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May 1, 2012

Approved by

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¹ Declaration of Ethical Conduct in Research: I, as a graduate student of KAIST, hereby declare that I have not committed any acts that may damage the credibility of my research. These include, but are not limited to: falsification, thesis written by someone else, distortion of research findings or plagiarism. I affirm that my thesis contains honest conclusions based on my own careful research under the guidance of my thesis advisor.
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ABSTRACT

The EC decided in 2007 to develop the Open Source Observatory and Repository in the European Union (OSOR.eu) portal. The OSOR.eu portal was developed based on the paradigm of open source software and e-government initiatives for sharing news, ideas and solutions among public administrations of the European Union. Through the OSOR.eu portal, sharing solutions for public administration can be an effective way how to reduce expenses to ICT projects for public administration, because basic public administration issues are similar in different countries. For citizens and business, OSOR.eu portal also have indirect benefits that can be achieved through faster and more effective development of e-Government services. However, there has been no research to examine what the portal OSOR.eu portal should consider for its success while various benefits of the OSOR.eu portal are expected. The contributions of the OSOR.eu portal to the development process of e-Government services in the EU also need to be addressed to demonstrate the impact of OSOR.eu portal to the e-Government services.

This study examined the success factors of open source software repositories designed for e-Government by employing the revised DeLone & McLean information systems success model to the OSOR.eu portal and the key success factors of the OSOR.eu portal and identified the main net benefits for the OSOR.eu users. One hundred and seventeen users of the OSOR.eu portal participated in the survey and the method of partial least squares was employed to analysis the data. The results indicate that information quality is the strongest factor to affect the net benefits of OSOR.eu. Service quality plays a significant role in the success of the open source software repository. This study also shows that organization type and job relevance are moderators for the success of the OSOR.eu portal.
This study has implications for how governments can improve the development of public services using open source software repositories and how the OSOR.eu portal fulfills its main goal to be an effective platform for exchange of information and OSS-based solutions among public administrations in the EU.

Keywords: Open source software, e-government, OSOR.eu, European Union, Partial least squares
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Chapter 1. Introduction

Several studies – such as Bhogle (2008), Moon (2002), and Layne and Lee (2001) – have verified that implementation of information and communication technologies (ICT) can be utilized to build more efficient and transparent government. Additionally, studies prepared or sponsored by the European Commission (EC) – including (Schmitz, 2001), (Ghosh et al., 2002a), and (Ghosh, 2006) – showed that Open Source Software (OSS) can significantly reduce the expenses for ICT implementation. Based on these studies, the EC decided in 2006 to establish and support the Open Source Observatory and Repository in the European Union portal (OSOR.eu).

Any activities sponsored from public fund should generate a basic question: Is there any benefit for citizens and business (in other words, the taxpayers)? Although this question may seem very simple, the answer can be very complicated. Some projects are too estranged from taxpayers and the benefits are very complicated. The OSOR.eu portal is an example of an estranged activity.

According to UN report in 2009, there are almost 200 countries around the world. Each country has its own history and culture, but public administrations need evidence of citizens and aliens, as well as evidence of cars, buildings or taxes. The similarity of administration problems in different countries in combination with information technologies offers the possibility of sharing similar e-Government solutions among public administrations of different countries. Additionally, governments increase the usage of information and communication technologies for public administration (UN, 2008).

According to the OSOR.eu, the OSOR.eu portal’s role is to support OSS solutions for public administration in the European Union (EU). Even though the OSOR.eu portal is supported by funds of the EC (in other words, from pockets of taxpayers in the EU), and the expenses are irrelevant (in comparison with the total budget of the EU), all public funds should be used effectively. The
OSOR.eu portal is not designed for the general use of citizens and businesses of the EU. The expected net benefits of the OSOR.eu portal for citizens and business are only indirect – through faster and more effective development of e-Government services.

The validation of whether the OSOR.eu portal can offer these indirect benefits to taxpayers in the EU is a very complex process. The fundamental element of this process is the net benefits validation for users of the portal. It would then be possible to prove the contribution of the OSOR.eu portal to the development process of e-Government services in the EU and finally to demonstrate the impact of the portal on the tangible e-Government services.

The primary objectives of this study are to identify the key success factors of the OSOR.eu portal and recognize the main net benefits for the OSOR.eu users based on a survey among OSOR.eu portal users. Additionally, the study demonstrates the feasibility of the Updated DeLone McLean Information System Success Model (D&M Model) for a repository and observatory portal supported by public funds. Finally, this study demonstrates how the OSOR.eu portal fulfills its main goal – to be an effective platform for exchange of information and an OSS-based solution for public administration in the EU.

This dissertation has the following organization. In Chapter 2 (Literature Review), are discussed the studies, papers, and other relevant sources associated with e-Government, open source software, the European Union and D&M Model. In Chapter 3 (Conceptual Development, Research Method, Model and Hypotheses), are developed a conceptual model for the OSOR.eu portal, the research methodology and hypotheses. In Chapter 4 (Research Design), are described the survey and provided the statistical analysis of the survey data. In Chapter 5 are presented the survey results, in Chapter 6 are discussed key insights, and implications for theory. Finally, Chapter 7 (Conclusion) presents contribution and limitations and describes areas of future research.

Appendixes of this study present a glossary and used questionnaire.
Chapter 2. Literature Review

The research topic combines papers and studies from different topics (such as open source software, information system success models, and e-Government). This Chapter organizes all key papers and studies then thematically and then chronologically. Each sub-chapter concludes with a summary the key information for this research.

2.1 History and basic principles of Open Source Software

At the end of the 1970s, the majority of software was published under restrictive licenses. The previous practice, where software was distributed with the source code (and users could modify the software according to their needs) had come to an end. Even when software was published just for one system, the accessible source code was a valuable inspiration for competitors, who could reuse the ideas and solutions and better compete.

In 1980, Richard Mathew Stallman modified the control software of a printer in the Artificial Intelligence Lab at Massachusetts Institute of Technology (AI Lab at MIT), because the vendor rejected the software modification demand (Bretthauer, 2001). This modification improved the status messages to users about print jobs (finished job, printing, paper jam, etc.). Based on this experience, R. M. Stallman recognized that users should have the right to modify software and announced the GNU Project (GNU is a recursive acronym GNU’s Not UNIX) in 1983. In 1984 he quit his job at MIT and subsequently established the Free Software Foundation (FSF) in 1985.

According to Bretthauer (2001), the FSF defines the four basic freedoms of free software as:

The freedom to run a program, for any reason.

The freedom to study the program, and to adapt it to your needs. Access to the source code is a precondition for this.
The freedom to redistribute the program, so you can help others.

The freedom to release improvements, so everyone benefits. Again, access to the source code is a precondition for this.

These freedoms have no geographical limitations, and thus anybody (individual, company or government of any country) can use the published software. This means that a license cannot limit running the program to a particular computer, user group or purpose (such as OEM licenses or student or home versions of software (Välimäki and Oksanen, 2005)), and the users have the right to change, sell or copy the free software.

Today several terms are used for identifying free software based on these four freedoms. Additionally, the original term “Free software” is often used for software that is available free-of-charge but the users cannot study or modify the program. For this study, the term “Open Source Software” (OSS) is used for any software that is compliant with the four basic freedoms of free software (regardless of license). Even though there are many different OSS licenses, the most often used OSS license is the GNU General Public License (GNU GPL or GPL, Skidmore, 2006).

Generally, OSS licenses offer users much greater possibilities regarding how to use the software than proprietary software. The freedom to release improvement allows users to solve future changes in software – regardless of whether these changes are initiated by law changes or security update. The freedom to share the code allows the common development of software solving similar issues. Finally, the OSS licenses allow easier development of interoperable systems.

2.2 Information Systems Success models overview

In 1980, the typical computers in public administration were mainframe computers with terminals in offices. These computers were very expensive with poor user interfaces, and hence were used for limited issues (IBM launched its IBM PC in 1981 and totally changed the usage of computers).
According to DeLone and McLean (1992), Peter Keen identified the fundamental problems of management information systems (MIS). Information systems (IS) and evaluation of IS has become a prominent research area.

2.2.1 Information Systems Success: The Quest for the Dependent Variable

DeLone and McLean (1992) recognized that “the evaluation of I/S practice, policies and procedures requires an Information system (IS) success measure against which various strategies can be tested”. They covered 180 empirical studies related to IS success issued in years 1981-87 and categorized all used variables into six groups: System Quality, Information Quality, Use of Information, User Satisfaction, Individual Impact and Organizational Impact. As outlined in DeLone and McLean (1992), only 28 among these empirical studies used variables from three or more categories of variables and only one of the empirical studies tested variables from four categories. (No study with five or six categories of variables was found.)

**System Quality** represents measures of the information processing itself – in other words, HOW the information is provided. The typical variables are System Accuracy, Ease of Use, System Reliability, System Flexibility or System Efficiency.

**Information Quality** represents measures of information system output – in other words, these measures evaluate the objective CONTENTS of an IS. This category includes variables such as Timeliness, Reliability (of information), Accuracy, Clarity Informativeness and Freedom of Bias.

**Information Use** (or Use only) represents measures of recipient consumption of the output of an information system – in other words, measures that describe HOW USERS use the information provided by an information system. The typical variables are Frequency of Access, Regularity of Use, Amount of Connected Time, and Number of Reports Generated.
**User Satisfaction** represents measures of recipient response to the use of the output of an information system – in other words, the SUBJECTIVE evaluation of information system satisfaction by its users. This category is represented with variables such as Overall Satisfaction, Enjoyment or Information Satisfaction.

**Individual Impact** represents measures of the effect of information on the behavior of the recipient – in other words, measures of how the information system involves the PERSONAL activity of each user. The typical variables are Task Performance, Decision Effectiveness, Correctness of Decision, and Improved Individual Productivity.

**Organization impact** represents measures of the effect of information on organizational performance – in other words, how the information system involves the ORGANIZATION itself. In this category are variables such as Operating Cost Reductions, Increased Revenues or Profit, Staff Reduction, Service Effectiveness, and Product Quality.

Based on the theoretical background, DeLone and McLean (1992) proposed an IS success model that contains all six categories and respects all dependencies and temporal influences for a better description of information system success. Figure 1 shows DeLone and McLean's IS success model (1992 D&M IS success model).
System Quality and Information Quality category variables (constructs), which “create the system”, involve Use (Information Use) and User Satisfaction constructs (or, “use of system” constructs). Use and User Satisfaction constructs affect each other, too. Finally, Use and User Satisfaction constructs affect “consequences of this system” – the Individual Impact and from the Individual Impact is deduced the Organizational Impact.

This model was validated on a wide number of information systems and the 1992 D&M IS success model is still a significant resource for IS success researchers. However, based on both practical experience and theoretical research, the original 1992 D&M IS success model was modified.

### 2.2.2 The DeLone and McLean Model of IS Success: A Ten-Year Update

Seddon (1997) argued that the 1992 D&M IS success model (discussed in Chapter 2.2.1) combines process and variance interpretations and the model can be confusing. He respecified and extended the 1992 D&M IS success model. Even though this model complicates the IS success model and is
not so popular as the 1992 D&M IS success model, it defines the net benefits of information system use, which are divided into the following:

- Net benefits to individuals
- Net benefits to organizations
- Net benefits to society

Seddon shows that information systems can have some impacts on not directly involved people or organizations – in other words, society. Additionally, Seddon argued that net benefits variables can involve both User Satisfaction and Use constructs. Seddon offers the use of a Perceived Usefulness construct based on Davis and Davis (1989) definition instead of the use construct.

Kettinger and Lee (1994) and then Pitt et al. (1995) demonstrated that the Service quality should be implemented in the IS success model. Variables in this category describe support services, which are not directly related to information system or data. The typical examples of service quality variables are Quality of Responses of the Support Team, Response Time of Support Team, and Quality of Documentation.
Based on these comments and on empirical testings and validations of the 1992 D&M IS success model, DeLone and McLean updated and extended their model (DeLone and McLean, 2003). Figure 2 shows this updated DeLone and McLean IS success model (2003 D&M IS success model).

In comparison with the 1992 D&M IS success model, the updated version has one more construct in the “creation of system” part – the Service Quality. Its impact is on both constructs in the “use of system” part. The change of the construct Use to Use/Intention demonstrates the real behavior or expected behavior of IS users. The “consequences of IS system” is now represented by just one construct – Net Benefits. But this construct contains not only benefits (or impacts) to users and organization, but also represents the society (to all other individuals or organizations) benefits.

As with the original model, the 2003 D&M IS success model is widely used for evaluation of many information system around the world. Each application of the 2003 D&M IS success model examines and validates this model and the 2003 D&M IS success model is one of the most reliable tools for IS success measurement.
2.2.3 Instruments used for measurement in D&M IS success models

Both the 1992 and 2003 D&M IS success models are widely used and many instruments are used for measurements. DeLone and McLean (2003) and Petter et al. (2008) summarized the widely used instruments. Additionally, other studies including Bharati & Chaudhury (2003), Negash et al. (2003), (Yang et al. (2005), and (Lin and Lee, 2006) extended the set of validated instruments for measurements.

2.2.4 Impacts of organization type and job relevance on information system

According to Perry and Rainey (1988), Roessner (1977) and G. Lee and Xia (2006), the organization type can affect how technologies (and information system as well) are adopted and used. Perry and Rainey (1988) summarize earlier studies related to differences among various organization types and categorize organizations by ownership, funding, and mode of social control. Roessner (1977) compares differences in organization innovation between private and public sectors. G. Lee and Xia (2006) found that the organization type has a significant moderating effect on IT innovation adoption.

Landrum et al. (2010) discuss the moderating effect of job or occupation on the perception of information services' quality and success. According to previous studies, Landrum et al. (2010) believed that job categories should moderate the relationship among constructs of D&M IS success model. They argue that “different user groups or people with different job duties could have different expectations of service quality, different perceptions of the usefulness of a system, and different satisfaction level requirements with a system”.

The OSOR.eu portal (as discussed in Chapter 2.9) users are from various organizations and work at different positions. This dissertation posits that these two factors (organization type and occupation) influence the expectations of OSOR.eu users.
2.3 Applications of D&M IS success models

The OSOR.eu portal combines two different concepts together. First, OSOR.eu portal is e-Government service (even though is focused to specific group of users). The OSOR.eu portal is fully supported from public funds and the European Commission, and the main goal of the portal is to provide a convenient environment for e-Government services development. Second, the whole system is based on open source software (OSS), and thus testing of the OSOR.eu portal requires tools that have been tested on other OSS projects.

2.3.1 Information systems success in free and open source software development: Theory and measures

Crowston et al. (2006) adapted the D&M IS success model to Open Source Software (OSS). Because their work started before the publication of the 1992 D&M IS success model (earlier versions of this paper were published during the International Conference on Information Systems in 2003 – ICIS 2003), it is based on the original version of the D&M IS success model. Nevertheless, this paper is a valuable source of an OSOR.eu case.

First, Crowston et al. (2006) tested the sourceforge.net (SF.net) portal, one of the most important independent developer portal for OSS; OSOR.eu is a similar portal, but is only focused on projects related with public administration. Second, based on high rating scores and low variations among 59 different projects they mentioned, they argue that “it seems likely that users who do not like some software simply do not bother to enter ratings”.

They collected data from SF.net in February 2001 and April 2002 and used additional data from other sources from October 2003, October 2004, and February 2005. The number of projects increased from more than 50,000 to almost 100,000 within four years of collecting data. They selected and measured 120 projects, which satisfied the following criteria:
projects with seven or more developers

projects with more than 100 reported bugs

Crowston et al. (2006) adapted the 1992 D&M IS success model for measurement of OSS projects and validated this model with projects hosted on SF.net.

