2. Problems experienced when using cloud services by individuals
Source: adapted from Eurostat (2016)

In the Czech Republic, only 3% of individuals indicated as their reasons for not-using CC data their safety concerns and reliability of service providers. Unlike Denmark, Germany and Austria, this value is up to 6 times lower, and in the case of service providers´ reliability in Austria up to 9 times lower. Only 6% of individuals indicated as their reasons for not-using CC in the Czech Republic their insufficient knowledge necessary for the use of any such storage, which is again about 50% of the EU average, and of all the countries of the survey it is the lowest value. Storing of files in storages of one's own, sending by e-mail or non-storing of files are the reasons indicated by 23% of individuals in the Czech Republic. Compared to Denmark, Germany and Austria it is less than a half of this indicator's value. Sharing files in a different manner or non-sharing of files on-line with other users are the reasons given for the non-use of CC by 26% of individuals in the Czech Republic. This value is similar to Germany and Hungary, and corresponds with the EU average. This reason is found more significant by users in Denmark and Austria and less significant in the remaining countries of the survey.

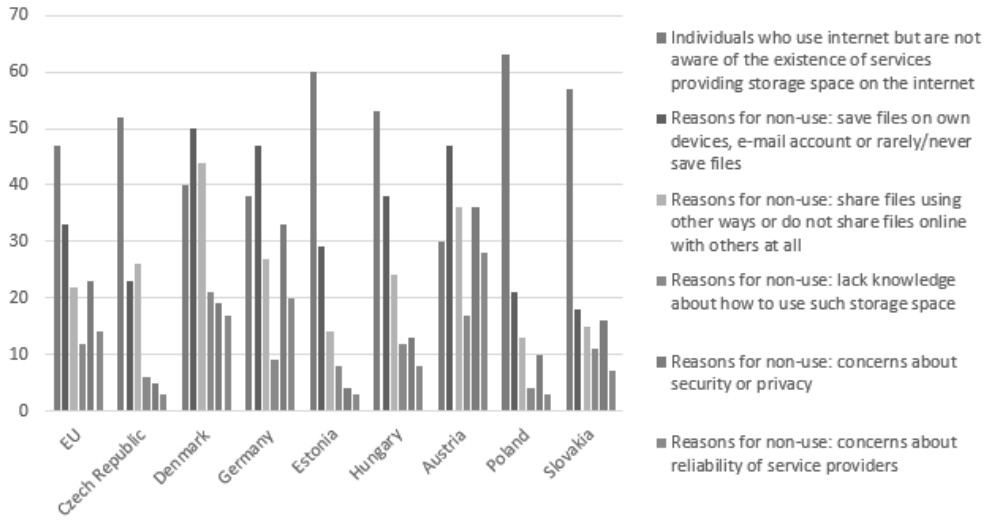

Figure 3. Awareness about cloud services and reasons for non-use by individuals who used internet but not cloud services
Source: adapted from Eurostat (2016)

The comparison of data in respect of the questioned individuals´ trust in specific CC applications, and the relating analysis of perception of their potential problems and benefits according to the respondents from such a sensitive area as health care can give us information about how the individuals are prepared for the use of cloud services also in the communication with public administration.
A statistically significant dependence between the age of the respondent and his/her interest in electronic prescriptions was proven by Pearson $\chi 2$ test at a significance level of 5%. However, not a very pleasing discovery was that 54% of respondents had not even heard of the term ePrescription. This situation was similarly copied by the questioning directed to whether the respondents would welcome the introduction of electronic prescriptions instead of conventional paper ones, as shown in Fig. 4.

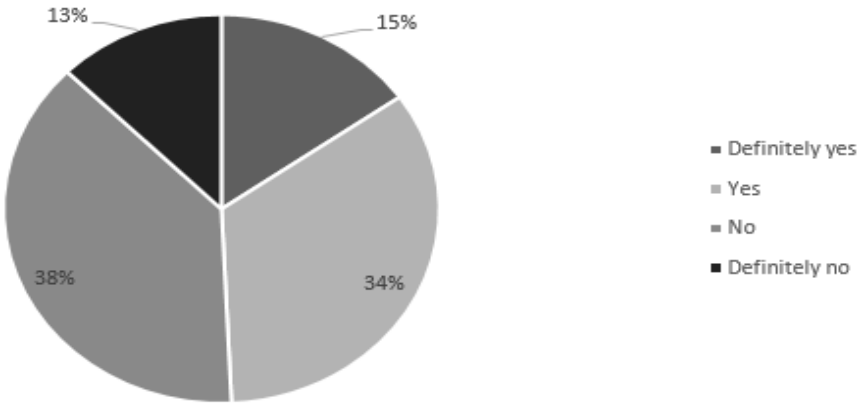

Figure 4. Would you welcome mandatory introduction of ePrescriptions (prescriptions in an electronic form) instead of the current form of traditional paper prescriptions?
Source: own survey

It was then very interesting to focus on the benefits and pitfalls, which the respondents see in such a system. 60% of respondents see the advantage of such a system in time savings, 26% of respondents find an advantage of the system in paper savings, 12% of respondents see the benefit in reducing

errors and the impossibility of a loss, and 5% of respondents in better traceability of prescribed drugs and impossibility of a loss or destruction of the prescription itself. From the perspective of potential pitfalls, 18% of respondents consider it a problem that the prescription can be easily falsified. 15% of respondents see potential problems in insufficient availability of IT on both sides and in potential problems associated with computerization. 8% of respondents believe that the introduction of the system would bring problems especially to seniors. The same number of respondents is afraid of problems relating to security and possible monitoring. 4% of respondents would then be concerned about the mandatory implementation of such a system and increased dependence on IT.

