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**Analyzing the effects of cloud computing implementation  
in SMEs in the Republic of Macedonia**

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## **Abstract**

*Cloud computing is a technology that can potentially enable companies to reduce their capital and operating costs, increase their flexibility and productivity, as well as improve the overall quality of the business processes that are performed. As part of the research done for the master thesis "Implementation of Cloud Computing in small businesses through a case study of "Triger Computers D.O.O.", it was discovered that this technology can be realistically implemented in a small Macedonian company and produce significant benefits and cost reductions in a timeframe of one year. This scientific research paper is an extension of the research done in the master thesis, with the main purpose of examining the viability of the implementation and usage of cloud computing, as a technology and a business model, in small and medium enterprises on the territory of the Republic of Macedonia. The main objective is, by using several different scientific methods, to analyze the factors that influence cloud computing and the economic benefits it can produce for SMEs in Macedonia.*

Keywords: Cloud, computing, Macedonia, SMEs, implementation, costs, trends

# 1. Introduction

Cloud computing is a model for enabling an on-demand network access to a shared pool of configurable computing resources (NIST, 2011). As part of the research done for the master thesis “*Implementation of cloud computing in small businesses through a case study of “Triger Computers D.O.O.”*”<sup>1</sup>, it was discovered that this model can be successfully implemented in a small Macedonian company. The analyzed company “Triger Computers D.O.O.” is part of the technological industry and is from the capital city of Macedonia, Skopje. The research done in the master thesis also produced unexpected results in terms of benefits for the analyzed company. The most notable benefit were the potential cost savings, in a projected time period of one year, which were 480%. One limitation of the master thesis was that the research was focused only on a single small-size Macedonian company, covering a single industry.

This scientific research paper is aimed at expanding the master thesis scope by analyzing the potential implementation of cloud computing in small and medium enterprises (SMEs) from different industries and cities in the Republic of Macedonia. According to the Constitution of Macedonia (1996), a small enterprise has a maximum of 50 employees and a medium enterprise has a maximum of 250 employees. The main purpose of this research is to examine whether cloud computing, as a business model, would prove successful in different industries and different cities in the Republic of Macedonia. Although this type of research may have been done for different countries in the past, we think that Macedonia is specific in terms of economic and technological conditions. One argument is that Macedonia lags behind more developed countries in certain economic and technological aspects (Cako, 2011), therefore cloud computing cannot be successfully implemented in this type of third world country. As authors, we tend to disagree, because we think the technology gap between countries decreases, primarily accelerated by the use of Internet technologies.

Through the use of various methods and techniques, we aim to provide insights for different aspects of cloud computing, with the primary focus on the economic benefits that cloud computing can offer SMEs in Macedonia and the macro factors that could influence or be influenced by cloud computing implementation. Cloud computing is an infrastructure approach that transforms the cost structure, by allocating 80% of the costs for usage of applications and 20% of the costs for maintaining the underlying hardware components (Kepes, 2011). The information collected in this research is used to create trends for different aspects of cloud computing in Macedonia. Taking into account all the information that is collected, this scientific research paper also aims to provide a conclusion whether cloud computing, as a technology and a business model, could be realistically implemented in SMEs in Macedonia.

## 2. Methods and materials

All the data that is presented in this research is collected from October 2012 through December 2012. For the purpose of the study, a total of 30 companies were chosen for analysis. 15 of the chosen companies are small enterprises with a maximum of 50 employees, while the other 15 are medium enterprises with a maximum of 250 employees. The chosen companies are from 6 different industries and 8 different cities.

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<sup>1</sup> Referred in the rest of the text as “master thesis”

The primary method used for analysis of the chosen companies is distribution and analysis of questionnaires. The structure and format of the questionnaires can be examined in greater detail in the appendix of this paper. A total of 120 questionnaires were created and distributed to 4 employees from each analyzed company. The employees were chosen by hand with the main criterion to be on different positions in the company. Further breakdown of the demographics of the employees (age, technical knowledge etc.) was deemed unnecessary for the purpose of this research. The results from the questionnaires are used to create trends for different aspects of cloud computing for the Republic of Macedonia.