2.3.2 Assessing e-Government systems success: A validation of the DeLone and McLean model of information systems' success

(Y. Wang & Liao, 2008) used the 2003 D&M IS success model for testing six different e-Government services in Taiwan:

- Taiwan Railways (www.railway.gov.tw),
- motor vehicle and driver IS (www.mvdis.gov.tw),
- tax filing (tax.nat.gov.tw),
- employment services center (www.ejob.gov.tw),
- an e-Government portal (www.gov.tw) and
- Bureau of Tourism (www.taiwan.net.tw).
Figure 3 shows the modifications of the 2003 D&M IS success model by Wang and Liao. They use the Use construct only (and omitted the Intention of Use), because all systems are used voluntary and Wang and Liao measured the actual usage of systems. Because the research is cross-sectional, they also excluded two feedback relations from Perceived Net Benefit.


### 2.3.3 Measuring open source software success

Lee et al. (2009) adapted the 2003 D&M IS success model for measurement of success of open source software (OSS). Figure 4 shows the model modifications.
First, because the study examined software instead of an information system, the System Quality construct was replaced with Software Quality. Also the Information Quality construct was excluded, because it is irrelevant for software cases, and Service Quality was focused on Community Service Quality only. The Net Benefits were measured for individuals only. Finally, because this study is cross-sectional, the feedbacks relations (from Use to User Satisfaction and both from Net Benefits) were avoided in this research model.

Based on a survey with 157 respondents, Lee, Kim and Gupta proved that the adapted 2003 D&M IS success model can also be used for OSS projects.

2.3.4 Summary of applications of D&M IS success models

The discussed studies proved that the D&M IS success model can be adapted both for e-Government and OSS projects and it is a flexible success model. In other words, the D&M IS success model can be used for e-Government projects that are based and focused on OSS.
2.4 e-Government Related Studies

The OSOR.eu portal is designed as a support tool for developers of e-Government services, not for provision to citizens or businesses. However, if the e-Government services had no utility, there would be no reason to build and maintain a portal such OSOR.eu. Papers and studies discussed in this chapter describe the main issues in e-Government service development and which e-Government services are demanded by citizens and businesses.

2.4.1 Developing a fully functional E-government: A four stage model

Layne and Lee (2001) published four developmental stages of e-Government services. The e-Government services are divided into four groups according to the level of integration and interaction:

**Catalogue** is the simplest type of e-Government service. It offers just a list of services available in some office, access information such as office hours or address, presentation of the office, or downloadable forms. There is no online interaction between citizens and the office.

**Transaction** services offer some online interaction between citizens (companies) and the office. It can be a simple reservation system or web-based forms, where data provided by citizens are stored in a database and then electronically processed. There is no communication with other offices; all transactions are just local, independent of other systems in public administration.

**Vertical Integration** refers to services that require some interaction both with citizens (or businesses) and some systems on a higher level for proper functionality. This means that citizen can put their social security numbers (SSNs); based on given SSN are other information (such name, address, and birth date) are obtained from central information system.

**Horizontal Integration** represents the highest level of integration, where all e-Government services are provided at one site. Citizens and businesses have a single point where they can find all
information related to them. Citizens can ask for passport or driver's license, pay taxes or fines, or check their obligations related to public administration.

Layne and Lee (2001) discussed three important challenges of successful e-Government services:

Universal Access means that the service should be accessible by anybody, anywhere and anytime. In 2001, the typical device with an Internet connection was a computer, but by 2010 many different devices could be used for accessing the Internet (and for e-Government services access as well). In other words, we should add any “any device request” to Universal Access.

Privacy and confidentiality are critical points for e-Government services – both for citizens (and companies) and public administration. Based on Layne and Lee, services must be based on transparent methods of security, clear rules and procedures and appropriate technical solutions.

Citizen focus means that citizens (in other words, taxpayers) are the most important part of any e-Government service. The e-Government service designers must consider citizen needs and prepare easy to use services.

2.4.2 Interoperability in e-Government

Guijarro (2009) compares interoperability frameworks in three European countries (the United Kingdom, France, and Denmark), in the United States of America and the initiative of the European Commission. He demonstrates that interoperability is the crucial attribute of e-Government services and it simplifies further exploitation of collected information.

Otjacques et al. (2007) demonstrate the importance of interoperability of an e-Government information system in single identification numbers (SIN) in the European Union. The current 27 member countries use their own systems of SIN (if any), and this situation generates many difficulties for data exchange inside the EU.
2.4.3 e-Government success factors

According to Jaeger and Thompson (2003), the e-Government should focus on the following issues:

- coordinate the e-Government policy in all levels of public administration (governmental, regional and local)
- efficient usage of information and communication technologies
- access to relevant services and data
- find reliable methods for evaluation of e-Government service usage

Similar factors are involved in the e-Government services. (Gilbert & Balestrini, 2004) show that quality of e-Government services helps to reduce barriers and increase benefits for users. Additionally, they identify the key factors for e-Government service success as follows:

- time needed for e-Government service use
- expenses related to service
- quality of presented information
- security of financial transaction
- level of trust

The discussed studies show the main issues in the development of e-Government. The services should be secure, offer relevant information, be easy for users to use and save time or money to taxpayers. Additionally, they should be interoperable among different levels as well as among different parts of public administrations (and, in case of the EU, at the international level). These goals can be better achieved if the public administrations know the exact functionality and data formats of systems, which should be connected.
2.5 Software in Ownership of Governments

According to the study from the FISTERA network described in (R. A. Ghosh, 2006), less than 20% of all software in the European Union and the United States is proprietary licensed software; more than 80% of software is delivered through internal or external development, or customization of software and is under sole ownership of governments or public agencies.

In other words, 80% of software used in governments and municipalities, is software solutions dedicated to public administration tasks. According to Ghosh (2006), many software packages can be opened and immediately reused in other parts of the country or (after translation and localization) in another country.

2.6 The European Union Overview

The European Union is an economic and political association of 27 European countries (EU, 2009). The EU historically started as the European Coal and Steel Community (ECSC) in 1951. This organization organized the common production of coal and steel of member countries – Belgium, Germany, France, Italy, Luxembourg, and the Netherlands. These countries extended collaboration to other areas of the economy in 1957, with the establishment of the European Atomic Energy Community (EAEC or Euroatom), an organization for coordination of peaceful nuclear energy research, and the European Economic Community (EEC), the economic integration and single market creation (with common external tariffs) of member countries. These projects were interesting for other countries; simultaneously the collaboration of member countries became stronger. Since 2007, the European Union, an economic and political union, has 27 member countries, and as for 2009 16 countries are using the common currency, the Euro. The conditions during the establishment of European Communities and extensions of the EU result in a very complicated decision system inside the EU.

The budget of the European Union bodies is supported by three different sources (EU, 2011):
According to (EU, 2011), the contribution of each citizen of the EU to the EU budget is about 270 Euro each year. The total commitment appropriations of the General Budget of the European Union was 132 026 million Euro in 2008 (EU, 2008).

The integration of the EU results in the convergence of legal systems of member countries. According to the Treaty on European Union (EU, 1992) and Treaty of Lisbon (EU, 2007a), many legal acts in member countries are directed from or coordinated at the EU level. The similarity of the legal environments of the EU member countries simplifies the adoption of solutions to administration issues from one member country to another.

2.7 E-Government in the EU

As discussed in Chapter 2.6, the European Union is a unique international organization. The European Commission has not only a coordination role, but decision authority as well. Additionally, the member countries converge their legal frameworks. Finally, because the OSOR.eu portal is focused on supporting the development of e-Government services inside the EU, papers and studies related to e-Government in the EU are collected in this section.

The issues related to coordination and collaboration between European public administrations are maintained by a unit named Inter-operable Delivery of European e-Government Services to public Administrations, Businesses and Citizens (IDABC), which is a unit of the Directorate General for Informatics of the EC.
2.7.1 Value for citizens

The European Commission is concerned with efficient public administration. One of the results of this policy is Value for citizens – Vision of Public Governance in 2020 (Botterman et al., 2009). Four research institutes GNKS Consult from the Netherlands, Danish Technology Institute, RAND Europe (the United Kingdom), and Rathenau Institute (the Netherlands), prepared this report, which was sponsored by European Commission funds in December 2009.

This report describes lessons from earlier periods, current trends, and future drivers in e-Government and compares the current changes with changes in communication and transportation, electrification, and broadcasting.

The report identifies the following issues for e-Government services:

Efficiency of government – e-Government services can reduce public administration expenses

Improve the quality of e-Government services – they should be oriented to citizens and companies

Governance – e-Government services should be flexible and accountable

Besides these issues, the Value for citizens report emphasizes interoperability, openness, and transparency of future e-Government services.

2.7.2 Study on the Measurement of e-Government User Satisfaction and Impact

In 2008, the European Commission published a study focused on e-Government user satisfaction, prepared by Deloitte and Indigov (2009) (Impact Study). From 10 EU member countries (Austria, Belgium, France, Germany, Italy, the Netherlands, Poland, Spain, Sweden and the United Kingdom) 10,000 citizens (1,000 per country) and 4,000 companies (400 per country) were selected for this study.
The Impact Study defines four groups of e-Government services focused on different clients:

citizens (government-to-citizens, G2C)

businesses (government-to-businesses, G2B)

governments and public administration (government-to-government, G2G)

civil society (non-governmental) organization and other stakeholders (government-to-non-
government, G2N)

In September 2008 this Impact Study tested the user satisfaction of two groups of e-
Government – G2C and G2B. Each of the groups was tested with separate online surveys – User Satis-
faction Benchmark (USB) and eService Evaluation Tool (eSET).

<table>
<thead>
<tr>
<th>Citizen life-events</th>
<th>Business life-events</th>
</tr>
</thead>
<tbody>
<tr>
<td>I declared the birth of a child in my family</td>
<td>I became/started as self-employed</td>
</tr>
<tr>
<td>I got married or my marital status changed</td>
<td>We started a new company or branch (within our country)</td>
</tr>
<tr>
<td>I moved and changed the address of where I live (within my country)</td>
<td>My company invested, started-up or undertook business abroad</td>
</tr>
<tr>
<td>I needed a passport or visa to travel abroad</td>
<td>My company bought or built new offices or plants</td>
</tr>
<tr>
<td>I went to live, study or work abroad</td>
<td>My company had to declare corporate taxes, VAT or social contributions</td>
</tr>
<tr>
<td>I or one of my children enrolled in higher education</td>
<td>My company searched and applied for public funds</td>
</tr>
<tr>
<td>I applied for a study grant for myself or (one of) my children</td>
<td>My company hired new personnel</td>
</tr>
<tr>
<td>I looked for a job</td>
<td>My company had to declare customs taxes</td>
</tr>
<tr>
<td>I am or I became unemployed</td>
<td>My company needed environment-related permits</td>
</tr>
<tr>
<td>I retired</td>
<td>My company was involved in a public procurement exercise</td>
</tr>
<tr>
<td>I had to declare income taxes</td>
<td>My company applied for a patent</td>
</tr>
<tr>
<td>I bought, built or renovated a house</td>
<td>My company had to close down (a branch)</td>
</tr>
<tr>
<td>I bought a new car</td>
<td>My company went bankrupt</td>
</tr>
<tr>
<td>I reported a crime</td>
<td></td>
</tr>
<tr>
<td>I made use of the public library</td>
<td></td>
</tr>
<tr>
<td>A close relative died</td>
<td></td>
</tr>
<tr>
<td>I came into an inheritance</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Customer life-events selected for Study of the Measurement of e-Government User Satis-
faction and Impact (EU, 2005)
All questionnaires contained parts for basic statistical data (such as gender, age, social status for citizens, and number of employees, main economic activity, and total annual turnover for companies) and ICT skills of responders. These data were compared with data provided by (Eurostat (2008).

The e-Government oriented questions were based on citizen and business life-events, as specified in the EU eUser project (EU, 2005). According to the Impact Study, life-events specified in Table 1 were selected as the object of measurement. 17 citizen life-events and 13 business life-events were tested.

The Impact Study found that the main results consist of five components:

- trust (both in ICT and government/public administration)
- easy access (information and services should be easily findable and usable)
- awareness (for both e-Government services and users – citizens and companies)
- perceived benefits (users – both citizens and companies – are concerned most with saving time, rather than efficiency and simplicity of services)
- user profiling (finding special needs of users)

2.7.3 E-government development on delivering public services among EU cities

Torres et al. (2005) researched e-Government services offered on web sites of 33 cities from 10 countries in the EU:

**Austria:** Wien

**Belgium:** Brussels

**France:** Lyon, Marseille, Paris

**Germany:** Berlin, Köln, Essen, Frankfurt, Hamburg, München, Stuttgart
Ireland: Dublin

Italy: Genova, Milano, Napoli, Palermo, Roma

Luxembourg: Luxembourg

Portugal: Lisbon

Spain: Barcelona, Madrid, Zaragoza, Seville, Valencia

United Kingdom: Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, London, Sheffield

They identified web sites for a total of 67 different e-Government services in these cities and divided them into seven groups:

**General services**: Public employment, Public procurement, Change of personal data, Identity card/domicile register, Traffic fines' applying, Traffic fines payment, Lost objects, Register (birth, marriage, death), Birth, death, and marriage certificates, Reporting errors, Register of civil partnerships, Marriage in town halls, Changes to the census, Voter registration, Application for meetings in public spaces, Permission for loading, unloading or driving in restricted areas, and Funeral services and cemeteries;

**Education**: Municipal schools and Kindergartens;

**Environment—health**: Consumer's office, Food safety, Application for garbage containers and litter, Collection of bulky items, Applications for recycling bins, Domestic collection of garbage, Pest control, Sanitary license, Selective collection of garbage (trades/works), Complaints about public nuisances (noise, graffiti, etc.), Abandoned vehicles, Dangerous trees and protection of trees, Waste water, discharge effluent to a sewer, Water supply and License/registration of dogs and other animals;

**Housing**: Car parking prohibitions, Building permission, Planning applications, Grants (to buy or rehabilitate housing, etc.), Council dwellings, Inspection/change of use of premises, Demolition,
Buying a public property, Payment of rent, repairs of municipal properties, and Private works affecting public roads;

**Social services:** Tele-assistance, Adaptations for the disabled, Grants, Home care, Meals on Wheels, nursery homes and Social activities/youth;

**Economic activities:** Payment of business rates, Payment of taxes, Benefits, Communication change of fiscal data, Parking for residents, Parkings, Parking for the disabled, Public transport fares, Venues for meetings, congresses, Markets, trade in public ways, Use of streets and public sites for commercial activities, Licenses for taxi and private hire, and Applications for licenses to open or close establishments;

**Culture/leisure/sport:** Catalogue of libraries, Reserving books, Booking of sport facilities, Public entertainment tickets, and Filming permits

Data collected from 33 city web sites in 10 European countries and presented by Torres et al. (2005) show that the public administrations in the EU member countries use e-Government services for solving similar issues. As discussed in Chapter 2.6, the legal framework of EU member countries converges. This situation allows easier adoption of e-Government service solutions from one country to another.

2.8 The EU, e-Government and OSS

The interest of the European Union (EU) in Open-source software (OSS) is based on the results of several systematical studies that deal with technical, legal, and economic aspects of using OSS for public administrations.

