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Quality Assessment of Estonian e-Government Services

Master's thesis (30 EAP)

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1   INTRODUCTION

Estonia is known for its e-Government and public electronic services. In the United Nations' Global E-Government Survey 2012 Estonia is placed 20th [United Nations (2012b)]. Estonia has developed ID-card, Mobile-ID and a wealth of public electronic services [Capgemini (2011)]. Yet, despite the level of sophistication of the Estonian e-Government service landscape, the quality of Estonian e-Government services has not been measured in detail. This can be partly attributed to the fact that there is no official quality assessment model and frameworks described for Estonian purposes [MKM RISO (2010); MKM RISO (2011)].

This thesis aims at contributing to the development of such a model by addressing the following questions:

- What is e-Government quality and e-service quality?

- Why measure e-Government and its quality?

- What are the e-Government services quality assessment frameworks (models) and could these be implemented in Estonia?

- How to assess and measure the quality of e-Government and e-services?

The thesis is based on research what is done in the world, especially in the European Union, about user-centric e-Government quality management and assessment. The first goal of the thesis is to review e-Government quality assessment models e-GovQual [Papadomichelaki, X., Mentzas, G. (2011)], COBRAS [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)] and Finnish Ministry of Finance's "Quality criteria for web service" [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)], all focusing on government-to-citizen and citizen-centric e-services. E-GovQual is an instrument that measures users' perceived service quality of e-Government sites. Within e-GovQual, four dimensions are used: Reliability, Efficiency, Citizen Support, and Trust, and 21 evaluation criteria across four dimensions can be measured. COBRAS is a holistic and citizen-centric evaluation framework (model) with four dimensions: **C**osts, **O**pportunities, **B**enefits, **R**isks Analysis for **S**atisfaction,

and 49 quality questions to be answered. Finnish Ministry of Finance has completed several projects to work out the second version of quality criteria for Finnish e-service assessment. There are 40 quality criteria in the set, grouped into five assessment areas: use, content, management, production and benefits.

The second goal is to fit and apply the above e-Government quality assessment models into Estonian e-Government context. The quality assessment models are practically tested on two different Estonian e-Government services' portals – state portal eesti.ee and client portal e-PRIA of the Agricultural Registers and Information Board. The assessment results put into evidence areas of strength and potential weaknesses in the evaluated e-Government services.

The Master's thesis is a starting point to further studies of e-Government quality assessment models and standardization in Estonia and in context of European Union.

The Master's thesis is arranged into 8 chapters:

- Chapter 1 present an overview to the thesis motivation, scope and research questions.

- Chapter 2 gives an overview of e-Government definitions and descriptions used in this Master's thesis.

- Chapter 3 describes the e-Government services quality models overall and in European Union and in Estonia.

- Chapter 4 describes the e-Government service quality assessment methods used and e-Government service quality models e-GovQual, COBRAS and Finnish Ministry of Finance "Quality criteria for web service" for practical assessment of two portals: state portal eesti.ee and client portal e-PRIA of the Agricultural Registers and Information Board.

- Chapter 5 describes the practical e-Government service quality models e-GovQual, COBRAS and Finnish Ministry of Finance "Quality criteria for web service" results for state portal eesti.ee.

- Chapter 6 describes the practical e-Government service quality models e-GovQual, COBRAS and Finnish Ministry of Finance "Quality criteria for web service" results for client portal e-PRIA of the Agricultural Registers and Information Board.

- Chapter 7 summarizes and points out the findings for the e-Government service quality models e-GovQual, COBRAS and Finnish Ministry of Finance "Quality criteria for web service" for practical assessment of two portals: state portal eesti.ee and client portal e-PRIA of the Agricultural Registers and Information Board.

- Chapter 8 concludes the thesis and gives suggestions for Estonian e-Government quality assessment model development.

There are 10 appendices attached to this Master's thesis, which are tables of inter-connections between quality models and all the results for practical assessment criteria scoring.