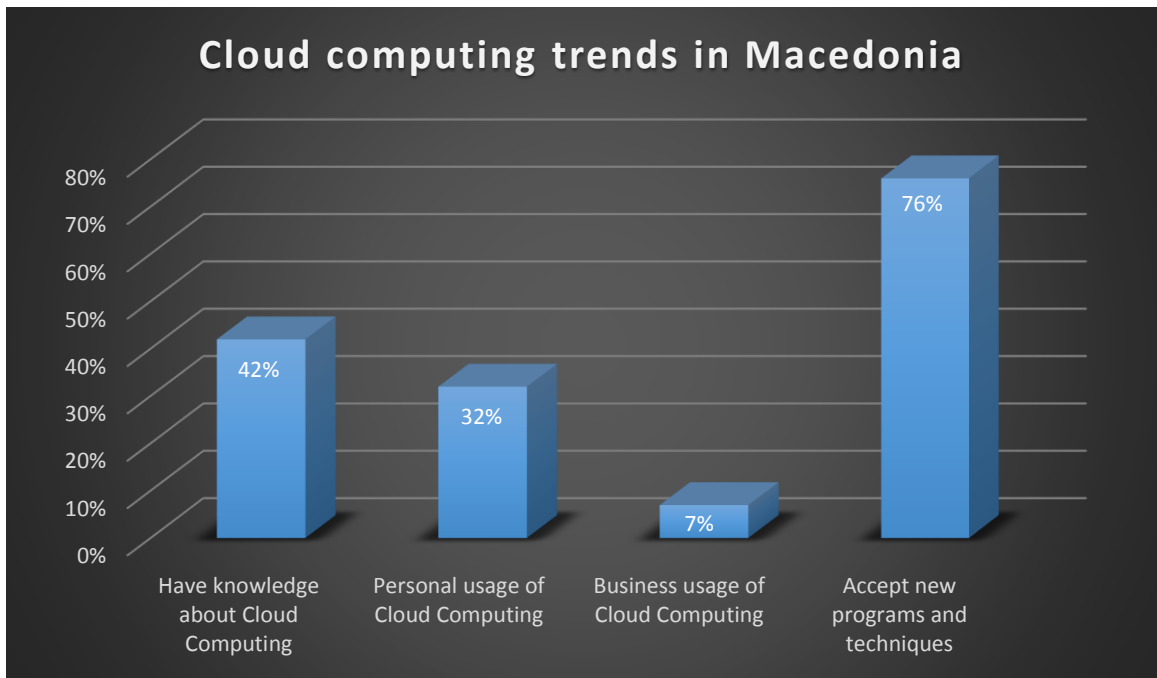
From the 30 analyzed companies, 10 were chosen for further methods of analysis, including 5 small enterprises and 5 medium enterprises. Several aspects were involved in the selection of the companies. Only companies that were from different cities and different industries could be chosen, eliminating the possibility that two similar companies are chosen and achieving diversification based on different cities and industries. In the selected companies, specific employees were interviewed through a personal visit, telephone or via the Internet. In the next step, the chosen companies were individually analyzed to assess their specific business needs for hardware and software applications. Afterwards, various cloud computing services were chosen that would benefit and fulfill the needs of each individual company.

Cost projection for a time period of one year was performed for the 10 selected companies. The cost projection is a continuation of the one that was done in the master thesis. The cost projection is structured in two different parts: projection of fixed and variable costs without cloud computing and projection of fixed and variable costs with cloud computing.

A PEST analysis on the overall Macedonian market was also performed. PEST includes an analysis of the political, economic, social and technological factors that affect the industries. Similar as the SWOT analysis, the PEST analysis wasn't performed in full extent, meaning only those factors that affect or are affected by cloud computing implementation and usage were analyzed.

### **3. Results**

Based on the questionnaire, we developed trends for different aspects of cloud computing in Macedonia. The data is combined from the questionnaires that were sent to respondents from the analyzed SMEs. Evaluating the knowledge about cloud computing of the respondents, 7% know about the benefits and weakness of cloud computing in great detail, 23% have limited knowledge and 70% don't have any knowledge at all. Other important aspects concerning cloud computing as a technology and a business model are summarized in graph 3.1 on the next page.