One of the key studies, which describes OSS in the European Union, is Ghosh et al. (2002), prepared by a team of authors from the International Institute of Informatics (University of Maastricht, the Netherlands) and Berlecon Research (Berlin, Germany).
The study was published in July 2002 and is the one of the key sources for the European Commission decisions in Open Source software area and policy. It is important to remember all limitations based on the date of publication of this study and on the limited range of the research (just selected countries and company size). On the other hand, supported by the European Commission and used as a source for the Open Source Observatory and Repository portal in the European Union (OSOR.eu), it is the one of the first systematic studies in the OSS area.

This study is divided into six parts:

Part I: Use of Open Source Software in Firms and Public Institutions

Part II: Firms’ Open Source Activities: Motivations and Policy Implications

Part IIb: Open Source Software in the Public Sector: Policy within the European Union

Part III: Basics of Open Source Software Markets and Business Models

Part IV: Survey of Developers

Part V: Source Code Survey

For the present research, the most important parts are Part I (Wichmann, 2002) and Part IIb (Ghosh et al., 2002b).

2.8.1 Use of Open Source Software in Firms and Public Institutions – Evidence from Germany, Sweden and UK

This part of the study was prepared in the first half of 2002 by Berlecon Research (Berlin, Germany). The researchers contacted 1,452 firms and public bodies with more than 100 employees from three European countries only – Germany, Sweden, and United Kingdom. Open Source Software (OSS) was used (or planned to use) in 395 of the contacted companies and public bodies. Note that all data, tables, and figures used in this chapter were originally published in FLOSS Final Report
Part 1: Use of Open Source Software in Firms and Public Institutions – Evidence from Germany, Sweden and UK (Ghosh et al., 2002).

The survey focused on two areas:

- the actual popularity of OSS usage in selected countries
- motivations for OSS usage and expected benefits

According to the final report, Germany, Sweden, and the United Kingdom were selected not as a typical EU countries, but as a significant markets (Germany and the UK are the significant markets inside the EU) or as an example of a small country with high ICT usage (Sweden). The survey did not attempt to describe the actual situation in the EU. Additionally, the survey had limited financial resources.

The respondents were indexed into two categories:

by the size of the company or public institution:

- less than 500 employees
- more than 500 employees

by the type of industry, divided by NACE (Nomenclature statistique des Activités économiques), the official classification of industries used in the EU:

- public sector
- private – high IT intensity
- private – middle IT intensity
- private – low IT intensity
Table 2: Surveyed companies which use (or plan to use) some OSS, divided by countries, size and type (Ghosh et al., 2002)

<table>
<thead>
<tr>
<th>Country</th>
<th>United Kingdom</th>
<th>Sweden</th>
<th>Germany</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>small</td>
<td>large</td>
<td>small</td>
<td>large</td>
</tr>
<tr>
<td>High intensity (NACE I,J,K,N)</td>
<td>7</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Medium Intensity (NACE D, E)</td>
<td>9</td>
<td>1</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Low Intensity (NACE F, G, H)</td>
<td>7</td>
<td>7</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Public sector (NACE L, M)</td>
<td>20</td>
<td>13</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>41</td>
<td>81</td>
<td>70</td>
</tr>
</tbody>
</table>

Table 2 describes the companies and public bodies that participated in the survey. The low number of participants in the UK is caused by budget limitation, high refusal rate, and low level of OSS adoption in the segment. Based on the study, the refusal rate was highest in Germany (82%), followed by the UK (76.2%) and then in Sweden (39.2%).

Table 3 displays, how many companies and public bodies used (or planned to use) OSS in first half of year 2002. The collected data do not prove any trends in OSS usage, only shows that the public sector usage of OSS is above average in observed countries.

Table 3: Current and planned professional use of OSS in Germany, Sweden and United Kingdom, n=1,452 (Ghosh et al., 2002)

<table>
<thead>
<tr>
<th>Country</th>
<th>United Kingdom</th>
<th>Sweden</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>small</td>
<td>large</td>
<td>small</td>
</tr>
<tr>
<td>High intensity (NACE I,J,K,N)</td>
<td>25.00%</td>
<td>74.10%</td>
<td>20.40%</td>
</tr>
<tr>
<td>Medium Intensity (NACE D, E)</td>
<td>39.10%</td>
<td>9.10%</td>
<td>14.60%</td>
</tr>
<tr>
<td>Low Intensity (NACE F, G, H)</td>
<td>25.00%</td>
<td>14.30%</td>
<td>13.60%</td>
</tr>
<tr>
<td>Public sector (NACE L, M)</td>
<td>32.80%</td>
<td>38.20%</td>
<td>16.40%</td>
</tr>
<tr>
<td>Total</td>
<td>31.50%</td>
<td>17.70%</td>
<td>43.70%</td>
</tr>
</tbody>
</table>

The research shows that main motivation for OSS usage in British, German and Swedish companies and public bodies is highly independence. With statement “We use Open Source Software because we want to be more independent from the pricing and licensing policies of big software companies.” totally agreed 30% from 395 respondents, 26% somewhat agreed (neither or not: 12%, somewhat disagree: 12%, totally disagree: 19%, no answer or don't know: 4%). On the other hand, only
19% respondents of this survey (8% totally agreed, 11% somewhat agreed) preferred the using of Open Source Software (OSS). One third of respondents recognized the importance of OSS for their company’s IT infrastructure as very high (10%) or high (23%). Interesting point is that the highest importance of OSS was found in Sweden (13% very high, 30% high), even though the level of OSS usage is the lowest from three observed countries (17.7%).

The usage of OSS was divided in four areas, in which key benefits were measured for the companies and public bodies:

- OSS as server operating system (total 220 respondents)
- OSS for databases (total 167 respondents)
- OSS on the desktop (total 80 respondents)
- OSS for websites (total 155 respondents)

The respondents of the survey evaluated the usage of OSS separately in different 15 criteria. All criteria was evaluated in five grade scale (very important, important, neither nor, less important and not important), completed with additional choices “don’t know” and “no answer”.

- 28 -
220 respondents (the highest number) of the survey planned to use some Open Source Software (OSS) as a server operating system. Figure 5 shows the importance of each of 15 criteria. The results show that cost savings (both for installation and operation) are important for more than 50% of respondents (combined result of very important and important evaluations of criterion).
167 respondents planned to use some OSS database for the professional usage. As the Figure 6 shows, 65% of respondents evaluated the better functionality of OSS databases as important or very important criteria. 50% of respondents declared that the openness and/or modifiability of source code are important or very important.
Only 80 respondents of the survey used (or planned) OSS on the desktop the first half of year 2002. As it shows in Figure 7, better access protection, higher stability, low finance fees and better price to performance ratio were the four key criteria (compilation of important and very important) for OSS usage on desktop. Only three criteria – IT service provider recommendations, Integration in acquired product and Training cost savings – have lower importance level than 50%.

155 respondents were familiar with OSS usage for websites. As declared in Figure 8, the six most important criteria were Higher stability, Better price to performance ratio, Better access protection, low license fee, Higher performance and better functionality.

Figure 7: Importance of criteria for decision in favour of desktop software (Ghosh et al., 2002)
The comparison of results in different areas shows very important information about OSS benefits among surveyed companies and public bodies. The most important reason for using (or planning to use) Open Source Software (OSS) is Higher stability (the highest share of combined very important and important answers), following by Better access protection (the most important criterion for databases and desktops and the second most important criterion for servers and websites). Low license fees, Better price to performance ratio and Higher performance close the five most important criteria of OSS usage among the surveyed companies and public bodies.

![Figure 8: Importance of criteria for decision in favor of OSS in connection with websites (Ghosh et al., 2002)](image)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Very Important</th>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher stability</td>
<td>48%</td>
<td>35%</td>
</tr>
<tr>
<td>Better access protection</td>
<td>44%</td>
<td>30%</td>
</tr>
<tr>
<td>Low license fees</td>
<td>32%</td>
<td>41%</td>
</tr>
<tr>
<td>Higher performance</td>
<td>32%</td>
<td>41%</td>
</tr>
<tr>
<td>Better price to performance ratio</td>
<td>30%</td>
<td>47%</td>
</tr>
<tr>
<td>Better functionality</td>
<td>30%</td>
<td>41%</td>
</tr>
<tr>
<td>Operation and administration cost savings</td>
<td>20%</td>
<td>35%</td>
</tr>
<tr>
<td>Open and/or modifiable source code</td>
<td>19%</td>
<td>37%</td>
</tr>
<tr>
<td>Installation and integration cost savings</td>
<td>16%</td>
<td>37%</td>
</tr>
<tr>
<td>Existing solutions and know-how</td>
<td>12%</td>
<td>38%</td>
</tr>
<tr>
<td>Hardware cost savings</td>
<td>11%</td>
<td>27%</td>
</tr>
<tr>
<td>Higher number of potential applications</td>
<td>10%</td>
<td>38%</td>
</tr>
<tr>
<td>Training cost savings</td>
<td>10%</td>
<td>23%</td>
</tr>
<tr>
<td>IT service provider recommendations</td>
<td>6%</td>
<td>21%</td>
</tr>
<tr>
<td>Integration in acquired product</td>
<td>6%</td>
<td>19%</td>
</tr>
</tbody>
</table>

$n=155$
2.8.2 Open Source Software in the Public Sector: Policy within the European Union

The Open Source Software policy within the European Union is described in Part IIb (Ghosh et al., 2002b) of the study (Ghosh et al., 2002). Part IIb of the study mapped the status of OSS policy in six countries: Austria, Belgium, France, Germany, Spain and the United Kingdom. The study describes four areas, which were identified as motivations for creating the OSS policy:

- Interoperability, proprietary standards and vendor lock-in
- Costs and benefits
- Security
- Transparency and public right to information

In 2002, the data formats used were usually the proprietary defined and closed standards. This situation complicated the data interchange between two information systems, limited the usable software and increased the dependency on one or several software vendors. When some a software vendor decides to change the version of software (and format, how data are stored) and finishes the support of old version of software, users are forced to upgrade, even though they don't need the new features. Additionally, if business partners upgrade their software, data exchange can usually be more complicated and users are “motivated” to upgrade the software, too. In other words, decision to change convenient software is forced by external factors only, not by internal needs.

The study identifies the costs and benefits as second motivation for creating of the OSS policy. Based on the reports of Bavarian Court of Auditors (in German, “Bayerischer Oberster Rechnungshof”) and the Commission for usage of ICT of the Federal Diet of Germany (in German, “Deutscher Bundestag”), the study identifies financial and non-financial parameters, which should be considered in case of any software change:
direct costs related with software itself (such as license fees and installation, training and support costs),

indirect costs (like hardware upgrades or integration costs)

a level of dependency on specific vendor (less dependency on specific vendor extents the number of solutions in the future and can help to negotiate better condition with current vendors)

In case of security, the study claims that “...Open Source Software (OSS) is believed to be less vulnerable than proprietary software due to a simple reason: the source code is available.” Because the proprietary software is usually provided without source code, customers have to trust to software vendors that there are no “backdoors” or other vulnerabilities. In case of OSS, customers have an opportunity to check the code and report the potential problem or report it to the vendor. Additionally, the source code of OSS is available to any developer (not only to limited number of developers as in proprietary software case), so the probability of bug discovering seems to be higher in comparison with proprietary software.

Finally, the last area for OSS policy discovered in the study, is transparency and public right to information. According to the study, transparency and public right to information cannot be limited to just data itself, but policy in this area should be concerned with techniques and how the data are processed. The study emphasizes two examples: the computation of votes during elections and calculation of taxes.

The study shows the policy status in six European countries in 2002. (Note that EU had 15 member countries in 2002, so the study covers 40% of countries with more than 68% of inhabitants).

The comparison of policy status of selected countries is in Table 4. The OSS implementation started in different areas of public administration, based on local condition. In other words, there was no universal pattern for OSS implementation in selected countries. Based on collected data, France and Germany were the EU leaders in OSS usage policy.
<table>
<thead>
<tr>
<th>Country</th>
<th>Popul.</th>
<th>Policy</th>
<th>Implementation</th>
<th>Future Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>8</td>
<td>marginal</td>
<td>marginal</td>
<td>Implementation and Policy not expected in the near Future</td>
</tr>
<tr>
<td>Belgium</td>
<td>10.3</td>
<td>starting</td>
<td>National Army, Public Administration</td>
<td>Growing Implementation, Developing Policies</td>
</tr>
<tr>
<td>France</td>
<td>58.5</td>
<td>strong</td>
<td>Ministries, Public Administration, National Education</td>
<td>Growing Implementation, Stronger Policies</td>
</tr>
<tr>
<td>Germany</td>
<td>81.5</td>
<td>strong</td>
<td>Parliament, Public Administration, Police</td>
<td>Growing Implementation, Stronger Policies</td>
</tr>
<tr>
<td>Spain</td>
<td>40.6</td>
<td>starting</td>
<td>Ministries, Public Administration</td>
<td>Growing Implementation, Developing Policies</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>58.8</td>
<td>increasing</td>
<td>Public Health</td>
<td>Starting Implementation, Stronger Policies</td>
</tr>
</tbody>
</table>

Table 4: Policy status in six European countries (Ghosh et al., 2002b)

According to (Ghosh et al. 2002b), the governments should concern with the following issues:

- Guaranteeing free access to public information,
- Maintaining the permanence of public data,
- Assuring security of public and citizen provided data,
- Avoiding unnecessary public spending.

### 2.8.3 Study on the Economic Impact of Open Source Software on Innovation and the Competitiveness of the Information and Communication Technologies (ICT) Sector in the EU

Based on the results of Study (Ghosh et al., 2002), the European Commission supported another study, focused to the Economic impact of OSS on innovation and the competitiveness of ICT sector. That study, which its final report was published in November 2006, was prepared by five institutions:
The study's objectives were the demonstration and description of the OSS impact on innovation and the competitiveness of the ICT sector in the EU. The key findings of that study (Ghosh et al., 2002) is in the following statements:

a) by market share and geography:

- in markets of web servers and web browsers, server and desktop operating systems, databases, email and other ICT infrastructure systems, the OSS solutions are one of the three most used products,
- large share of public and private organizations use some OSS solution

b) by direct economic impact of OSS

- quality OSS applications represent almost Euro 12 billion, if the software should be reproduced internally. The financial value of OSS increased rapidly in years 1998-2006,
- the company investments to OSS development is estimated to Euro 1.2 billion,
- The study predicted that OSS related services will reach almost one third of all IT services in 2010.

c) Indirect economic impact: FOSS, innovation and growth:
- OSS can save over 36% in software research and development investment,

- OSS increases the value of ICT infrastructure,

- Increased OSS share can offer to the EU the compensation of lower GDP share of ICT investments (in comparison with the United States).

d) trends, scenarios and policy strategies

- the study predicted the share of software investment increase from 1% to 1.4% in Europe, in case of doubling of OSS take-up to 1.5%

- the share of OSS investments in the EU represents more than 20% of total software investments (approx. Euro 22 billion)

- OSS provides new opportunities, especially for small and medium enterprises (SME)

- the study suggested policy strategies like support OSS in innovation, funding and public software procurement, research, standardization or focus the ICT education process to general skills, not teach students how to work with specific software

The study mentioned a survey which was conducted by MERIT (Maastricht University, the Netherlands) in third quarter of 2004 among 955 public sector organizations. The survey showed that almost 80% of respondents used some open source software. There is a dramatical increase of OSS users in comparison with another survey of 2002 (see Table 9 on page 60). This survey showed important information – the interoperability and open standards are demanded by both groups (users and non-users of OSS).