There are 6 attachments to this Master's thesis in the format of Microsoft$^{®}$ Excel$^{™}$, including the practical quality assessment results and comments for three quality models and two portals: state portal eesti.ee and client portal e-PRIA of the Agricultural Registers and Information Board.

2   E-GOVERNMENT OVERVIEW

As a starting point for this thesis, the definitions used must be described in the context of e-Government. The definitions: e-service, e-Government, user-centric e-Government, e-Government service level and e-Government service quality are described in this chapter.

2.1   E-service and e-Government

Defining the concept of e-service (short term of electronic service) has been found to be rather challenging because of the many aspects it encompasses – see for example [Verdegem P., Verleye G. (2009); Madlberger M., Kotzab H. (2001); Boyer K.K., Hallowell R., Roth A.V. (2002)]. The simplest way to define e-service is "the electronic provision of a service to customers" [Saanen, Y.A., Sol, H.G., Verbraeck, A. (1999)].

Buckley [Buckley J. (2003)] contends that the definitions of e-service proposed in various studies are clearly based on private sector experience and that the term e-Government should be used in the public sector instead. On the other hand, Verdegem and Verleye find at their study [Verdegem P., Verleye G. (2009)] that the term e-Government may have different definitions that may reflect priorities in government strategies.

United Nations defines e-Government as "the use of ICT[1] and its application by the government for the provision of information and public services to the people". [United Nations (2012a)]

The Organization for Economic Co-Operation and Development (OECD) [OECD (2003)] has a definition to e-Government: "The use of information and communication technologies, and particularly the internet, as a tool to achieve better government".

The World Bank [World Bank (2012)] has a definition: ""E-Government" refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet,

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[1] Information and Communication Technology (abbreviation ICT)

and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government." E-Government aims to make the interaction between government and citizens (G2C), government and business enterprises (G2B), and inter-agency relationships (G2G) more friendly, convenient, transparent, and inexpensive.

European Commission [European Commission (2003)] defines eGovernment as use of ICT in public administration, combined with organizational change and new skills, in order to improve public services and democratic processes and strengthen support to public policies.

The definition e-Government, also eGovernment, varies from different organizations and scholars but the idea is the same overall – using ICT to improve the delivery of government (public) services to the users (citizens (G2C), businesses (G2B) and other government agencies (G2G)). As a synonym to e-Government, also eGovernment, the term government e-service, e-public service or e-Government e-service can be used.

2.2   User-centric e-Government

The notion of user-centric e-Government (also known as also citizen-centric e-Government) has been brought forward as a counter-weight to the tendency observed by some that too much attention is paid to technology, not the real needs and expectations of users, see for example [Verdegem P., Verleye G. (2009)]. Bertot, Jaeger and McClure find in their study [Bertot, J.C., Jaeger, P.T., McClure, C.R. (2008)] that "citizen-centered E-Government suggests that governments will provide services and resources tailored to the actual service and resource needs of users, including citizens, residents, government employees, and others".

United Nations is promoting citizen-centric design in the E-Government Survey 2012 [United Nations (2012b)]. There are two design proposals: whole-of-government and one-stop government. From the citizens' perspective, whole-of-government approach to e-Government permits them to access information and services without needing to know anything about the structure of government [United Nations (2012b)]. One-stop government refers to the integration of public online services from a customer's view point via a single entry point, irrespective of whether these services are actually provided by different departments or authorities [United Nations (2012b)].

OECD is concerned that for many years the e-services focus has been on technology and the user is forgotten among other key challenges [OECD (2009)]. The shift on focus towards user-centricity (with special focus on citizen) in the mid-2000s is significant. User-centric e-Government is a new paradigm which is against the old government-centric paradigm. The new paradigm is a contextual orientation with an emphasis on external coherence. The government-centric paradigm is a transformational orientation with an emphasis on organisational coherence. The user-centric paradigm focuses on context-oriented view on service development and delivery. That means interconnecting ICT with social, organisational and political factors [OECD (2009)].