A positive fact found by the survey was that 68% of respondents would welcome a mandatory introduction of electronic patient's records, as shown in Figure 5.

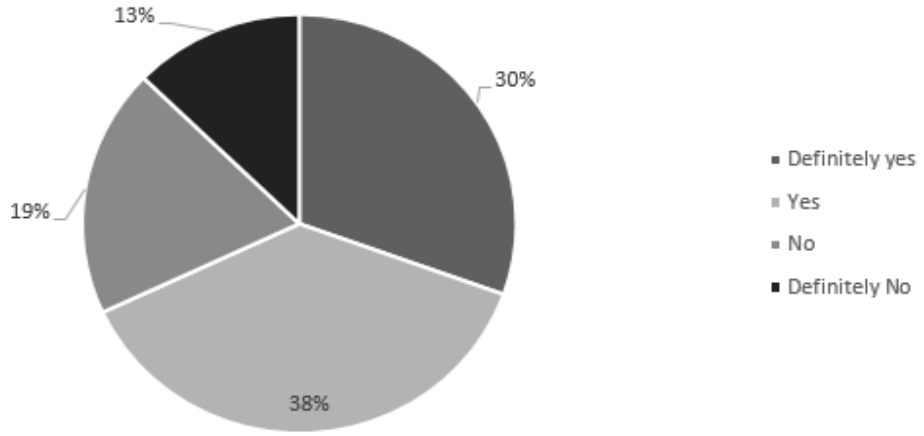

Figure 5. Would you welcome a mandatory introduction of electronic patient's records accessible after the authorization to the doctor / patient via a special Internet portal?
Source: own survey

The analysis of enterprises using CC and also the analysis of obstacles assumed to limit the use of CC services can give us another view of the society's readiness for the communication with public administration using CC services.

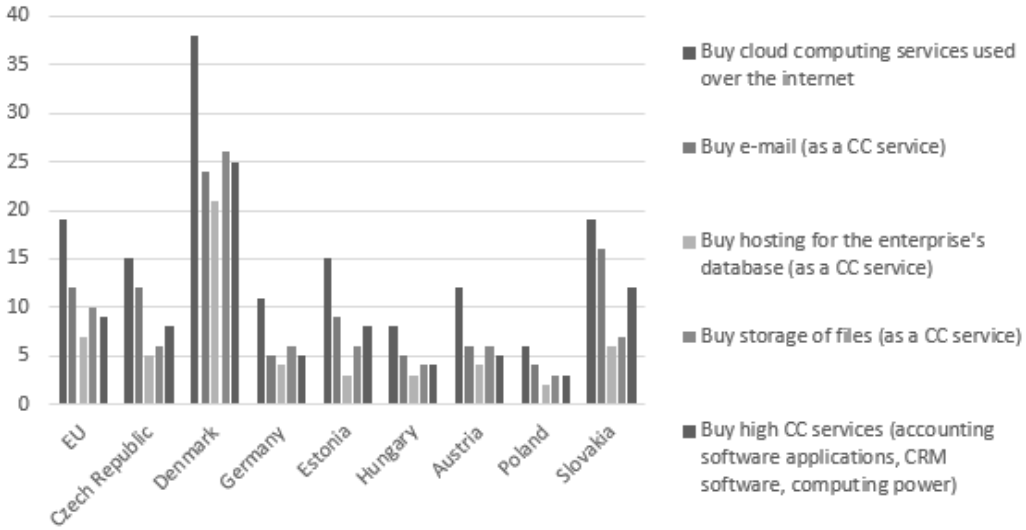

Figure 6. Use of cloud computing services by enterprises
Source: adapted from Eurostat (2016)

Comparing the use of CC services by enterprises, the Czech Republic is on a comparable level with the EU average, and out of the countries surveyed, it is on the third position. The situation in Denmark is interesting as the development copies that of the individuals and their use of CC services. The structure of CC services used is very similar in all countries of the survey.
The diagram shows that the obstacles that limit the use of CC services in the Czech Republic do not differ from the EU average. In terms of perception by enterprises, however, they are the second biggest out of the countries analysed. The question is to what extent the influence of perception of these obstacles affects the decision-making about the use of CC services. Although the obstacles are perceived more moderately in many countries observed, the use of CC services is not spread any more in them. On the contrary, in Denmark, where the spread of CC services is higher, the enterprises are more sensitive to the perception of obstacles in CC.