Ghosh (2006) contains case studies about migration from Microsoft Office to OpenOffice.org in six different public organizations (see Table 5). These case studies compare data from migration of more than 6000 computers in four countries. The used model (fully described in the study) computes initial costs of purchasing (inclusive license fees or training costs) and ownership costs. According to
the model used in the study, in all six cases the OSS solutions decreased the initial costs and in five cases (except the Province of Pisa case) decreased the ownership costs over five years.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Country</th>
<th>Type of migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consorzio dei Comuni della Provincia di Bolzano</td>
<td>Italy</td>
<td>Partial migration from proprietary software</td>
</tr>
<tr>
<td>Province of Pisa</td>
<td>Italy</td>
<td>Partial migration from proprietary software</td>
</tr>
<tr>
<td>Public Administration of City of Skopje</td>
<td>Republic of Macedonia</td>
<td>Migration from scratch</td>
</tr>
<tr>
<td>Törökbálint Nagyközség Polgármesteri Hivatala</td>
<td>Hungary</td>
<td>Migration from scratch</td>
</tr>
<tr>
<td>Province of Bolzano-Bozen</td>
<td>Italy</td>
<td>Trial. Partial migration from proprietary software</td>
</tr>
<tr>
<td>Fundecyt in Estremadura</td>
<td>Spain</td>
<td>Migration from scratch</td>
</tr>
</tbody>
</table>

Table 5: List of OSS migration case studies (Ghosh, 2006)

### 2.8.4 Study on the effect on the development of the information society of European public bodies making their own software available as open source

The “Study on the effect on the development of the information society of European public bodies making their own software available as open source” (Ghosh et al., 2007) is the third key study prepared for the European Commission, which describes the Open source software in the European Union. This study, based on five case studies in four European countries (see Table 6), analyzed and examined the possible impact of OSS on European public institutions and ICT market.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Country</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Council of the London Borough of Camden</td>
<td>The United Kingdom</td>
<td>APLAWS, a Content Management System for public authorities</td>
</tr>
<tr>
<td>NFI – Dutch Forensic Institute</td>
<td>The Netherlands</td>
<td>TULP2G, a program that allows reading out the content of mobile phones</td>
</tr>
<tr>
<td>The Beaumont Hospital in Dublin</td>
<td>Ireland</td>
<td>OSS health care system</td>
</tr>
<tr>
<td>VPRO, The Dutch public broadcasting company</td>
<td>The Netherlands</td>
<td>MMBASE, a Multimedia content Management System</td>
</tr>
<tr>
<td>The provincial government of Extremadura</td>
<td>Spain</td>
<td>LinEx, GNU/Linux focused to the education</td>
</tr>
</tbody>
</table>

Table 6: Overview of examined project in Study (Ghosh et al., 2007)
This study defines the Public Sector Software (PSS) as “software that translates the law (broadly understood) into operational information processing inside the public administration or between the administration, enterprises and citizens”. According to the study, the PSS should be very efficient and interoperable in the international level. The Treaty on European Union (or “Maastricht Treaty”, (EU, 1992)) guarantees to citizens of the EU to live and work in any other EU member country. In other words, the number of people migrating among European countries will probably rapidly increase and communication among public administrations of EU member states as well. The study identifies expected impacts as:

- improvements in public sector effectiveness and efficiency
- lower administrative burdens
- higher quality of life
- decreased public ICT expenses
- higher cooperation in policy and research areas inside the EU.

Additionally, the study (Ghosh et al., 2007) declares motivators, why the public institutions should provide own software as OSS:

- public institutions can benefit from current OSS community
- achieve better quality
- avoid the vendor lock-in effect
- reduce costs

Four of five projects described in case studies (except the Beaumont Hospital in Dublin) were initiated by functionality not provided by proprietary software or solutions. As discussed in Chapter 2.7, the public authorities usually solve very similar issues and share ideas and solutions among them
(under free licenses like General Public License – GPL, European Union Public License – EUPL or Creative Commons – CC) that can reduce expenses allocated to software.

The cost saving was the main reason in only one presented case study while all five case studies shows significant costs reduction. Additionally, the study notices the natural transparency and interoperability features of OSS and IDABC’s recommendations for interoperable e-Government services (European Interoperability Framework for pan-European e-Government Services, (EU, 2004)).

2.8.5 Summary of the EU studies related to OSS

All studies supported from the European Union demonstrate that open source software (OSS) can help to decrease expenses in public funds related to information and communication technologies (ICT). Additionally, the small and medium enterprises (SME) as well as local developers can easily join the development of OSS designed for public administration.

Based on these studies, the European Commission approved in 2007 the European Union Public License – EUPL, (EU, 2007b) and supported several projects for familiarizing of OSS (and solutions based on OSS) in public administrations in the European Union. One of these projects is the OSOR.eu portal.

2.9 OSOR.eu and Joinup portals

The main idea of Open Source Observatory and Repository (OSOR.eu) is in reuse of the solution for resolving similar problems. If governments need to solve some agenda, probably they can use solutions which were used to solve similar agenda in other country. In other words, the finished and tested solutions, which can be reused after small changes, may exist and these solutions are more effective than developing the whole system from scratch.

According to Hollmann and Zo (2008), the OSOR.EU portal has two main functions – to publish information about OSS and provide repository and development platform for OSS solutions de-
signed for public administration. The observatory (or publication part of the OSOR.eu portal) offers case studies, news or reports related to OSS and public administration, the repository part prepared support tools for development like release and task management, bug tracking system, documentation support, mailing lists or forums.

Based on Hollmann and Zo (2009), the OSOR.eu portal defines following net benefits, which can be divided in three groups:

- For public administrations, the OSOR.eu will help to reduce costs for the implementation of IT projects by facilitating sharing and cross-border collaboration, thus also promoting the reuse of existing code. Additionally, Transparency and openness promise improved interoperability and better code.

- For IT-developers and -businesses, the OSOR.eu will publish activities and requirements of the public sector, thus keeping developers and business informed. The collaborative character allows direct exchange between public administrations and developers. New business opportunities for SMEs may arise.

- For Citizens and Businesses, the OSOR.eu will accelerate the availability of platform independent user-friendly e-Government services.

Furthermore, sharing of e-Government solutions can help bridge digital divides for developing countries. Solutions published in OSOR.eu can be reused for solving other e-Government problems. In addition, developing countries can use knowledge and good practices from OSOR.eu, so that their e-Government solutions can be created in a faster and more effective way.

In December 2011, the OSOR.eu portal was merged with SEMIC.eu project to JoinUp.eu. The OSOR.eu portal defined the SEMIC.eu project as “a participatory platform and a service by the European Commission that supports the sharing of assets of interoperability to be used in public administration and e-Government”. In other words, the SEMIC.eu project expands the OSOR.eu portal.
Additionally, both systems had similar users and merged portal (named Joinup) that better supported the information exchange. Based on the Joinup pages, the Joinup portal “offers a new set of services to help e-Government professionals share their experience with interoperability solutions and support them to find, choose, re-use, develop, and implement open source software and semantic interoperability assets”.

Even though the merged portal has new name and several new functions, the original OSOR.eu preserves all functionalities of original OSOR.eu portal. Thus, the paper will refer to original name OSOR.eu.

2.10 Literature review – summary

The collected literature shows that taxpayers (both citizens and businesses) expect effective public administration and e-Government services to be successful means in help them achieve their goals. The similarity of public administration issues in the European Union is supported with the convergence of legal frameworks of member countries and the high level of ownership can create a platform for exchange of solutions among governments, local authorities and municipalities. Finally, the open source software (OSS) concept allows easier way of sharing of ideas among public administration in all member countries.

Based on these prepositions, Open Source Observatory and Repository in the European Union (OSOR.eu) aims to be a platform for sharing ideas for more effective public administration tools and for support of e-Government services developed under OSS license like BSD, GPL or EUPL.
Chapter 3. Conceptual Development, Research Method, Model and Hypotheses

This research design is based on (Kumar, 2005) and ITTP753 course (IT Technology Management and Policy). Kumar describes the research process in eight steps:

Formulating a research problem,

Conceptualizing a research design,

Constructing an instrument for data collection,

Selecting a sample,

Writing a research proposal,

Collecting data,

Processing data and

Writing a research report.

These steps are discussed now.

3.1 Research Variables

The research variables are based on 2003 D&M IS Success Model (DeLone & McLean, 2003) and the OSOR.eu portal structure. Research variables are divided in six groups by 2003 D&M IS Success Model. I added one additional group for control variables, which describes the survey sample for its better comparison both with population of the European Union and the SEMIC.eu, OSOR.eu and ePractice.eu: User Experience and Expectations Survey (discussed in Chapter 4.5.2). Additionally,
this research is based on cooperation with the IDABC unit of Directorate General for Informatics of European Commission, which offers the opportunity to collect primary data directly from OSOR.eu portal's users, resulted in wider than necessary set of variables for this study. The research variables are supplemented by general (or overall) variables for validation of collected data.

The variables are measured in Seven-grade Likert scale (unless otherwise stated) with following grades:

Strongly Disagree,

Disagree,

Slightly Disagree,

Neutral,

Slightly Agree,

Agree and

Strongly Agree.
3.2 Association of variables

Figure 9 shows the association of variables with appropriate constructs of 2003 D&M IS Success Model. All constructs are represented by several variables (as described in Table 4).

3.3 Research Model

The research model used the 2003 D&M IS Success Model, which is modified for cross-sectional retrospective study model. According to DeLone and McLean (2003), these feedback loops are designed for longitudinal or before-and-after studies. The same modifications were used in previous applications of the 2003 D&M IS Success Model for cross-sectional studies (Wang and Liao, 2008, (Lee et al., 2009), as discussed in Chapter 2.3).

Rai et al. (2002) comparison of IS success models (1992 D&M IS success model and 1997 Seddon IS success model) proved that Use and Perceived usefulness constructs are both related with
the same extraneous variable. The meta-analysis (Petter and McLean, 2009) evaluates different constructs related to usage of information system (like Use, Intention to Use or Perceived Usefulness) as interchangeable and are represented as “Intention to Use” in the meta-analysis. Thus, we modified the 2003 D&M IS success model for our research. Similar model as is used for this research was proved by Wang and Hu (2009) and Lee et al. (2009).

Figure 10 shows the used research model with hypotheses.

Based on the collected data, it will be possible to validate the modified 2003 D&M IS Success model for e-Government projects like OSOR.eu portal. The collected data will be validated with general variables and find the dependencies among 2003 D&M IS Success Model constructs (Information quality, System quality, Service quality, Perceived Usefulness, User satisfaction and Net benefits).
3.4 Research Hypotheses

As discussed before, the research model is based on 2003 D&M IS Success Model with hidden feedback loops (see Figure 10). A meta-analysis (Petter & McLean, 2009) published the meta-analysis of 52 studies and summarized the results of support of used hypothesis. Thus, it is the main source of hypothesis for this research. Based on this background, there are 15 hypotheses related to the OSOR.eu portal.

3.4.1 Information Quality

Petter et al. (2008) defined the Information Quality construct as the desirable characteristics of the system outputs (typically, management reports and Web pages). Petter and McLean (2009) proved that there is a significant, positive relationship between Information Quality and both Intention to Use and User Satisfaction. Thus, there are defined two hypotheses related to Information Quality Construct:

<H1>: Higher perception of the Information Quality will positively affect Perceived Usefulness.

<H2>: Higher perception of the Information Quality will positively affect User Satisfaction.

3.4.2 System Quality

Petter et al. (2008) defined the System Quality construct as the desirable characteristics of an information system (for example: ease of use, system flexibility, system reliability, and ease of learning, as well as system features of intuitiveness, sophistication, flexibility, and response times). Petter and McLean (2009) proved there is a significant, positive relationship between System Quality and both Intention to Use and User Satisfaction. Thus, there are defined two hypotheses related to System Quality Construct:
Higher perception of the System Quality will positively affect Perceived Usefulness.

Higher perception of the System Quality will positively affect User Satisfaction.

3.4.3 Service Quality

Petter et al. (2008) defined the Service quality as the quality of the support that system users receive from the IS department and IT support personnel (for example responsiveness, accuracy, reliability, technical competence, and empathy of the personnel staff). Petter and McLean (2009) did not test the relation between Service Quality and Intention of Use (this relation was used in one researched study only) and a significant, positive relationship between Service Quality and User Satisfaction was not proved. However, there are other studies, which tested and partially proved a significant, positive relationship between Service Quality and both User Satisfaction and Use, resp. Intention to Use (Wang and Liao, 2008 and Lee et al., 2009). Thus, this study will test these two hypotheses related to Service Quality:

Higher perception of the Service Quality will positively affect Perceived Usefulness.

Higher perception of the Service Quality will positively affect User Satisfaction.

3.4.4 Perceived Usefulness

Seddon (1997) defines Perceived Usefulness as a perceptual indicator of the degree to which the stakeholder believes that using a particular system has enhanced his or her job performance, or his or her group’s or organization's performance. According to Rai et al. (2002) and Petter and McLean (2009) Perceived Usefulness has positive relationship both to User Satisfaction and Net Benefits. Thus, this research will test these two hypotheses related to Perceived Usefulness:

Perceived Usefulness increase will positively affect User Satisfaction.

Perceived Usefulness increase will positively affect Net Benefits.
3.4.5 User Satisfaction and Net Benefits

Petter et al. (2008) defined the User Satisfaction construct as users’ level of satisfaction with reports, Web sites, and support services; Net Benefits construct as the extent to which IS are contributing to the success of individuals, groups, organizations, industries, and nations (for example: improved decision-making, improved productivity, increased sales, cost reductions, improved profits, market efficiency, consumer welfare, creation of jobs, and economic development). Petter and McLean (2009) proved there is a significant, positive relationship between User Satisfaction and Net Benefits. Thus, this research will test this hypothesis related to User Satisfaction:

\textbf{H9}: General satisfaction increase will positively affect Net benefits.

3.4.6 Moderating effects

As discussed in Chapter 2.2.4, Job Relevance and Organization Type can have moderating effects, because different user groups or people with different job duties could have different expectations of service quality, different perceptions of the usefulness of a system, and different satisfaction level requirements with a system.

Kim (2008) supported his research about the moderation effects of job relevance and experience on mobile wireless technology acceptance with two previous works. First, Bhattacherjee and Sanford (2006) prepared the Elaboration Likelihood Model (ELM) for testing the moderation effects of job relevance on attitude and perceived usefulness. Second, Venkatesh et al. (2003) found that “there was a little evidence of a direct relationship between attitude and intention”. In addition, Landrum et al. (2010) discussed the moderating effect of job or occupation on the perception of information services quality and success. They argue that job categories can moderate the relationships among constructs of D&M IS success model (except the Net Benefits construct) and tested the moderating effects of occupation.
Perry and Rainey (1988), Roessner (1977) and Lee and Xia (2006) argue that organization type affects how technologies including information systems can be adopted and used. Perry and Rainey (1988) summarize earlier studies related to differences among various types of organizations and categorize organizations by ownership, funding and mode of social control. Roessner (1977) compares differences in organization innovation between private and public sectors. Lee and Xia (2006) found that organization type has significant moderating effect to IT innovation adoption.

Thus, based on this theoretical background, this study includes organization type and job relevance as moderators in the revised D&M model to examine the success of OSS repositories:

- **H10a**: Job relevance moderates the relation between information quality and perceived usefulness.
- **H10b**: Job relevance moderates the relation between system quality and perceived usefulness.
- **H10c**: Job relevance moderates the relation between service quality and perceived usefulness.
- **H10d**: Job relevance moderates the relation between information quality and user satisfaction.
- **H10e**: Job relevance moderates the relation between system quality and user satisfaction.
- **H10f**: Job relevance moderates the relation between service quality and user satisfaction.
- **H11a**: Organization type moderates the relation between information quality and perceived usefulness.
- **H11b**: Organization type moderates the relation between system quality and perceived usefulness.
<H11c>: Organization type moderates the relation between service quality and perceived usefulness.