User-centricity is strongly connected to the public welfare. Public welfare is benefits (monetary and non-monetary), given the resources invested, the citizen gets from the e-services. There is always a question: "can the public welfare created by e-Government services be more than achieving the outcome of user take-up at "a reasonable and acceptable cost"?". There must be a balance between internal organisational (e.g. efficiency and effectiveness) and external outcome goals. OECD finds that one of the user-centric approaches external outcome goals is user quality of services among user focus, take-up, and satisfaction, and openness and transparency. There must be a balance of outcomes with the cost-effectiveness of the public sector [OECD (2009)]. This balance is also mentioned by in studies [Lau E. (2005); Bertot, J.C., Jaeger, P.T., McClure, C.R. (2008); Verdegem P., Verleye G. (2009); Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)].

The European Union has also started to think about user-centric e-services and the measurement. First indications of user-centric e-services were introduced in benchmarking report as a pilot [Capgemini 2007] and extending to the "ME-model" (see Figure 3) in other reports [Capgemini (2009), page 61]. There is also emerging a new term "GOV 2.0" [Capgemini (2009)] and Government 2.0 [Capgemini 2010], which means social networks and other Web 2.0 technologies interconnecting with e-Government.
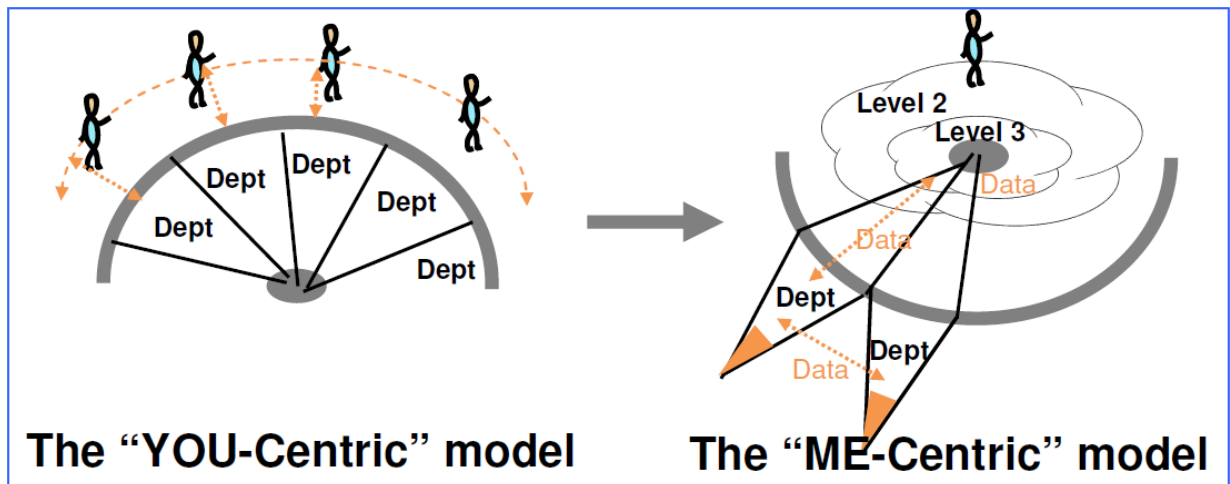
Figure 1. The "ME-centric" model [Capgemini (2009)].

EU e-Government action plan 2011-2015, which were declared by Malmö declaration sets out four political priorities, one of them is „empower citizens and businesses" [European Commission (2010)] or „eGovernment empowerment" [Capgemini (2010), page 11]. It means „citizens and businesses are empowered by eGovernment services designed around users" needs and developed in collaboration with third parties, as well as by increased access to public information, strengthened transparency and effective means for involvement of stakeholders in the policy process" [European Commission (2010)].

The priority eGovernment empowerment has one indicator „User focus Core" in the „eGovernment Progress Diamond" [Capgemini (2010), page 11] and connected to the priority „User centricity and transparency" [European Commission (2009)]. The „eGovernment Progress Diamond" is a concept proposed to convey the main results of the measurement and benchmark activities. It consists of four domains and the third domain is „eGovernment empowerment". It is at the same importance level than the others and all the domains are needed for a balanced development of eGovernment in Europe [Capgemini (2010), page 11]. Previous plan did not have the clear user-centric e-Government priority or indicators [European Commission (2006)]. To conclude, EU is moving towards user-centric e-Government and e-services.