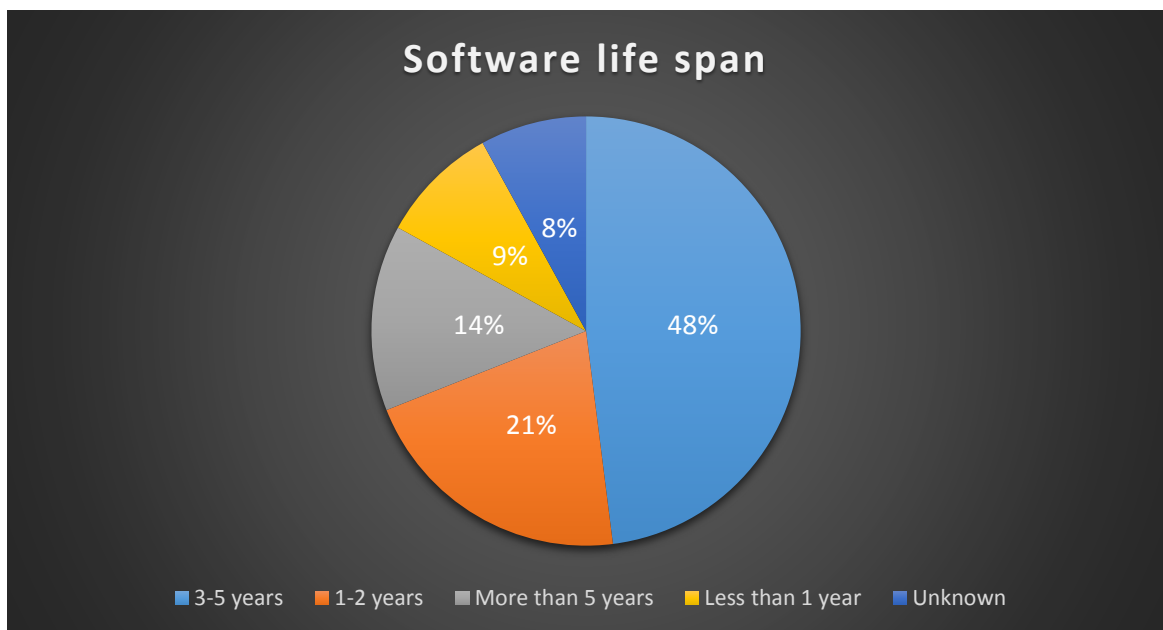


Graph 3.1: [Trends about Cloud Computing usage in Macedonia]

In graph 3.1, we notice that 6% of the analyzed small and medium enterprises are actively using cloud computing services. Another aspect is that 42% of the employees are familiar with the concept of cloud computing.

The areas that produce the greatest costs in the company are the hardware with 67%, followed by the software with 35% and the infrastructure with 28%. Training costs participate with 16% and security and staff are both participating with 7%. Note that the answers are not mutually exclusive, meaning that the respondents can select more than one area.

In graph 3.2, a pie chart is developed to present the life span of the software that is used in the analyzed companies.



Graph 3.2: [Life span of the software that is used in SMEs in Macedonia]

In table 3.1, the results of the PEST analysis are presented, focusing on two different types of factors for cloud computing implementation and use in SMEs in the Republic of Macedonia. The factors that affect cloud computing are represented in **black letters**, while the factors that are or will be affected by cloud computing implementation are represented in **blue letters**.