<H11d>: Organization type moderates the relation between information quality and user satisfaction.

<H11e>: Organization type moderates the relation between system quality and user satisfaction.

<H11f>: Organization type moderates the relation between service quality and user satisfaction.
Chapter 4. Research design

4.1 Study design

As discussed in Chapter 1, this study will validate the Net benefits for OSOR.eu portal users and test the 2003 D&M IS Success model for OSOR.eu portal; portal designed for more effective e-Government service development. In other words, this study has no intention to find any changes in the users' behavior. Based on Kumar (2005), the cross-sectional retrospective non-experimental study design was selected.

4.2 Measurement instruments

All used measurement instruments are completed in Table 7:

<table>
<thead>
<tr>
<th>Research construct</th>
<th>Instrument</th>
<th>Definition</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information quality</td>
<td>Information precis-</td>
<td>describes the accuracy of information provided by OSOR.eu portal</td>
<td>(DeLone &amp; McLean, 2003)</td>
</tr>
<tr>
<td></td>
<td>-eness</td>
<td></td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td>Information suffici-</td>
<td>completeness of information provided by OSOR.eu portal.</td>
<td>(DeLone &amp; McLean, 2003)</td>
</tr>
<tr>
<td></td>
<td>ency</td>
<td></td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td>Information topical-</td>
<td>measures, how the information provided by OSOR.eu portal are actual.</td>
<td>(DeLone &amp; McLean, 2003)</td>
</tr>
<tr>
<td></td>
<td>ity</td>
<td></td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td>Information relevan-</td>
<td>describes, how appropriate are information provided by OSOR.eu portal.</td>
<td>(DeLone &amp; McLean, 2003)</td>
</tr>
<tr>
<td></td>
<td>cy</td>
<td></td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td>System quality</td>
<td>Accessibility</td>
<td>describes the flexibility of OSOR.eu portal on different platforms.</td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Bharati &amp; Chaudhury, 2003)</td>
</tr>
<tr>
<td></td>
<td>Adaptability</td>
<td>shows the OSOR.eu portal's feature to optimize form of provided information to users.</td>
<td>(DeLone &amp; McLean, 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td>Validity</td>
<td>describes the reliability of web links of the OSOR.eu portal.</td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Bharati &amp; Chaudhury, 2003)</td>
</tr>
<tr>
<td></td>
<td>Responsiveness</td>
<td>shows, how users perceive the response time of the OSOR.eu portal.</td>
<td>(DeLone &amp; McLean, 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td></td>
<td>Lucidity</td>
<td>measures the clarity of the OSOR.eu portal.</td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td>Service quality</td>
<td>Portal maintenance</td>
<td>describes how the users perceive the OSOR.eu portal's care.</td>
<td>(Petter &amp; McLean, 2009)</td>
</tr>
<tr>
<td>Research construct</td>
<td>Instrument</td>
<td>Definition</td>
<td>References</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Portal design</td>
<td>measures the user's satisfaction with the design of the OSOR.eu portal.</td>
<td>(Negash et al., 2003)</td>
<td></td>
</tr>
<tr>
<td>Support response</td>
<td>shows user's satisfaction with the speed of reaction of OSOR.eu portal's team member to questions.</td>
<td>(Negash et al., 2003)</td>
<td></td>
</tr>
<tr>
<td>General service quality</td>
<td>describes the overall evaluation of services related to the OSOR.eu portal.</td>
<td>(Negash et al., 2009)</td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>measures, how the OSOR.eu portal helps to user to find information related to Open Source Software (OSS) usage in public administration.</td>
<td>(Seddon, 1997)</td>
<td></td>
</tr>
<tr>
<td>Search information</td>
<td>measures, how the OSOR.eu portal helps to simplify the respondent's job.</td>
<td>(Seddon, 1997)</td>
<td></td>
</tr>
<tr>
<td>Simplification</td>
<td>describes the overall user perception of usefulness related to the OSOR.eu portal.</td>
<td>(Seddon, 1997)</td>
<td></td>
</tr>
<tr>
<td>General valuability</td>
<td>describes the overall user perception of usefulness related to the OSOR.eu portal.</td>
<td>(Seddon, 1997)</td>
<td></td>
</tr>
<tr>
<td>User satisfaction</td>
<td>shows, if the OSOR.eu portal is used as the primary source of information related with OSS and e-Government services.</td>
<td>(Lin &amp; Lee, 2006)</td>
<td></td>
</tr>
<tr>
<td>Primary source</td>
<td>describes the willingness of users to recommend the portal to other people.</td>
<td>(Lin &amp; Lee, 2006)</td>
<td></td>
</tr>
<tr>
<td>Recommendation</td>
<td>measures, how the OSOR.eu portal complete the anticipations of users.</td>
<td>(Lin &amp; Lee, 2006)</td>
<td></td>
</tr>
<tr>
<td>Expectation fulfillment</td>
<td>describes the overall user satisfaction with the OSOR.eu portal.</td>
<td>(Negash et al., 2003)</td>
<td></td>
</tr>
<tr>
<td>General satisfaction</td>
<td>shows, how the OSOR.eu portal helps to user to save expenses of his/her organization or company.</td>
<td>(Petter &amp; McLean, 2009)</td>
<td></td>
</tr>
<tr>
<td>Net benefits</td>
<td>shows, how the OSOR.eu portal helps to user to save his/her time.</td>
<td>(Petter &amp; McLean, 2009)</td>
<td></td>
</tr>
<tr>
<td>Expense savings</td>
<td>shows, how the OSOR.eu portal helps to user to be flexible in his/her job.</td>
<td>(Petter &amp; McLean, 2009)</td>
<td></td>
</tr>
<tr>
<td>Time savings</td>
<td>measures, how the OSOR.eu portal helps to user to save his/her time.</td>
<td>(Petter &amp; McLean, 2009)</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: List of used measurement instruments

4.3 Method of data selection

There are publicly available data about OSOR.eu portal user behavior or perception. There are three basic methods, how to collect primary data – observation, interviewing and questionnaire. As the most effective method for this case on-line form of questionnaire was selected. (The questionnaire is discussed in Chapter 4.5.3)
4.4 Sampling

This study is focused to user community and visitors of the OSOR.eu portal – this group of individuals creates the population of the OSOR.eu portal. As other portals similar to OSOR.eu (like SourceForge.net), the OSOR.eu portal users can be divided in three groups:

a) **Registered users.** These users provided the basic information to the OSOR.eu Portal. The basic information are name, surname, e-mail address, country, organization and organization type (Public, Private – small or media enterprise, Private – large enterprise, Non-profit organization or Academic organization). The OSOR.eu portal registration is free-of-charge and there is no membership fee, the registration has no regional limitation. According to published statistics, the OSOR.eu portal had at end of February 2010 more than 1,700 registered users. The database of registered users is not available for purposes of this study.

b) **Non-registered users.** The OSOR.eu portal can be used without any registration and OSOR.eu support team has no possibility of how to contact these users. The non-registered users cannot create any content of OSOR.eu, but they can use any published content on the OSOR.eu portal – like news, information or projects. For this purposes of this study, the non-registered user is anybody who visit the OSOR.eu portal at least once a month.

c) **Visitors.** The visitors have the same rights as non-registered users; the OSOR.eu portal doesn't distinguish the non-registered users and visitors. For purposes of this study, visitors of the OSOR.eu portal are all users, who visit the OSOR.eu portal less than once a month and are not registered users.

The OSOR.eu portal is focused to the very small group of people, who are interested in Open source software (OSS) exploitation for public administration (the number of registered users is less than 2,000). Additionally, the sample size of previous survey organized by IDABC and related to OSOR.eu portal (see Chapter 4.5.2) was the sample size n=242. Based on this condition, the non-
random/probability accidental sampling was selected for this study. The information about the questionnaire was published on OSOR.eu portal and registered users were reminded to the survey by weekly emails. Additionally, the OSOR.eu groups at social networks LinkedIn.com and Facebook.com were used.

Because the respondents of this survey are volunteers, the sample is probably biased and the findings of study cannot be generalized to the population of the OSOR.eu portal users. On the other hand, it was the only option for this study. Additionally, the survey organized by IDABC (and discussed in Chapter 4.5.2) used the same sampling method.

4.5 Research survey

The OSS tool Unit Command Climate Assessment and Survey System (UCCASS) version 1.8.1 was used for collecting data. This tool was installed as a part of ITTP Student Council Portal in ITTP Lab (KAIST Munji Campus). This server is based on Linux Ubuntu 8.04.3 LTS Server Edition. UCCASS v.1.8.1 allows export of data in CSV format (Comma-Separated-Value), which can be easily imported to analyze software for further processing. The final version of research questionnaire is in Appendix.

The EC planned its own survey at the end of year 2009 (described in Chapter 4.5.2); the research survey (described in Chapter 4.5.3) was planned for February 2010. Both discussed surveys are focused on registered and active OSOR.eu portal users only. Additionally, the OSOR.eu users’ database was not accessible for this research. OSOR.eu users were contacted by information published on OSOR.eu homepage.

Based on these reasons, the pilot survey was replaced with Survey feasibility test.

4.5.1 Survey feasibility test

This test was focused to two issues:
validation of questionnaire formulation

technical test of used platform for collecting data

Survey feasibility test was started in November 2009 and announced among students and alumni of ITTP program and Arachne Lab members. Based on the recommendations of twenty testers, it was omitted the general variable for Use construct (Total usage). The testers argued that they don't measure the total time spent on some portal.

Additionally, it was slightly modified formulations for better understanding, removed the typing errors and changed the order of some questions.

Finally, based on the technical tests, it was found a bugs in data export feature of UCCASS v.1.8.1 (the exported file contained the data structure only, no data). This bug was fixed before surveying of OSOR.eu users.

4.5.2 SEMIC.eu, OSOR.eu and ePractice.eu: User Experience and Expectations Survey

The European Commission (EC) surveyed in December 2009 and January 2010 the users of three portals focused on the e-Government development in the European Union (EU). This survey (Arents and van Doesburg, 2010) was prepared by EC and Gartner Nederland. This survey collected 819 responds, 242 responds was related to OSOR.eu.

This survey was focused to users of three portals, which was established by the EC for information and experience exchange among different levels of public administration in the EU: ePractice.eu, OSOR.eu and SEMIC.eu. Additionally, the survey changed the structure of questionnaire based on respondent's answers. Even though this survey is focused to user experience and expectations and some of the results are published commonly for all three portals, this survey has been used for validation of data collected for my research.
4.5.3 Research Questionnaire

The research questionnaire is based on the research model and hypothesis, research design discussed in this Chapter and results of survey feasibility test (see Chapter 4.5.1).

The Research questionnaire was published on-line from 26th February to 31st March 2010 at ITTP Student Council portal (link http://ittpcouncil.kaist.ac.kr/survey/survey.php?sid=38). Respondents answered 39 mandatory questions focused to OSOR.eu portal. Information about this survey was published on OSOR.eu portal at 26th February. The published notice about the survey is available online at http://www.osor.eu/news/eu-osor-user-survey-part-of-thesis-on-governmental-open-source-use.

4.6 Sample Characteristics

The questionnaire was answered by 119 respondents; one response was discarded for missing data and one for insincere data. The final dataset contains 117 responses.

Table 8 evaluates the respondents by country. 85.47 % of respondents lived in the European Union, 10.26 % in other European countries and 4.27 % of respondents live outside Europe. This respondents distribution is similar to distribution of sample of previous survey provided by European Commission (EC, see Chapter 4.5.2).

<table>
<thead>
<tr>
<th>Country</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Country</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU Member countries</td>
<td>100</td>
<td>85.47%</td>
<td>Other European countries</td>
<td>12</td>
<td>10.26%</td>
</tr>
<tr>
<td>Austria</td>
<td>2</td>
<td>1.71%</td>
<td>Bosnia and Herzegovina</td>
<td>1</td>
<td>0.85%</td>
</tr>
<tr>
<td>Belgium</td>
<td>9</td>
<td>7.69%</td>
<td>Croatia</td>
<td>2</td>
<td>1.71%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1</td>
<td>0.85%</td>
<td>Macedonia</td>
<td>1</td>
<td>0.85%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>3</td>
<td>2.56%</td>
<td>Norway</td>
<td>4</td>
<td>3.42%</td>
</tr>
<tr>
<td>Denmark</td>
<td>1</td>
<td>0.85%</td>
<td>Turkey</td>
<td>3</td>
<td>2.56%</td>
</tr>
<tr>
<td>Estonia</td>
<td>2</td>
<td>1.71%</td>
<td>Ukraine</td>
<td>1</td>
<td>0.85%</td>
</tr>
<tr>
<td>Finland</td>
<td>2</td>
<td>1.71%</td>
<td>Overseas countries</td>
<td>5</td>
<td>4.27%</td>
</tr>
<tr>
<td>France</td>
<td>7</td>
<td>5.98%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As discussed in Chapter 4.4, the user ratio of sample cannot be generalized to OSOR.eu population. This statement can be supported by number of respondents from different countries (both Germany and Malta have six respondents, but Germany has more than 80 million inhabitants, Malta as the smallest EU member country has population about 400 thousand).
Table 9 collects fundamental sample characteristics – gender, age and type of OSOR.eu users. The sample shows that males are dominating (almost 90%). About 38% declared age lower than 35 years, 44% between 36 and 50 years and 18% higher age than 51 years. More than 60% of respondents are registered users of OSOR.eu portal; in addition almost 32% of respondents visit the OSOR.eu portal more than once a month.

The survey provided by EC (discussed in Chapter 4.5.2) was not collecting data about gender or age, so it is not possible to compare both surveys in these areas. Additionally, both surveys define differently types of users.

4.7 Moderators

As discussed in Chapter 2.2.4, occupation and organization type can moderate expectations and behavior of information system users. Based on collected data, I prepared two moderating variables related to the research model:

- organization type by ownership (private or non-private/academic),

- job relevance by relation, which categorizes user's jobs or position by level of involvement into development process in two groups:
  - low related group (legal or business oriented occupations and top management),
  - high related group (people who are integral part of software development process like developers software engineers, consultants, project managers and CIOs)

Moderating variables are summarized in Table 10.

<table>
<thead>
<tr>
<th>Organization Type</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-private (public, non-profit and academic)</td>
<td>84</td>
<td>71.79%</td>
</tr>
</tbody>
</table>

- Occasional user 8 6.84%
Private (small, medium and large enterprises) 33 \(28.21\%\)

<table>
<thead>
<tr>
<th>Job Relevance</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (lawyers, businessmen, managers)</td>
<td>44</td>
<td>37.61%</td>
</tr>
<tr>
<td>High (developers and software designers, consultants, PMs, CIOs)</td>
<td>73</td>
<td>62.39%</td>
</tr>
</tbody>
</table>

Table 10: Sample characteristics: Moderating variables

4.8 Marker variables

The usage of three different part of OSOR.eu portal are used as marker variables for this research. Collected data shows the different usage of different parts of OSOR.eu portal by different type of users (See Table 11).