Different organizations have various definitions of user-centric or citizen centric e-Government. The main conclusion from the definitions is that the citizen or the user satisfactory must come first in developing and delivering government e-services.

2.3   E-government service (maturity) levels

The OECD uses the Nolan+ model to describe information flow complexity in the different development stages of public organisations (Stage 1: control; Stage 2: organisational maturity; Stage 3: sectoral networking; Stage 4: national information infrastructure; Stage 5: Information Society) [OECD, (2005) Figure 5.1, p. 136]. E-Government services follow different development stages with increasing sophistication: i) "push services" where information and data are made available to users; ii) "pull services" where information and data can be downloaded by users; iii) interactive services (e.g. electronic forms); iv) transactional services (e.g. full electronic case handling); and v) individualisation of services (e.g. automatic individualised information and data provision) [OECD, (2009)].

Both the United Nations and the European Union use a stage model. The United Nations describes "stages of e-Government evolution" (Stage I: emerging; Stage II: enhanced; Stage III: interactive; Stage IV: transactional; and Stage V: connected) in its Web Measure Index [United Nations (2012b)]. The European Union focus on "sophistication of online services" - Level 1: information; Level 2: one way interaction (e.g. downloadable forms); Level 3: two way interaction (e.g. electronic forms); Level 4: transaction (e.g. full electronic case handling); Level 5: targetisation (e.g. automated, proactive services) (see Figure 2) [Capgemini (2010)].

Estonia uses also the European Union stage model [MKM, RISO (2011)].
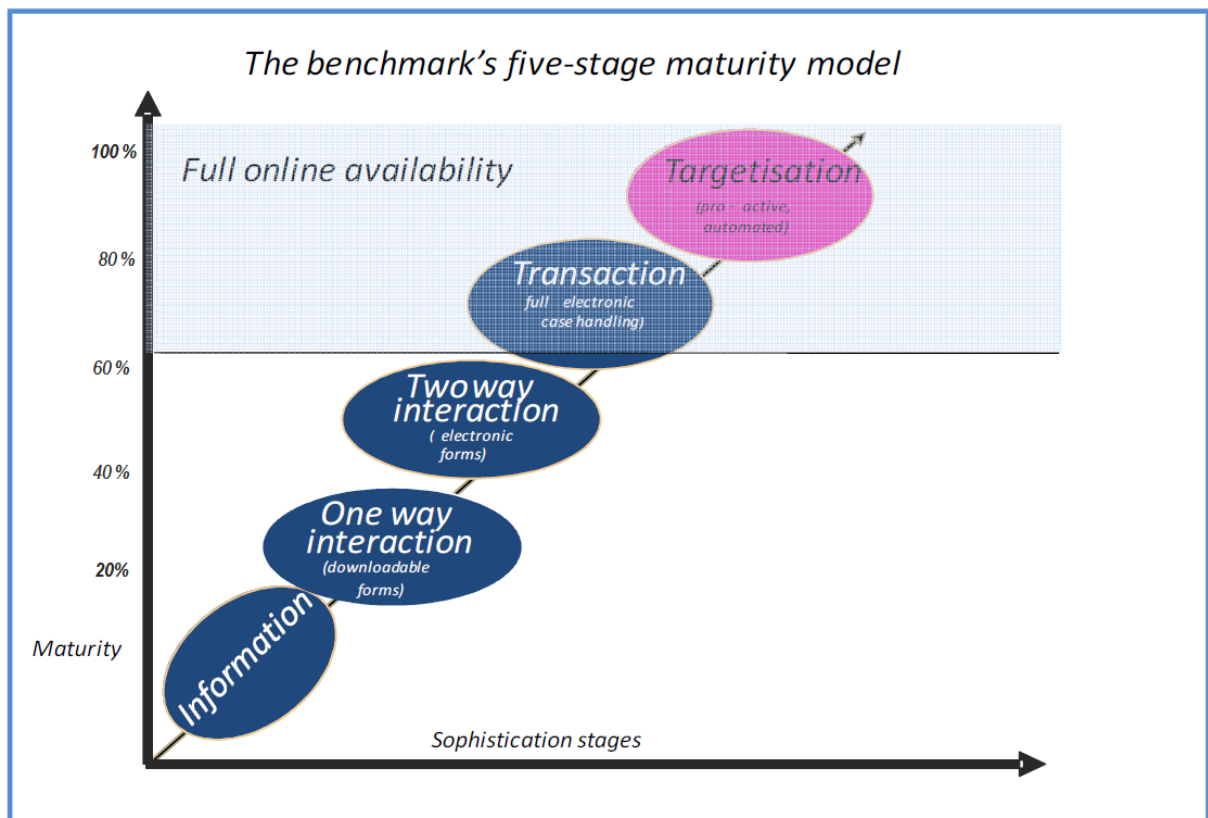
Figure 2. EU benchmark's five-stage maturity model [Capgemini (2010)].