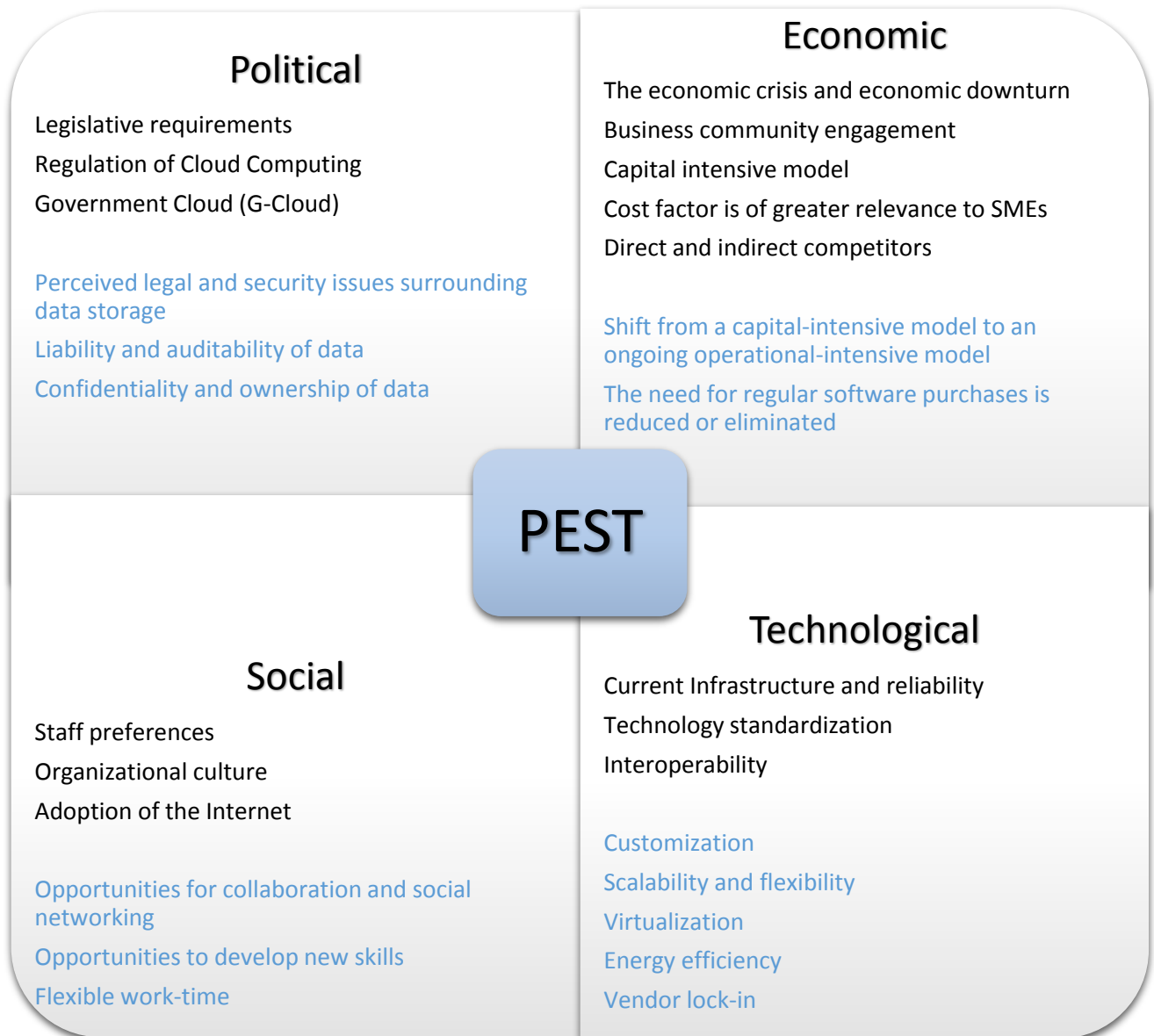
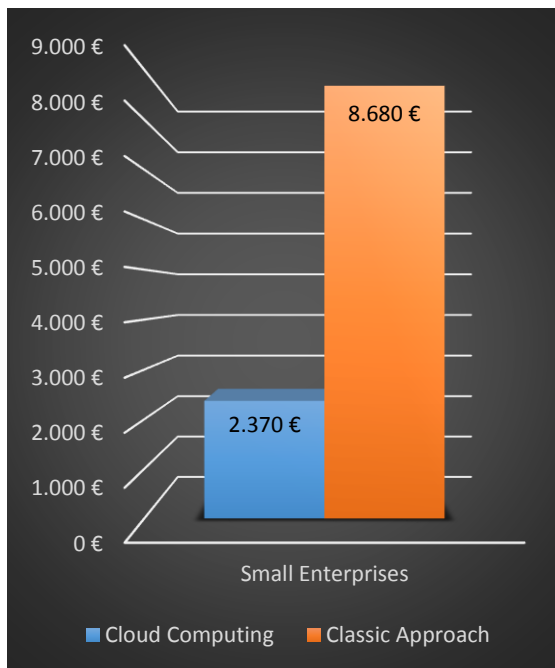
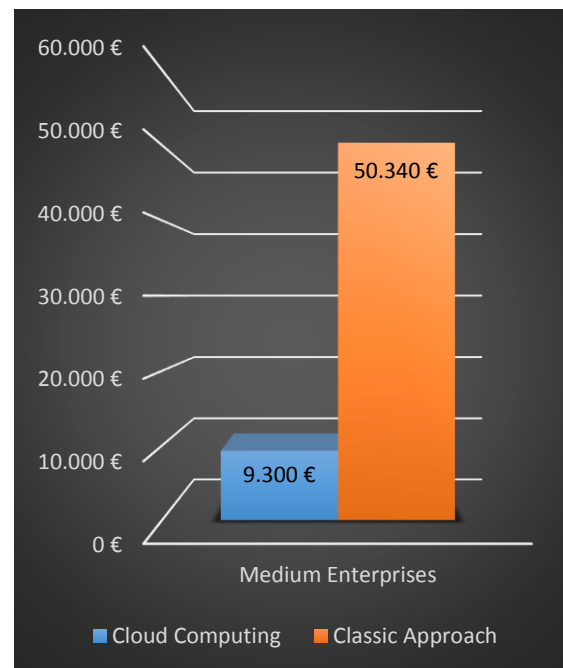