<table>
<thead>
<tr>
<th>Usage of OSOR.eu portal</th>
<th>Frequency of visits</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usage of Forge part</td>
<td>Less than once a month</td>
<td>42</td>
<td>35.90%</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
<td>37</td>
<td>31.62%</td>
</tr>
<tr>
<td></td>
<td>Bi-weekly</td>
<td>17</td>
<td>14.53%</td>
</tr>
<tr>
<td></td>
<td>Weekly</td>
<td>11</td>
<td>9.40%</td>
</tr>
<tr>
<td></td>
<td>Twice a week</td>
<td>4</td>
<td>3.42%</td>
</tr>
<tr>
<td></td>
<td>At least daily</td>
<td>5</td>
<td>4.27%</td>
</tr>
<tr>
<td></td>
<td>RSS Feed activated</td>
<td>1</td>
<td>0.85%</td>
</tr>
<tr>
<td>Usage of Information part</td>
<td>Less than once a month</td>
<td>16</td>
<td>13.68%</td>
</tr>
<tr>
<td>Usage of Repository part</td>
<td>Count</td>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Less than once a month</td>
<td>28</td>
<td>23.93%</td>
<td></td>
</tr>
<tr>
<td>Monthly</td>
<td>46</td>
<td>39.32%</td>
<td></td>
</tr>
<tr>
<td>Bi-weekly</td>
<td>15</td>
<td>12.82%</td>
<td></td>
</tr>
<tr>
<td>Weekly</td>
<td>14</td>
<td>11.97%</td>
<td></td>
</tr>
<tr>
<td>Twice a week</td>
<td>9</td>
<td>7.69%</td>
<td></td>
</tr>
<tr>
<td>At least daily</td>
<td>4</td>
<td>3.42%</td>
<td></td>
</tr>
<tr>
<td>RSS Feed activated</td>
<td>1</td>
<td>0.85%</td>
<td></td>
</tr>
</tbody>
</table>

Table 11: Usage of different parts of OSOR.eu portal
Chapter 5. Results

This chapter describes the result of survey, the assessment of measurement, and the hypotheses testing of the proposed research model. This study adopted the Partial Least Squares (PLS) method to conduct the assessment and testing of the model because of its various advantages. PLS is a suitable method to model multi-item constructs under non-normality condition, and it can explain complex relationships among various constructs with small to medium-sized samples (Chin, 1998; Gefen et al., 2000). PLS is also useful to avoid inadmissible solutions, non-convergence, and factor indeterminacy (Limayem et al. 2007). General statistics result was calculated by SPSS 18, and SmartPLS 2 (Ringle, Wende, & Will, 2005) was used for other data analysis. Chapter 5.1 explains the descriptive statistics of measurement model. Chapter 5.2 discusses the reliability and validity of the measurement model including the common method bias (CMB) issues. Chapter 5.3 shows the result of hypotheses testing.

5.1 Descriptive statistics

Table 12 shows the descriptive statistics of the measurement items. Overall mean values of every item were below 4. This implies that users of OSOR.eu portal generally have some negative perception about the quality of the system. Especially, information quality of the system was relatively lower than others. Insufficient content and inadequate information may cause this result, which may affect the willingness of users to recommend the portal to other people (SAT2). Moreover, minimum and maximum value of each item was polarized, due to respondents’ varying perceptions on quality measurements derived from personal characteristics of our target sample such as nationality, job, and other demographic variables.
<table>
<thead>
<tr>
<th>Construct</th>
<th>Measurement</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>StDev</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Quality</td>
<td>IQ1</td>
<td>1</td>
<td>7</td>
<td>2.46</td>
<td>1.23</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>IQ2</td>
<td>1</td>
<td>6</td>
<td>2.68</td>
<td>1.24</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>IQ3</td>
<td>1</td>
<td>6</td>
<td>2.36</td>
<td>1.13</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>IQ4</td>
<td>1</td>
<td>6</td>
<td>2.07</td>
<td>1.00</td>
<td>117</td>
</tr>
<tr>
<td>System Quality</td>
<td>SYSQ1</td>
<td>1</td>
<td>7</td>
<td>2.87</td>
<td>1.39</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SYSQ2</td>
<td>1</td>
<td>7</td>
<td>3.31</td>
<td>1.41</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SYSQ3</td>
<td>1</td>
<td>7</td>
<td>2.60</td>
<td>1.54</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SYSQ4</td>
<td>1</td>
<td>7</td>
<td>2.17</td>
<td>1.14</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SYSQ5</td>
<td>1</td>
<td>7</td>
<td>2.89</td>
<td>1.22</td>
<td>117</td>
</tr>
<tr>
<td>Service Quality</td>
<td>SERQ1</td>
<td>1</td>
<td>6</td>
<td>2.39</td>
<td>1.13</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SERQ2</td>
<td>1</td>
<td>7</td>
<td>2.84</td>
<td>1.29</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SERQ3</td>
<td>1</td>
<td>7</td>
<td>3.26</td>
<td>1.21</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SERQ4</td>
<td>1</td>
<td>7</td>
<td>2.58</td>
<td>1.22</td>
<td>117</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>PU1</td>
<td>1</td>
<td>6</td>
<td>2.29</td>
<td>1.20</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>1</td>
<td>7</td>
<td>2.98</td>
<td>1.30</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>1</td>
<td>6</td>
<td>2.20</td>
<td>0.99</td>
<td>117</td>
</tr>
<tr>
<td>User Satisfaction</td>
<td>SAT1</td>
<td>1</td>
<td>7</td>
<td>3.92</td>
<td>1.56</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SAT2</td>
<td>1</td>
<td>7</td>
<td>1.97</td>
<td>1.10</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SAT3</td>
<td>1</td>
<td>7</td>
<td>2.56</td>
<td>1.39</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>SAT4</td>
<td>1</td>
<td>7</td>
<td>2.36</td>
<td>1.08</td>
<td>117</td>
</tr>
<tr>
<td>Net Benefits</td>
<td>NB1</td>
<td>1</td>
<td>6</td>
<td>3.25</td>
<td>1.29</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>NB2</td>
<td>1</td>
<td>7</td>
<td>2.92</td>
<td>1.22</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>NB3</td>
<td>1</td>
<td>7</td>
<td>2.92</td>
<td>1.24</td>
<td>117</td>
</tr>
</tbody>
</table>

Table 12: Sample characteristics: Moderating variables

5.2 Measurement Model

In order to assess and ensure the reliability and validity of the measurement model, three key dimensions of construct validity: (1) internal consistency, (2) convergent validity, and (3) discriminate validity were examined. Firstly, internal consistency was determined by the value of Cronbach’s Alpha and Composite Reliability (CR). General recommended cut-off value of both tests is 0.7 but
slightly less value is also acceptable (Hair et al., 1998; Nunnally, 1978). Although the value of Cronbach’s Alpha for system quality and perceived usefulness was less than 0.7 but their CR values satisfied the recommended criteria.

Convergent validity refers to “the degree to which two or more attempts to measure the same concept by maximally dissimilar methods are in agreement.” (Bagozzi and Phillips, 1982). In other word, convergent validity can be verified when items of a construct should be highly correlated between each other. Convergent validity can be checked by factor loading score and average variance extracted (AVE). As shown in Table 13, the factor loading score of 7 indicators were lower than 0.7 so 3 items were finally excluded to improve the validity of the measurement model. After discarding 4 items, most indicators were over the cut-off value except one indicator (SYSQ5), and they showed significant t-value. SYSQ5, however, was also very close to the value so it was included in analysis. AVE of all the constructs also was over the recommended value of 0.5 and thus the measurement model satisfied the criteria of convergent validity (Fornell and Larcker, 1981).

Discriminant validity is “the degree to which measures of distinct concepts differ.” (Bagozzi and Phillips, 1982). Testing for discriminant validity can be conducted with comparing the square root of AVE with other inter-construct correlations. When the square root of AVE is higher than inter-construct correlations, sufficient validity can be obtained (Chin, 1998). Table 14 shows that all the square roots of AVE were greater than the correlations between it and other constructs.
For the further analysis of discriminant validity, checking cross-loading table is also required (Gefen et al 2000). Each item loading in assigned construct should be higher than loading score of other constructs. However, one item (SAT1) had low loading score compared with others so it was also removed for the hypotheses testing. PU1 and NB1 also showed relatively low loading score but their value satisfied the criteria, and the analysis of the square root of AVE was acceptable. Thus, our

### Table 13: Assessment of measurement model

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measurement Item</th>
<th>Factor Loading (Before)</th>
<th>Factor Loading (After)</th>
<th>Cronbach's Alpha</th>
<th>Composite Reliability</th>
<th>Average Variance Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information Quality</strong></td>
<td>IQ1</td>
<td>0.77</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IQ2</td>
<td>0.79</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IQ3</td>
<td>0.71</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IQ4</td>
<td>0.73</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYSQ1</td>
<td>0.58</td>
<td>Discarded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYSQ2</td>
<td>0.83</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>System Quality</strong></td>
<td>SYSQ3</td>
<td>0.46</td>
<td>Discarded</td>
<td>0.64</td>
<td>0.78</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>SYSQ4</td>
<td>0.68</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYSQ5</td>
<td>0.60</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SERQ1</td>
<td>0.84</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SERQ2</td>
<td>0.86</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SERQ3</td>
<td>0.59</td>
<td>Discarded</td>
<td>0.80</td>
<td>0.90</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>SYSQ7</td>
<td>0.84</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Service Quality</strong></td>
<td>PU1</td>
<td>0.69</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>0.79</td>
<td>0.79</td>
<td>0.65</td>
<td>0.82</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>0.84</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAT1</td>
<td>0.61</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAT2</td>
<td>0.73</td>
<td>0.73</td>
<td>0.74</td>
<td>0.87</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>SAT3</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAT4</td>
<td>0.84</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NB1</td>
<td>0.74</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Benefits</strong></td>
<td>NB2</td>
<td>0.89</td>
<td>0.88</td>
<td>0.78</td>
<td>0.87</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>NB3</td>
<td>0.87</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1</td>
<td>0.77</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td>0.91</td>
<td>0.91</td>
<td>0.79</td>
<td>0.86</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>M3</td>
<td>0.79</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the further analysis of discriminant validity, checking cross-loading table is also required (Gefen et al 2000). Each item loading in assigned construct should be higher than loading score of other constructs. However, one item (SAT1) had low loading score compared with others so it was also removed for the hypotheses testing. PU1 and NB1 also showed relatively low loading score but their value satisfied the criteria, and the analysis of the square root of AVE was acceptable. Thus, our
measurement model satisfied the general criteria for the discriminant validity. Table 15 presents the cross-loading table.

<table>
<thead>
<tr>
<th></th>
<th>Information Quality</th>
<th>System Quality</th>
<th>Service Quality</th>
<th>Perceived Usefulness</th>
<th>User Satisfaction</th>
<th>Net Benefits</th>
<th>Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Quality</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Quality</td>
<td>0.58</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Quality</td>
<td>0.58</td>
<td>0.69</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>0.55</td>
<td>0.44</td>
<td>0.51</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User Satisfaction</td>
<td>0.73</td>
<td>0.68</td>
<td>0.74</td>
<td>0.59</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Benefits</td>
<td>0.54</td>
<td>0.51</td>
<td>0.46</td>
<td>0.75</td>
<td>0.63</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>Marker</td>
<td>-0.23</td>
<td>-0.06</td>
<td>-0.19</td>
<td>-0.24</td>
<td>-0.16</td>
<td>-0.22</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Table 14: Correlation among constructs (Diagonal bold elements are the square root of AVE)

When the research handles self-reported data, one more required process is to check common method bias (CMB). As self-reported data can have an unexpected biased-response errors (e.g. consistency motif, social desirability bias, leniency biases) affecting the research finding, testing CMB has become an important step currently (Podsakoff et al., 2003). In this study, two different methods were applied for checking the CMB issue. Firstly, Harman’s single-factor analysis was conducted. All measurement items should not form into a single factor, and the variance of the first factor should be lower than 50% of the total variance. As shown Table 16, a single factor did not emerge, and the variance of the first factor was 33% of the total variance. Number of component was 7, which showed that it matches latent constructs’ number including marker construct. Another way is to compare the marker construct’s correlation value with others (Podsakoff et al., 2003). In Table 14, the correlation coefficient value of the marker showed negative value, which implies respondents answered without biased-response error. These results provide assurance that research data is safe from CMB issues.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ1</td>
<td>0.77</td>
<td>0.60</td>
<td>0.48</td>
<td>0.40</td>
<td>0.56</td>
<td>0.48</td>
<td>-0.12</td>
</tr>
<tr>
<td>IQ2</td>
<td>0.80</td>
<td>0.53</td>
<td>0.54</td>
<td>0.33</td>
<td>0.63</td>
<td>0.36</td>
<td>-0.16</td>
</tr>
<tr>
<td>IQ3</td>
<td>0.70</td>
<td>0.29</td>
<td>0.34</td>
<td>0.26</td>
<td>0.47</td>
<td>0.27</td>
<td>-0.24</td>
</tr>
<tr>
<td>IQ4</td>
<td>0.73</td>
<td>0.30</td>
<td>0.36</td>
<td>0.60</td>
<td>0.52</td>
<td>0.49</td>
<td>-0.19</td>
</tr>
<tr>
<td>SYSQ2</td>
<td>0.42</td>
<td>0.83</td>
<td>0.58</td>
<td>0.40</td>
<td>0.56</td>
<td>0.48</td>
<td>-0.16</td>
</tr>
<tr>
<td>SYSQ4</td>
<td>0.37</td>
<td>0.73</td>
<td>0.57</td>
<td>0.33</td>
<td>0.45</td>
<td>0.32</td>
<td>0.02</td>
</tr>
<tr>
<td>SYSQ5</td>
<td>0.51</td>
<td>0.66</td>
<td>0.39</td>
<td>0.23</td>
<td>0.49</td>
<td>0.32</td>
<td>0.03</td>
</tr>
<tr>
<td>SERQ1</td>
<td>0.52</td>
<td>0.58</td>
<td>0.86</td>
<td>0.45</td>
<td>0.63</td>
<td>0.34</td>
<td>-0.16</td>
</tr>
<tr>
<td>SERQ2</td>
<td>0.46</td>
<td>0.59</td>
<td>0.88</td>
<td>0.43</td>
<td>0.68</td>
<td>0.41</td>
<td>-0.19</td>
</tr>
<tr>
<td>SERQ4</td>
<td>0.52</td>
<td>0.62</td>
<td>0.84</td>
<td>0.45</td>
<td>0.60</td>
<td>0.44</td>
<td>-0.13</td>
</tr>
<tr>
<td>PU1</td>
<td>0.43</td>
<td>0.39</td>
<td>0.60</td>
<td>0.70</td>
<td>0.52</td>
<td>0.43</td>
<td>-0.05</td>
</tr>
<tr>
<td>PU2</td>
<td>0.38</td>
<td>0.39</td>
<td>0.28</td>
<td>0.79</td>
<td>0.45</td>
<td>0.76</td>
<td>-0.23</td>
</tr>
<tr>
<td>PU3</td>
<td>0.46</td>
<td>0.22</td>
<td>0.31</td>
<td>0.83</td>
<td>0.38</td>
<td>0.52</td>
<td>-0.30</td>
</tr>
<tr>
<td>SAT1</td>
<td>0.39</td>
<td>0.38</td>
<td>0.49</td>
<td>0.33</td>
<td>0.61</td>
<td>0.42</td>
<td>-0.10</td>
</tr>
<tr>
<td>SAT2</td>
<td>0.57</td>
<td>0.48</td>
<td>0.51</td>
<td>0.47</td>
<td>0.73</td>
<td>0.46</td>
<td>-0.06</td>
</tr>
<tr>
<td>SAT3</td>
<td>0.58</td>
<td>0.63</td>
<td>0.61</td>
<td>0.42</td>
<td>0.85</td>
<td>0.40</td>
<td>-0.10</td>
</tr>
<tr>
<td>SAT4</td>
<td>0.65</td>
<td>0.56</td>
<td>0.63</td>
<td>0.54</td>
<td>0.84</td>
<td>0.61</td>
<td>-0.21</td>
</tr>
<tr>
<td>NB1</td>
<td>0.42</td>
<td>0.30</td>
<td>0.28</td>
<td>0.46</td>
<td>0.41</td>
<td>0.74</td>
<td>-0.11</td>
</tr>
<tr>
<td>NB2</td>
<td>0.42</td>
<td>0.50</td>
<td>0.49</td>
<td>0.71</td>
<td>0.54</td>
<td>0.88</td>
<td>-0.18</td>
</tr>
<tr>
<td>NB3</td>
<td>0.52</td>
<td>0.44</td>
<td>0.37</td>
<td>0.67</td>
<td>0.60</td>
<td>0.87</td>
<td>-0.23</td>
</tr>
<tr>
<td>M1</td>
<td>-0.16</td>
<td>-0.03</td>
<td>-0.07</td>
<td>-0.16</td>
<td>-0.12</td>
<td>-0.13</td>
<td>0.77</td>
</tr>
<tr>
<td>M2</td>
<td>-0.24</td>
<td>-0.12</td>
<td>-0.26</td>
<td>-0.27</td>
<td>-0.21</td>
<td>-0.25</td>
<td>0.89</td>
</tr>
<tr>
<td>M3</td>
<td>-0.12</td>
<td>0.08</td>
<td>-0.02</td>
<td>-0.11</td>
<td>0.01</td>
<td>-0.10</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Table 15: Cross-loading table
### Table 16: Total variance explained