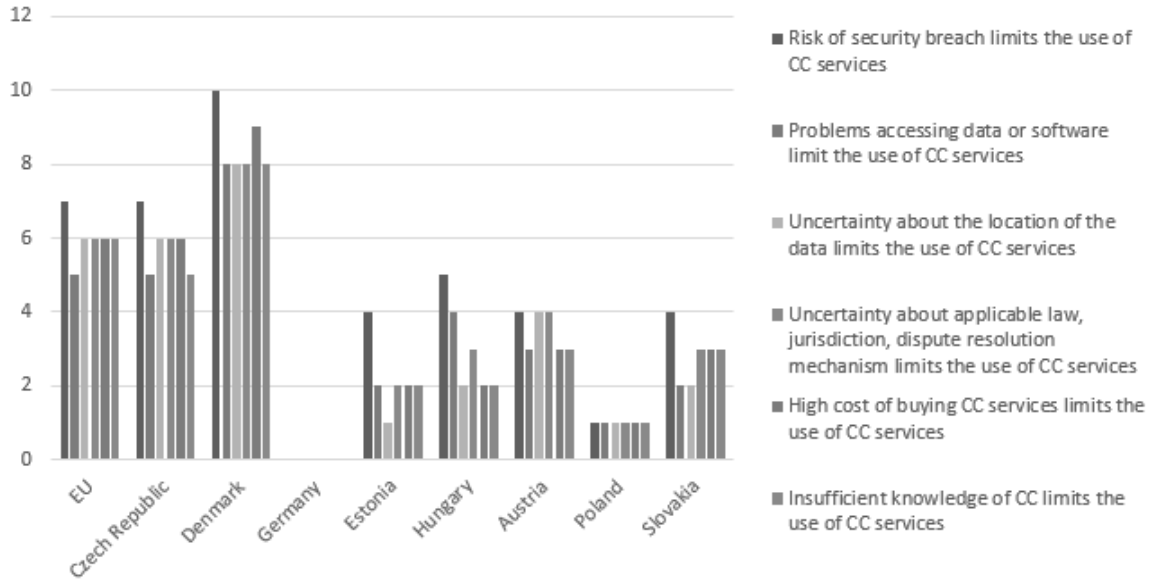

Figure 7. Obstacles that limit the use of cloud computing services
Source: adapted from Eurostat (2016)

5. DISCUSSION

Based on the information from a survey focusing on health care that was analysed we can believe that a very similar behavior of individuals would take place if we are to assess the readiness for communication with public administration using cloud computing. It is interesting to focus on the perception of potential difficulties that can be very similar in the case of CC in public administration. A half of the respondents are afraid of abuse of sensitive personal information and nearly 40% of the respondents fear risks associated with the operation of the system in on-line form. 18% of the respondents assume that the information stored in the system could be altered (falsified) easily, 15% then see a problem in insufficient spread of IT and potential problems relating to the electronization. 4% of the respondents see a problem in the ever-growing dependence on IT.
It was also interesting to find out that when using the CC services known (personal data sharing, e-mails ...) individuals do not manifest any problems in respect of making the data accessible to third parties because of safety problems or errors, and likewise the concern regarding unauthorized use of personal information by the service provided is low, too. However, the situation is different in services that are generally perceived by the public as services working directly with the individual's personal data.

6. CONCLUSIONS

In our opinion, the public in the Czech Republic is still under-prepared for the communication with public authorities using CC services. Comparing data from other EU countries, we can express an assumption that it is very similar in the public administration. We can seek inspiration for potential measures in Denmark, which stands out comparing the data with the other countries.
In the discussion, we have identified some difficulties, on the solution of which the public authorities should focus their attention.
Many of these difficulties should be addressed by both direct and indirect communication addressed to the public in the Czech Republic. The indirect way is undertaken by companies, such as Apple, Microsoft, Facebook, Google …, which in a relatively friendly way try to integrate cloud services in the operation systems of devices used by the public as standard (telephones, computers, tablets, ...).
By the direct way, the countries primarily form the legislative framework. The direct form of specific education of the public, targeted primarily at the safety and transparency of cloud services and rebutting of many myths relating to these services, is used only scarcely.
Reports in the mass media can sometimes have a negative effect on the public opinion, as they may deliberately focus on certain parts only and thus can distort the final opinion of the public. Nevertheless, public administration authorities are not able to affect this communication channel and they can only respond to it in certain cases and with a logical delay.
In terms of the public readiness for the communication with public administration using CC services, the more massive use of CC services in the commercial sphere has a positive effect, as demonstrated on the example of Denmark. This assumption is supported in the Czech Republic, for example, by the ever-growing interest in the data box information system to be used by individuals in the Czech Republic. This service has been introduced as obligatory for enterprises, public authorities and undertaking physical persons. We can thus assume that based on their experience the service spreads among non-undertaking physical persons on a voluntary basis.

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