Table 3.1: [PEST analysis of cloud computing in Macedonia]

The cost projection for the chosen companies was done by comparing the costs associated with using cloud computing over a time period of one year and the costs associated with buying and using software and hardware components over the same time period. In graphs 3.3 and 3.4 on the next page, the costs are summarized for a period of one year and are presented separately for small enterprises and medium enterprises, expressed in euros.



Graph 3.3: [Cost projection for a small enterprise]



Graph 3.4: [Cost projection for a medium enterprise]

## 4. Discussion

The trends that are constructed from the questionnaire are on levels that were expected, with slight variations. The knowledge about cloud computing, as a business model and a technology, is significantly low among the respondents, as presented in Graph 3.1. Over half of the employees (58%) don't have any knowledge about cloud computing and more than one third (70%) aren't informed about the benefits and weakness of this technology. This was expected and confirms the results of the previous research done for the master thesis, where 51% of the respondents weren't familiar with cloud computing. We think that the low level of knowledge does not represent a barrier to the implementation of cloud computing, because the problem isn't the technology itself, but the lack of information and promotion of cloud computing by corporations such as Microsoft or Google in Macedonia. If these lead technology players start promoting cloud computing, then the companies and employees will start paying greater attention, because the information will come from a credible and well-established source. This hypothesis is further confirmed by the fact that only 7% of the businesses currently use cloud computing services on an ongoing basis. Due to the nature of cloud computing services, this percentage cannot be taken as absolute, because there might be companies that use specific free of charge cloud computing services, but aren't aware that those services are in fact provided from the cloud. From the respondents, 32% use cloud computing services on a personal level. This percentage is comparable with the 42% that have knowledge about cloud computing, because both percentages are taken from the same respondent base. This means that from the 42% that have knowledge about cloud computing, 76% already use cloud computing services. This represents a strong signal that cloud computing has low-levels of usage in Macedonia

because of the lack of information and promotion of the technology, not because the companies and employees are unable or unwilling to use cloud services.

There are several important factors that could influence cloud adoption and implementation in SMEs in Macedonia. These were discovered in the research done for the master thesis and are as following: organizational culture through openness of the employees to learn new programs and techniques, the cost structure and the life span of the software in the company. Over one third (76%) of the respondents are willing to learn new programs and techniques (Graph 3.1), which is an unusually high percentage in this area. Employees are usually resistant to change, because it involves additional effort and time they have to invest in learning new skills and techniques (Mauer, 2009). We think that this high percentage is directly correlated with the typical life span of software in Macedonia (Graph 3.2). Nearly half of the software (48%) that is used in the analyzed companies is 3-5 years old and another 14% is older than 5 years. We think that this directly influences the high percentage of openness to change, because employees aren't satisfied with the old software they use and the incompatibility issues it causes. Only 9% of the software is less than 1 year old, which suggests that companies are unwilling to invest large capital for new software applications, meaning that cloud computing as a business model in SMEs in Macedonia has the potential to succeed. The last factor that is a precursor to cloud computing adoption in Macedonia is the cost structure of the companies. In this area, hardware and software dominate with 67% and 35% respectfully, followed by infrastructure costs with 28%. These percentages clearly indicate that the primary costs in most SMEs are capital costs, which fulfills the third factor for cloud computing implementation in Macedonia. Based on the results from this research paper, we think that all three preconditions are met and cloud computing could be realistically implemented in Macedonian companies.