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigen values</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>1</td>
<td>9.900</td>
<td>33.001</td>
</tr>
<tr>
<td>2</td>
<td>2.550</td>
<td>8.499</td>
</tr>
<tr>
<td>3</td>
<td>2.164</td>
<td>7.212</td>
</tr>
<tr>
<td>4</td>
<td>1.819</td>
<td>6.064</td>
</tr>
<tr>
<td>5</td>
<td>1.481</td>
<td>4.936</td>
</tr>
<tr>
<td>6</td>
<td>1.241</td>
<td>4.138</td>
</tr>
<tr>
<td>7</td>
<td>1.029</td>
<td>3.430</td>
</tr>
<tr>
<td>8</td>
<td>.979</td>
<td>3.263</td>
</tr>
<tr>
<td>9</td>
<td>.915</td>
<td>3.051</td>
</tr>
<tr>
<td>10</td>
<td>.770</td>
<td>2.567</td>
</tr>
<tr>
<td>11</td>
<td>.703</td>
<td>2.342</td>
</tr>
<tr>
<td>12</td>
<td>.671</td>
<td>2.238</td>
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<tr>
<td>13</td>
<td>.604</td>
<td>2.015</td>
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<td>14</td>
<td>.543</td>
<td>1.810</td>
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<tr>
<td>15</td>
<td>.521</td>
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</tr>
<tr>
<td>16</td>
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<td>1.548</td>
</tr>
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<td>17</td>
<td>.440</td>
<td>1.465</td>
</tr>
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<td>18</td>
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<tr>
<td>19</td>
<td>.370</td>
<td>1.235</td>
</tr>
<tr>
<td>20</td>
<td>.342</td>
<td>1.140</td>
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<tr>
<td>21</td>
<td>.322</td>
<td>1.074</td>
</tr>
<tr>
<td>22</td>
<td>.290</td>
<td>.966</td>
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<tr>
<td>23</td>
<td>.278</td>
<td>.928</td>
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<tr>
<td>24</td>
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<td>.860</td>
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<td>.236</td>
<td>.785</td>
</tr>
<tr>
<td>26</td>
<td>.188</td>
<td>.627</td>
</tr>
<tr>
<td>27</td>
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<td>.582</td>
</tr>
<tr>
<td>28</td>
<td>.140</td>
<td>.465</td>
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<tr>
<td>29</td>
<td>.118</td>
<td>.393</td>
</tr>
<tr>
<td>30</td>
<td>.088</td>
<td>.292</td>
</tr>
</tbody>
</table>

5.3 Hypotheses Testing

As a main step in data analysis, the significance and strength of each hypothesis were examined with three PLS models. In the first model, the main effects specified in H1 through H9 were examined. The second model included job relevance (H10a, H10b, H10c, H10d, H10e, H10f) as a moderating variable, organization type, another moderator (H11a, H11b, H11c, H11d, H11e, H11f), was tested in the third model respectively. Table 17 presents all hypotheses testing results.
In the main effect model, most hypotheses were statistically supported at the 95% confidence level for the two-tailed test except H3 (p > 0.05). The model explains about 60.5% of the variance in net benefit, 35.3% of the variance in perceived usefulness, and 68.3% of the variance in the user satisfaction. Information quality had a strong and significant effect on both perceived usefulness and user satisfaction (H1: p < 0.01, H2: p < 0.001). The path from system quality to perceived usefulness had no significant impact while system quality affected user satisfaction (H3: p > 0.05, H4: p < 0.05). However, path coefficient for H4 was relatively lower than other coefficient. Service quality also significantly influenced both perceived usefulness and user satisfaction (H5: p > 0.05, H6: p < 0.001). The relationship between perceived usefulness and user satisfaction was statistically supported (H7: p < 0.05), and net benefit was significantly influenced by both perceived usefulness and user satisfaction (H8: p < 0.001, H9: p < 0.05). Collectively, information quality is an important antecedent for net benefit through perceived usefulness and user satisfaction in our research model.

A moderating role of job relevance with antecedents toward perceived usefulness and organization type was investigated in the second model. Among six hypotheses, job relevance significantly moderated the relation between information quality and perceived usefulness. Job relevance enhanced the relationship between information quality and perceived usefulness from .36 to .77 and R2 value of perceived usefulness also increased from .353 to .41 (H10a: p < .05). However, H10b, H10c, H10d, H10e and H10f were not supported statistically (p > .05).

In the third model, it was found that organization type moderated two relationships among the six proposed hypotheses. Organization type significantly moderated the relationship between system quality and user satisfaction (H11e: p < .05). It increased the path coefficient of H4 by .41, and R2 value of user satisfaction to .707. In addition, organization type had a moderating effect on the relationship between service quality and user satisfaction (H11f: p < .05). An increased path coefficient value was .56, and R2 value of user satisfaction was .705.
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>P.C.</th>
<th>t</th>
<th>p</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;H1&gt; Inform. Quality → Perceived Usefulness</td>
<td>0.36</td>
<td>3.29</td>
<td>0.001</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>&lt;H2&gt; Inform. Quality → User Satisfaction</td>
<td>0.37</td>
<td>4.99</td>
<td>0.000</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>&lt;H3&gt; System Quality → Perceived Usefulness</td>
<td>0.04</td>
<td>0.30</td>
<td>0.765</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H4&gt; System Quality → User Satisfaction</td>
<td>0.19</td>
<td>2.22</td>
<td>0.028</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>&lt;H5&gt; Service Quality → Perceived Usefulness</td>
<td>0.28</td>
<td>2.39</td>
<td>0.018</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>&lt;H6&gt; Service Quality → User Satisfaction</td>
<td>0.28</td>
<td>3.77</td>
<td>0.000</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>&lt;H7&gt; Perceived Usefulness → User Satisfaction</td>
<td>0.15</td>
<td>2.06</td>
<td>0.042</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>&lt;H8&gt; Perceived Usefulness → Net Benefits</td>
<td>0.61</td>
<td>8.38</td>
<td>0.000</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td>&lt;H9&gt; User Satisfaction → Net Benefits</td>
<td>0.24</td>
<td>2.25</td>
<td>0.027</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>&lt;H10a&gt; Inf. Q. × Job R. → Perceived Usefulness</td>
<td>0.77</td>
<td>2.27</td>
<td>0.023</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>&lt;H10b&gt; Sys. Q. × Job R. → Perceived Usefulness</td>
<td>0.51</td>
<td>1.74</td>
<td>0.082</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H10c&gt; Ser. Q. × Job R. → Perceived Usefulness</td>
<td>0.08</td>
<td>0.25</td>
<td>0.805</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H10d&gt; Inf. Q. × Job R → User Satisfaction</td>
<td>-0.10</td>
<td>0.32</td>
<td>0.750</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H10e&gt; Sys. Q. × Job R → User Satisfaction</td>
<td>-0.38</td>
<td>1.04</td>
<td>0.297</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H10f&gt; Serv. Q. × Job R → User Satisfaction</td>
<td>-0.15</td>
<td>0.47</td>
<td>0.638</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H11a&gt; Inf. Q. × Org Type → Perceived Usefulness</td>
<td>0.55</td>
<td>1.52</td>
<td>0.133</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H11b&gt; Sys. Q. × Org Type → Perceived Usefulness</td>
<td>0.02</td>
<td>0.05</td>
<td>0.957</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H11c&gt; Ser. Q. × Org Type → Perceived Usefulness</td>
<td>-0.10</td>
<td>0.27</td>
<td>0.785</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H11d&gt; Inf. Q. × Org Type → User Satisfaction</td>
<td>0.27</td>
<td>1.07</td>
<td>0.287</td>
<td>p &gt; 0.05</td>
</tr>
<tr>
<td>&lt;H11e&gt; Sys. Q. × Org Type → User Satisfaction</td>
<td>0.60</td>
<td>2.13</td>
<td>0.035</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>&lt;H11f&gt; Serv. Q. × Org Type → User Satisfaction</td>
<td>0.56</td>
<td>2.02</td>
<td>0.045</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

Table 17: Path analysis

Overall result of path analysis is shown in Figure 11.
Figure 11: Path analysis

Path significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Chapter 6. Discussions

In 2006, the European Commission decided to establish and support Open Source Observatory and Repository in the European Union portal (OSOR.eu) and the main purpose of this paper is to find, which factors would affect the benefits of OSOR.eu portal users. Because the portal users are very different (both by organization type or job relevance), we included the examination of moderating effects (organization type and job relevance). This paper tests the D&M IS Success model (2003) and proves validity of this model in specific environment of OSS repository for e-Government solutions, which are shared among several countries. The summary of the results are given in Table 17 and the study presented key findings for OSS repositories related to e-Government OSS solutions.

6.1 General analysis of OSOR.eu Portal

As described in Chapter 2.9, OSOR.eu portal is focused to support of sharing solutions for e-Government among EU countries and municipalities, because sharing of these solutions can provide e-Government services more effective. Even the OSOR.eu portal is open to general public (anybody from any country can join to the OSOR.eu portal); more than 85% of respondents are located inside the European Union.

It were also compared these results with results of another survey, which was provided by the European Commission (EC) and Gartner Nederland and discussed in Chapter 4.5.2 (Arents and van Doesburg, 2010). Even though this survey was focused to experience and expectations of users of three portals, we can compare number of respondents and share of respondents from EU countries for validation of our data. The comparison is shown in Table 18.
<table>
<thead>
<tr>
<th>Survey</th>
<th>Number of resp. (n)</th>
<th>EU resp. share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research survey (March 2010)</td>
<td>117</td>
<td>84.30%</td>
</tr>
<tr>
<td>EC &amp; Gartner Survey (December 2009, January 2010)</td>
<td>242</td>
<td>Approx. 84%</td>
</tr>
</tbody>
</table>

Table 18: Survey comparison

The higher number of respondents in EU & Gartner Survey can be caused by longer duration of survey or better announcement of EU & Gartner Survey. This survey was announced at all three portals together (OSOR.eu, SEMIC.eu and ePractice.eu) and 135 respondents declared to be user of more than one portal. The share of respondents living in any of the EU country is almost identical – about 84%.

<table>
<thead>
<tr>
<th>Part of the OSOR.eu portal</th>
<th>Measurement</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>StDev</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forge part</td>
<td>M1</td>
<td>1</td>
<td>7</td>
<td>2.29</td>
<td>1.42</td>
<td>117</td>
</tr>
<tr>
<td>Information part</td>
<td>M2</td>
<td>1</td>
<td>7</td>
<td>3.17</td>
<td>1.66</td>
<td>117</td>
</tr>
<tr>
<td>Repository part</td>
<td>M3</td>
<td>1</td>
<td>7</td>
<td>2.54</td>
<td>1.42</td>
<td>117</td>
</tr>
</tbody>
</table>

Table 19: Typical usage of the OSOR.eu portal

As shown in Chapter 2.9, the Information part of the OSOR.eu portal is the most visited section of the portal. Repository part (where can be downloaded solutions and applications collected at OSOR.eu portal) and Forge part (which is designed for bug reporting) are visited less frequently. These results correspond with data published in EC & Gartner and which are based on OSOR.eu server statistics (Most visited pages OSOR – Q4 2009, Arents and van Doesburg 2010).

### 6.2 Discussion of hypotheses testing

Based on the hypotheses testing was found that the DeLone & McLean IS Updated Success Model (2003 D&M IS success model) is valid for the OSOR.eu case. Information Quality was found to have significant effect on Perceived Usefulness and User Satisfaction, System Quality was found to have significant effect on User Satisfaction and Service Quality was found to have significant effect
on Perceived Usefulness and User Satisfaction. Additionally, Perceived Usefulness was found to have significant effect on User Satisfaction and Net Benefits and User Satisfaction was found to have significant effect on Net Benefits. The significant results are consistent with the previous studies mentioned in Chapter 2.2 and Chapter 2.3.

6.2.1 Overall quality of the system

Based on collected data, respondent expectations of the OSOR.eu portal are slightly negative. As shown in Table 12 (page 64), mean values of all measured items are lower than neutral value.

This perception of the OSOR.eu portal can be caused by several reasons.

First, this portal is a new tool and the users need to find the optimal way on how to use it. Before the OSOR.eu portal, there were portals focused to general open source software (like sourceforge.net as discussed in Chapter 2.3.1) or portals designed for supporting some local or national e-Government solutions (like LinEx in Spain discussed in Chapter 2.8.4). But, the OSOR.eu is designed for sharing ideas and solutions among private companies and public administration in different countries. Additionally, there are several levels of public administration (local, regional and governmental) and even the agenda is similar (as discussed in Chapter 2.1 and Chapter 2.6), solutions from other country need to be customized and this process can be more difficult than expected. In other words, it is possible that the users expected the OSOR.eu to be the universal repository with finished solutions for many problems of public administration, but it provides projects, which started as a solution of a single problem in one city (region or country). Thus, these projects can have insufficient documentation or limited support for multilingual versions.

Second, even the OSOR.eu is Europe-wide project; the portal in 2010 was in English only. However, it covers projects, which cannot provide the sufficient support in English. This situation can be perceived as an inconvenience for user, who is not familiar with other language then English (such
as French, German, and Spanish). This issue can be solved with multilingual version of the OSOR.eu portal, but this solution probably increases the maintenance expenses to the portal.

Third, the OSOR.eu portal has very different users. They are living in many countries, working in different organizations and their job has different relevance with the portal. In other words, we can assume that the users' expectations are different and users can find different information at the portal or the same information in different form. It means that developers prefer information about source-code documentation, project managers about implementation process and lawyers about transferability of project to another country. This issue can be solved by single structure of information for each project covered by the OSOR.eu portal.

Finally, the EC & Gartner survey (Arents and van Doesburg, 2010) evaluates the OSOR.eu as “good platform” (with the overall score 3.6 from five-grade Likert scale). This difference can be caused by different structure of questions – the EC & Gartner survey published direct question to grade the OSOR.eu portal, this research focused to separate measurements. Additionally, the EC & Gartner survey mentioned several recommendations from selected users how to improve the OSOR.eu portal. Thus, the lower perception of this research can be caused by more focused questions.