2.4   E-service quality and e-Government service quality

E-service quality [Parasuraman, A. (2002); Santos J. (2003)] and e-Government service quality [Buckley J. (2003); Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)] has been studied by scholars in many cases. There are two definitions emerging: e-service quality and e-Government service quality [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)]. E-service quality definitions are more e-business oriented and e-Government service quality is emphasizing e-Government.

E-service quality is defined by [Parasuraman, A. (2002)] as "the extent to which a Website facilitates efficient and effective shopping, purchasing and delivery of products and services". Another definition is proposed by Santos [Santos J. (2003)] "the consumers' overall evaluation and judgment of the excellence and quality of e-service offerings in the virtual marketplace". E-service quality focuses on the quality of the service delivered through front-

office website (also portal) [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)].

E-Government service quality is defined as "users' overall assessment of quality in the virtual context and serves as one of the key factors in determining success or failure of e-Government" [Bhattacharya D., Gulla U., Gupta M.P (2012)]. E-government service quality focuses front-office website (also portal) and on overall user satisfaction [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)].

The e-Government service quality definition can be combined with e-service quality definition as the extent to which government website facilitates efficient and effective delivery of public services. The simplest way to define quality in the context e-Government is that quality is the extent to which user needs are fulfilled when consuming public services through electronic channels.

3   E-GOVERNMENT QUALITY ASSESSMENT MODELS

Firstly, the question to be answered is why measure e-Government and its quality?

The e-Government measurement is needed to achieve more efficiency in the functioning of government and to improve the delivery of government services. E-government development in countries is at varying stages and comparable indicators are needed throughout the world [ECA (2011)]. The European Commission, DG Information Society's annual e-Government benchmark study is measuring public sector performance and the maturity of e-Government services [Capgemini (2011)]. For the state's organizations, the quality measurement during developing and after publication gives an opportunity to assess, if the developed e-service meets the requirements of user-centric e-service [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)] or other assessment areas needed for the quality e-Government e-service. The measurement cannot be used to measure the user take-up of the service.

Secondly, the question to be answered is how to assess and measure the quality of e-Government and e-services?

The research has identified four layers (see Figure 3) of quality assessment categories:

1. back office process performance layer, addressing factors mainly found in quality models for traditional government services;

2. site technical performance layer, addressing the factors of the technical performance of the site, i.e. site reliability, security etc.;

3. site quality layer, addressing the factors of the site usability, and interface;

4. customer's overall satisfaction addressing the overall level of quality perceived by the user against user's expectations. [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)]