The cost aspect of cloud computing is further researched with the cost projections (Graphs 3.3 and 3.4) for SMEs in Macedonia. In the previous research done for the master thesis, the cost savings for using cloud computing services versus the classic approach<sup>2</sup> in the period of one year was 480%. This high percentage was the main reason that motivated us to continue the research and expand its scope. The cost projection for a small enterprise reveals that the average costs for using cloud computing services is 2.370€, while the classic approach would cost 8.680€. The cost difference is 366%, lower than the previous research. The cost projection for a medium enterprise reveals that cloud computing would average 9.300€, while the classic approach would cost 50.340€. The cost difference is 541%, which is higher than the previous research and the cost difference for small enterprises. This is expected, because cloud computing saves potential cost with each additional piece of hardware or software, meaning that as the number of computers and applications that are replaced by cloud services increases, the cost difference also should increase in a linear fashion. The projections reveal that as the size of the company increases, the cost difference between cloud computing and the classic approach also increases.

The PEST analysis (Table 3.1) was performed to determine which are the factors on the Macedonian market that affect cloud computing and which are the factors that are or will be affected by cloud computing in the future. From a political perspective, the regulation of cloud computing in Macedonia can greatly affect the potential future of this technology and we think that before future implementations, new laws and regulations have to be created regarding cloud computing usage and privacy issues. From an economic perspective, the economic crisis will likely be a catalyst for companies to start choosing cloud computing as a flexible and operational-intensive model. From a social perspective, the organizational culture and attitude

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<sup>2</sup> Classic approach - buying and using software and hardware components

is one of the most significant factors that will affect future implementations of cloud computing in Macedonia and will be greatly affected by the use of cloud computing in SMEs in the future. From a technological perspective, the current infrastructure will be the differentiating factor, because cloud computing depends on Internet technologies in general. Our research reveals that the infrastructure requirements are met in the other analyzed smaller cities besides Skopje and cloud computing can be potentially implemented in each one of them.

## 5. Conclusion

The purpose of this scientific research paper was to evaluate the viability of cloud computing implementation in small and medium companies from different industries on the territory of the Republic of Macedonia. Based on the results of the research, we conclude that cloud computing, as a business model and a technology, can be successfully implemented in companies that are part of the selected target group. Cloud computing implementation and usage isn't dependent from the city or industry the company is from and Macedonia has the necessary technological infrastructure to support this business model.

The most significant contribution of this research is discovering the linear progression of cost difference between cloud computing and the classic approach, as the size of the companies increases. This implies that a further research can be done to determine the viability and cost savings that cloud computing could offer to large enterprises and corporations in the Republic of Macedonia.

### Literature

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## 6. Appendix

### A. Sample from the questionnaire that is used for the purposes of this scientific research paper

Questionnaire about Cloud Computing implementation and usage

Name: \_\_\_\_\_ Company: \_\_\_\_\_

Position: \_\_\_\_\_

Date: \_\_\_\_\_

#### Instructions

The questionnaire is separated in two different parts (organization and cloud computing). You can select more than one answer for specific questions. If you don't know the answer for a particular question, you leave it blank and move on to the next one.

#### Part 1. Organization

1. What are your concerns about Internet technologies in general?

- A. Risk of hacking
- B. Privacy issues
- C. Unavailability of data and/or applications
- D. Unauthorized access and modification of data
- E. Lack of government regulations
- F. Other concern, I will specify: \_\_\_\_\_

2. What areas of the company produce the biggest costs?

- A. Hardware
- A. Software
- B. Infrastructure
- C. Security
- D. Staff
- E. Training

3. Would you accept learning new programs and techniques?

- A. Yes

B. No

4. In your profession, do you rely on using the Internet?

- A. It is vital to my work
- B. I use it occasionally
- C. My work does not depend on using the Internet

5. How old is the software on which you currently work?

- A. Less than a year
- B. 1-2 years
- C. 3-5 years
- D. More than 5 years

6. Which provider does your company use for Internet services?

- A. T-Home
  - B. Blizoo
  - C. Telekabel
  - D. On.net
  - E. Other, I will specify
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7. If you know the Internet package that your company uses, please specify:

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8. Does your company has a large number of mission-critical applications and data?

- A. Yes
- B. No

## **Part 2. Cloud Computing**

1. Are you familiar with the term Cloud Computing and what it means?

- A. Yes
- B. No

2. Do you know which are the benefits and weaknesses of Cloud Computing?

- A. I know them in great detail
- B. I know about some of them

C. No

3. Are you actively using cloud computing services for personal use?

A. Yes

B. No

4. Is your organization actively using cloud computing applications and services?

A. Yes

B. No

C. I don't know