6.2.2 Importance of information quality

Based on results discussed in Chapter 5.3, the Information Quality is the most important for the OSOR.eu portal users. As shown in Table 17 and Figure 11, the path coefficients related to Information Quality (hypotheses H1 and H2) are relative higher than path coefficients than coefficients related to Service Quality (hypotheses H5 and H6) or System Quality (hypotheses H3 and H4). It means that the increase of Information Quality results in higher Perceived Usefulness and User Satisfaction than the same increase of System Quality or Service Quality. Thus, the improvement of Information Quality is the most important issue of the OSOR.eu portal.
This issue is more important according to evaluation of Information Quality itself. As discussed in Chapter 5.1, information quality was relatively lower than others. Based on collected data, the mean of items related to information quality are between 2.07 and 2.68. But, according to EC & Gartner survey (Arents and van Doesburg, 2010); the traffic of OSOR.eu portal was increasing in 2009. This can indicate that respondents of the OSOR.eu portal use it as the initial source of information about Open-source software for public administration and expect more deeply, precise and up-to-date information directly at the OSOR.eu portal.

The low relevance of information provided by the OSOR.eu portal can be caused by different group of users. Even the Open-source software for public administration is relative narrow topic; there are different types of users – by job relevance or organization type. Thus, different type of users can have different exceptions and needs and they reflected this in the survey. In other words, the OSOR.eu portal needs some improvements to improve its information quality.

The EC & Gartner survey asked 69 respondents (which declared they visit the OSOR.eu portal twice a year or less), why do they not use OSOR.eu more often. 60% of respondents (n=69) selected the answer “I find the portal interesting but I do not have enough time to visit more regularly”, 15% “I am interested in the topic, but the portal does not provide me the information I am looking for”. (This question was not opened to respondents, who visited the OSOR.eu portal more often than twice a year.)

These results can be interpreted as demand for more precise, sufficient, up-to-date and relevant data at the OSOR.eu portal and the improving of information quality is the main issue for the future of the OSOR.eu portal.

6.2.3 System Quality issues

According to hypotheses testing in Chapter 5.3 (Table 17 and Figure 11), there is no significant relation between System Quality and Perceived Usefulness, because the hypothesis H3 is not support-
ed by collected data. It means that respondents' Perceived Usefulness is not affected by System Quality. Additionally, the influence of System Quality to User Satisfaction has the relative lowest influence from all constructs. The path coefficient related to System Quality is 0.19, but path coefficient 0.28 related to Service Quality is 0.28 and p.c. related to Information Quality is 0.37. This issue can be caused by two reasons. First, the OSOR.eu users are usually educated in ICT area and are not so sensitive to System Quality as users of general portals. Second, in 2010 was no similar international portal related to open-source software usage in public administration.

Even the perception of System Quality of the OSOR.eu portal is among respondents better than the perception of Information Quality; the overall level is still negative. The worst score among respondents is related to response time of server. This issue can be caused by underestimated technological infrastructure of the OSOR.eu portal (like insufficient connectivity or server capacity).

The respondents prefer better support for different devices. This issue can be explained by new kind of devices like smartphones, netbooks or tablets. In 2007, when the OSOR.eu portal was started, the typical device for access was a personal computer, but in 2010 users can used other devices for OSOR.eu portal access.

6.3 Moderating effects

As discussed in Chapter 4.7, the OSOR.eu portal is used by different type of users. The OSOR.eu portal users can be divided by job relevance and organization type. Based on results (Chapter 5.3), both moderators have significant effect to OSOR.eu portal users' behavior.

6.3.1 Moderation effect of Job Relevance

We proved that job relevance moderate the relationship between information quality and perceived usefulness. In other words, based on their relevance level to software development, the OSOR.eu portal users expected different level of usefulness of the OSOR.eu portal. Collected data
showed that Information Quality construct is more important to respondents with jobs higher related to the software development and this group creates more than 62% of respondents. This is next evidence, how important is the Information Quality for the OSOR.eu portal. Additionally, this finding show, how important can be for the future of OSOR.eu portal to find, which kind of information are expected by each group of users and maybe find the form, how to distinguish the different types of information for different users.

6.3.2 Moderation effects of Organization Type

There were proved moderation effects of the organization type. Based on results, respondents from private companies declared their higher sensitivity of system quality and service quality to user satisfaction. Even the share of users from private sector is under 30%, this group of users can provide important incentives for improvements of the OSOR.eu portal. Additionally, the decreasing share of users from private sector can indicate lower usability for this group of users.
Chapter 7. Conclusions

This paper was inspired by two ideas. First, to collect information about tools for effective public administration and for sharing of ideas among different countries. As discussed in Chapter 2.7, the public administration issues are similar in different countries. Additionally, in the European Union is a significant part of law coordinated. Open the software, which is owned by public administration and sharing this code among different countries, provinces or cities. The OSOR.eu portal offers a platform for easier sharing of ideas and solutions and this paper can help to improve the OSOR.eu portal atractivity for users.

Second, the OSOR.eu portal is a specific platform for support Open-Source Software (OSS) solutions prepared for public administration. In other words, it offers a new type of platform, which can be tested by the DeLone & McLean IS Updated Success Model (2003 D&M IS success model).

7.1 Academic Contribution

First, this paper applied the 2003 D&M IS success model into specific area. The OSOR.eu portal is focused to support of open-source software (OSS) for public administration. This combination (OSS and public administration in one international portal) is unique and we don't know other scientific paper related to similar information system like the OSOR.eu portal. Thus, 2003 D&M IS success model seems to be a universal tool for IS success testing and this paper confirmed the validity of the 2003 D&M IS success model for the OSS software for public administration area.

Second, because the OSOR.eu portal is specialized to specific field, the survey results can differ from results of surveys focused to OSS portals or public administration information systems. Users of the OSOR.eu portal are interested both in OSS and public administration and based on our results; they prefer the Information Quality as the main factor. However, this characteristic can be specific for the OSOR.eu users.
Third, users' expectations or needs can be moderated by different moderators. We examined the role of Job Relevance and Organization Type and proved different behavior of users based on these moderators.

Fourth, we found that the external variable should be considered for ISS model's extension.

7.2 Practical Contribution

First, the OSOR.eu portal can use results of our research for better understanding of users' needs and expectations. This research analyzed relationships among different constructs of the OSOR.eu portal and has found which areas should be improved.

Second, we found that the OSOR.eu portal overall quality is perceived slightly negative and improving of quality can increase the usage of the OSOR.eu portal.

Third, the Information Quality was found as the weakest part of the OSOR.eu portal and improvement of this part should be considered firstly.

Fourth, the OSOR.eu portal's users have different needs and expectations (based on Job Relevance and Organization Type). Thus, more customized services for different type of users will better satisfy various needs of users.

7.3 Limitations and future research

First limitation is the sample of respondents. The information about survey was published at the OSOR.eu portal and all registered users of the OSOR.eu portal were informed about the survey. In other words, there was no selection of respondents based on the OSOR.eu users' population, but this was the only option how to collect some data from the OSOR.eu portal users. Additionally, we used the same method as the European Commission and Deloitte Nederland in their own research in December 2009 (Arents and van Doesburg, 2010) and – as discussed in Chapter 4.6 – both samples can
be compared. There were collected some additional information like domain of company or organization for better checking of data validity. Based on this, some answers were eliminated because of their inconsistency.

Second, even the OSOR.eu users are interested in OSS usage in public administration, their involvement can be differ based of the organization type or job relevance to software development. By our opinion, it is fundamental for the OSOR.eu portal to recognize needs and prepare several surveys for each specific group of users.

Third, the European Union is a multilingual community and the OSOR.eu portal and our survey is in English only. Even if English is one of the working languages of the European Union, it still can be a barrier for users.

Further research can be based on the OSOR.eu portal changes (migration with the SEMIC.eu portal and creating of the Joinup.eu portal and improving of portal). Comparing of results of these researches can evaluate the changes. Second, another research can evaluate the benefits from sharing solutions for public administration.
References


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Appendixes

Glossary

1992 D&M IS success model  DeLone and McLean IS success model
2003 D&M IS success model. updated DeLone and McLean IS success model
AI Lab  Artificial Intelligence Lab at MIT
CC  Creative Commons
CSV  Comma-Separated-Value format
EAEC  Euroatom, European Atomic Energy Community
EC  European Commission
ECSC  European Coal and Steel Community
EEC  European Economic Community
eSET  eService Evaluation Tool
EU  European Union
EUPL  European Union Public License
FSF  Free Software Foundation
G2B  government-to-businesses,
G2C  government-to-citizens,
G2N  government-to-non-government,
GNU  GNU is recursive acronym GNU’s Not Unix
GPL GNU General Public License
ICT information and communication technologies
IDABC Inter-operable Delivery of European e-Government Services to public Administrations, Businesses and Citizens, an organizational unit of Directorate General for Informatics of the EC.
IS information system
MIS management information system
MIT Massachusetts Institute of Technology
NACE Nomenclature statistique des Activités économiques
OEM Original Equipment manufacturer
OSOR.eu Open Source Observatory and Repository portal in the EU
OSS Open Source Software
SF.net sourceforge.net
SIN single identification numbers
SME small and medium enterprises
SSN social security number
UCCASS Unit Command Climate Assessment and Survey System
UNU United Nations University
USB User Satisfaction Benchmark
Questionnaire

All answers in the questionnaire were mandatory.

The following questions used Seven-grades Likert scale:

Strongly Disagree, Disagree, Slightly Disagree, Neutral, Slightly Agree, Agree, Strongly Agree

1. The OSOR.eu Portal provides the **precise information**.

2. The OSOR.eu Portal provides **sufficient information**.

3. The OSOR.eu Portal provides **up-to-date information**.

4. The OSOR.eu Portal provides **relevant information**.

5. In general, the OSOR.eu Portal provides **quality information**.

6. The OSOR.eu Portal is **accessible** from any kind of device (computer, netbook, mobile phone, whatever).

7. The OSOR.eu portal **adapts** the content that has been requested to provide an optimized user experience.

8. Every time I request the OSOR.eu portal, the portal is **available**.

9. The OSOR.eu portal has only **valid web links**.

10. The OSOR.eu portal **response time** satisfies me.

11. The OSOR.eu portal design **effectively leads users** to searched information.

12. In general, the **system** of OSOR.eu portal works **very good**.

The following questions used Seven-grades Likert scale:
Less than month, Monthly, Bi-weekly, Weekly, Twice a week, At least daily, RSS Feed activated

13. How often do you visit the **Information part** of OSOR.eu portal (Home page, News, Case Studies, IDABC Studies, Communities or Events)?

14. How often do you visit the **Repository part** of OSOR.eu portal (Projects)?

15. How often do you visit the **Forge part** of OSOR.eu portal?

The following questions used Seven-grades Likert scale:

Strongly Disagree, Disagree, Slightly Disagree, Neutral, Slightly Agree, Agree, Strongly Agree

16. The OSOR.eu portal is **well maintained**.

17. The OSOR.eu portal is designed according to my needs.

18. The OSOR.eu team members respond my questions in reasonable time.

19. In general, the OSOR.eu portal provides **very good service**

The following question used Six-grades Likert scale:

Less than 2 minutes, Between 2 and 5 minutes, Between 5 and 15 minutes, Between 15 and 30 minutes, Between 30 minutes and 1 hour, More than 1 hour

20. How long in **average** do you spent at OSOR.eu portal during **one visit**?

The following questions used this Seven-grades Likert scale:

Strongly Disagree, Disagree, Slightly Disagree, Neutral, Slightly Agree, Agree, Strongly Agree

21. In general, the OSOR.eu portal is the **my first information source** about FLOSS and E-government.
22. I can **recommend the OSOR.eu** portal as a reliable and trustworthy source of information about Open Source Software (OSS).

23. The OSOR.eu **fulfills my expectation** about a portal related to the OSS usage in public administration.

24. The OSOR.eu portal helps to **reduce expenses** of my organization.

25. In general, I **am satisfied** with OSOR.eu portal.

26. The OSOR.eu portal **helps to search** information about Open Source Software (OSS) usage in public administration environment.

27. The OSOR.eu portal **saves my time**.

28. The OSOR.eu portal helps me to be **more flexible** in my job.

29. The OSOR.eu portal **simplifies** my work.

30. In general, the OSOR.eu is **valuable** for me.

The following question used this Three-grades Likert scale:

Yes, registered user, No, but I visit OSOR.eu at least once a month, No, occasional visitor only

31. I am a **registered user** of OSOR.eu portal

The following questions asked for typed answers:

32. Please, type the name of the country, where you work (Example: Korea, Republic)

33. Please, type name of the city, where you work (Example: Daejeon).

34. Please, type the ZIP code of the city, where you work (Example: 305-000 for Daejeon).

35. Please, type the domain which your organization or company uses (Example: kaist.ac.kr for KAIST)
The following questions used this Seven-grades Likert scale:

Public, Private (SME), Private (large enterprise), Non-profit Academic

36. Please, select the type of your organization

The following question asked for typed answer:

37. Please, specify your job:

The following question asked for selecting gender:

38. Please, select your gender

The following question asked for typed answer:

39. Please, specify your age

End of questionnaire.
Summary (Korean)

공개 소프트웨어 레파지토리의 성공 요인 탐색: 유럽의 OSOR 포탈 사례를 중심으로

2006년 유럽 공동체(EC)는 유럽연합(EU) 포탈 내에서 공공기관들이 공개소프트웨어를 공유할 수 있는 OSOR (Open Source Observatory and Repository) 사이트를 구축하기로 결정했다. OSOR 포탈은 공개소프트 패러다임에 기반을 두고 유럽 연합 내에서 다양한 정보, 아이디어, 솔루션 등을 공유하여 전자정부 구현에 기여하도록 개발되었다. OSOR 포탈을 통한 공공기관들 간의 다양한 자료의 공유는 많은 국가에서 전자정부 구축이나 운영 시에 발생하는 유사한 문제들을 해결할 수 있는 방안을 제공하기 때문에 개별 국가의 정보통신기술 프로젝트 비용을 절감할 수 있는 효과적인 방법으로 기대된다. 또한 OSOR 포탈은 전자정부를 보다 빠르고 효과적으로 구축할 수 있도록 도와 국민과 기업들에게도 간접적 효과를 제공할 수 있다. 그러나 이러한 기대 속에서도 아직까지 OSOR 포탈의 성공 요인들에 대한 연구가 부족하였고, 유럽연합의 전자정부 구축 과정에 있어 OSOR 포탈의 실제적 공헌에 대해 검토해 볼 필요성이 있다.

본 연구에서는 확장된 DeLone & McLean의 정보시스템 성공 모형을 기반으로 전자정부 구축을 위해 설계된 OSOR 포탈의 성공 요인들에 대해 분석하고 OSOR 포탈의 순 편익(Net benefits)에 대해 살펴보았다. 실증적 연구를 위해 PLS(Partial least squares) 분석 방법론을 적용하여 OSOR 포탈의 117명 사용자를 대상으로 분석을 진행하였다. 분석 결과는 정보품질이 공개 소프트웨어 레파지토리인 OSOR 포탈의 순 편익에 영향을 미치는 가장 중요한 요인으로 보여주고 있고, OSOR 포탈을 사용하는 조직의 유형과 업무 연관성이 해당 시스템의 순 편익에 조절 효과를 가지는 것으로 나타났다.
본 연구는 공개 소프트웨어를 기반으로 한 공공 서비스 개발에 있어 정부의 시스템 구현
방법에 대한 시사점을 제공하며, OSOR 포털이 유럽 연합 내의 공공기관들 사이에서 정보와
공개 소프트웨어 솔루션을 공유하는 효과적 플랫폼이 되기 위한 방향을 제시한다.

핵심어: 공개 소프트웨어, 전자정부, OSOR 포털, 유럽 연합, 부분최소자승법