The categories are help to answer the question what should be assessed for the evaluation of e-Government services [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)].
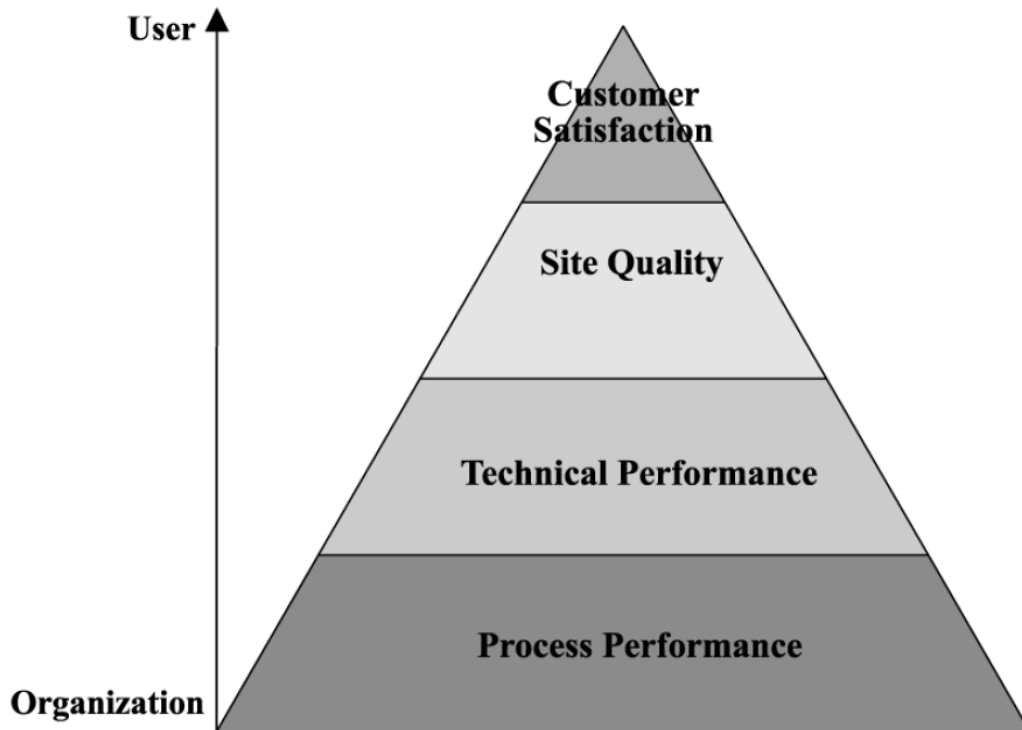
Figure 3. Four layers of quality assessment [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)]

E-government service quality in process, technical and site performance can be measured as a self-assessment in the organization before, during and after e-services' developing [Bertot, J.C., Jaeger, P.T., McClure, C.R. (2008); Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)] and as user surveys for satisfaction and take-up after the e-Government service has been implemented and publicly available [Capgemini (2010)]. Studies have proposed that the e-Government service quality has a direct outcome for the users of e-Government services – user satisfaction [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007); Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b); Verdegem P., Verleye G. (2009)]. The user satisfaction can be measured by user surveys [Capgemini (2010)]. The quality is the cause and the satisfaction is the effect - cause-effect relationship has been indicated in the recent research [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007); Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)].

Thirdly, the question to be answered what are the e-Government services quality assessment frameworks (models) and could these be implemented in Estonia? The second part of the question can be answered after practical assessment in this Master's thesis.

The recent research categorises the models into three groups: quality of traditional public services, quality of e-Government services and quality of e-services. The study elaborated limited set of 36 quality models. 23 e-service quality models exist, including SERVQUAL, SITEQUAL, etc. The list of e-Government service quality includes 7 models: American Customer Satisfaction Index (ACSI) for e-Government (egov-ACSI), the Korean Customer satisfaction level in e-Government (e.g.-CSI) (based on ACSI model), Quality of Norwegian public web sites, European top of the web, Interactive e-Government by Barnes and Vidgen, User satisfaction of e-Government services and E-government in Thai. [(Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)]

Another research has listed and studied 14 different e-service quality models and studies, categorised the models as service quality, traditional national satisfaction index and e-Government success. The e-Government service quality models include GovQual, EGOVSAT, E-GOVSQUAL-RISK and e-GovQual. The studies and other can be found in the study [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b), Table 1].

Latest research studies have proposed new models, developed on the basis of other quality models' studies and have reference to user-centric concept, e-GovQual [Papadomichelaki, X., Mentzas, G. (2011)], COBRAS [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)] and e-service quality model for Indian government portals [Bhattacharya D., Gulla U., Gupta M.P. (2012)].

Finnish Ministry of Finance has developed a quality assessment model "Quality criteria for web service" for front-office and back-office e-Government service evaluation [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008); Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)].

3.1   Quality assessment areas

Service quality assessment areas might vary with political environment, technical advancement and socio-economic conditions of a country, but the primary objective for such studies is to provide citizens with a transparent and effective service [Bhattacharya D., Gulla

U., Gupta M.P (2012)]. The e-Government quality assessment areas vary in different models (e.g. COBRAS, e-GovQual and Finnish Ministry of Finance quality assessment models' assessment areas are provided in Chapter 4) but overall construct of user satisfaction is the same.

Research shows that are three domains in user-centric e-Government quality:

- User-focused: ease of learning; efficiency of use; memorability; user drop-out; error frequency and severity.

- User satisfaction: measured by instruments such as SERVQUAL, including perceptions of privacy; volunteered through site-based feedback mechanisms.

- Outcomes based measures: yield and income by site, and per customer; customer loyalty; customer drop-off rates. [Buckley J. (2003)]

For user engagement usability, functionality and accessibility can be tested with experts and users during e-service development and in operation [Bertot, J.C., Jaeger, P.T., McClure, C.R. (2008)].

EU uses for user-centric benchmarking survey [Capgemini (2011)] three interrelated themes: user needs and insights, user experience and user satisfaction. Three themes describe how governments take into consideration users at different points in the policy cycle: user needs and requirements guide the design and development phases of e-Government, user experience describes fulfilment during usage whilst satisfaction is typically assessed as an ex post phenomenon [Capgemini (2010)]. The user experience theme includes criteria for usability, transparency, multi-channel service provision, privacy & data protection and ease-of-use of the service. [Capgemini (2010); Capgemini (2011)]

3.2 European Union quality assessment models

The Common Assessment Framework (CAF) is a Total Quality Management (TQM) tool inspired by the Excellence Model of the European Foundation for Quality Management (EFQM) and the model of the German University of Administrative Sciences in Speyer. It is based on the premise that excellent results in organisational performance, citizens/customers,

people and society are achieved through leadership driving strategy and planning, people, partnerships and resources and processes. It looks at the organisation from different angles at the same time, providing a holistic approach to organisation performance analysis. [CAF Resource Center (2006)]

The CAF is offered as an easy to use tool to assist public sector organisations across Europe to use quality management techniques to improve performance. The CAF provides a self-assessment framework that is conceptually similar to the major TQM models, EFQM in particular, but is specially conceived for the public sector organisations, taking into account their differences. [CAF Resource Center (2006)]

The CAF model includes quality criteria that mention e-Government "1. Leadership" and "5. Processes" (sub criteria "5.3 Innovate processes involving citizens/customers") [CAF Resource Center (2006)].

European Commission has developed and agreed on European Interoperability Framework for pan-European e-Government services. Interoperability Framework can be defined as the overarching set of policies, standards and guidelines which describe the way in which organisations have agreed, or should agree, to do business with each other. The document represents the highest-ranking module of a comprehensive methodological tool kit for implementing pan-European e-Government services. [European Commission (2004)]

European Commission Directorate General for Information Society and Media in co-operation with Capgemini has prepared the e-Government benchmark method paper. The method is for measure the "core" indicators - availability and maturity of 20 online services, User focus, visibility of e-Procurement and its pre-award phases; and the "proof of concept" indicators - availability and maturity of select life events, back-office enablers, and the e-Procurement post-award process phases. The benchmark is one of few international (OECD and UN), consistent measures which has enabled EU to build a statistically robust data base of e-Government progress in Europe. The method paper refers to European Interoperability Framework and the criteria from it are used in back-office enablers' measurement. [Capgemini (2010)]

3.3 Estonian quality assessment models

Estonian contact for Common Assessment Framework (CAF) is Estonian Ministry of Finance. Estonian Ministry of Economic Affairs and Communications (MKM) organize designing and implementing development plans relating to IT and telecommunications, as well as coordinates the development of the state information system.

The modernization in Estonian e-Government is based on the Estonian Information Society Strategy 2013. The Estonian Information Society Strategy is implemented on the basis of annual Information Society Implementation Plans. The implementation plan is realized in the form of project-based development works in accordance with the principles set out in the Estonian IT Architecture and Interoperability Framework. [Kalja, A., Pold, J., Robal, T., Vallner, U. (2011)]

The Estonian Ministry of Economic Affairs and Communications has endorsed Estonian Interoperability Framework [MKM RISO (2011)]. The objective of the interoperability framework is "to make the operation of the Estonian public sector more effective, improving the services offered to Estonian and EU citizens". The Estonian interoperability framework is harmonized with the European Interoperability Framework. There is also interoperability documents of specific/different spheres present (e.g. semantic interoperability, security, software, websites, management of documents, open standards, development framework). [MKM RISO (2011)]

The framework for websites [MKM RISO (2012)] is part of the Estonian Interoperability Framework. The objective is "to raise the quality of public sector websites and their mutual linking, proceeding from the needs of user groups, using open standards". The framework includes an assessment area for the website content, other include semantic interoperability, web engines and open standards. The assessment area website includes criteria for usability, availability, security and archiving of a website. The framework usability criterion refers to the guidelines for usability and user-centric design of web services [Trinidad Consulting (2009)]. The framework for websites includes self-assessment of the interoperability of websites.

The interoperability framework and the documents of specific spheres reference to the areas of quality, there are self-assessment questionnaires available but comprehensive e-Government quality model is not developed, like in Finland. The interoperability framework documents are not formally published with International Standard Serial Number (ISSN) or International Standard Book Number (ISBN) or similar standards.

There are Estonian surveys that suggest to government that there should be quality models for e-services [MKM, RIA (2011)]. The need for e-Government user satisfaction surveys are not described Estonian Interoperability Framework [MKM RISO (2011); MKM RISO (2012)] but the surveys should be mentioned, as it is a one of the layer of e-Government quality assessment [Halaris C., Magoutas B., Papadomichelaki X., Mentzas X. (2007)].

3.3.1 Benchmarking of Estonian e-Government

In the United Nations' Global E-Government Survey 2012 Estonia is placed 20th [United Nations (2012b)]. Estonia's full online availability (94%) is above the EU average of 82%. In the full online availability ranking, Estonia in the year 2010 ranks 14th out of the 32 measured countries [Capgemini (2011)]. Estonia's e-Services score is 94% on usability and 100% on user satisfaction monitoring (as compared to the EU averages of 79% and 80% respectively). For e-Services, usability refers to:

- Transparency of service delivery: rated at 70% (EU+: 52%)

- Multi-Channel service provision: rated at 100% (EU+: 88%)

- Privacy and data protection: rated at 100% (EU+: 90%)

- Ease of use of services: rated at 83% (EU+: 80%) [Capgemini (2011)]

Estonia and 6 other countries have fulfilled all the key enablers of e-Government back-office. Key enablers are IT enablers, or the so called horizontal building blocks, defined as "the basis of many eGovernment applications and are hence a condition sine qua non for eGovernment progress". These back-office 9 key enablers are Authentic Sources, ePayment, eIdentity, Open Specifications, Single Sign On, Architecture Guidelines, Catalogue of Horizontal Enablers, Secure eDelivery and eSafe Electronic Safe (eSafe). [Capgemini (2011)]

4   METHOS USED FOR PRACTIAL ASSESSMENT OF ESTONIAN E-SERVICES

The select quality assessment models for practical assessment were chosen for different reasons. The first reason is to use user-centric e-Government quality assessment models developed in European Union member states or candidate countries. Secondly, as the new technologies emerge, the quality models should show an on-going development and improvement. Thirdly, the quality assessment areas are varied throughout the models.

The chosen models have one common objective: to assess the quality in the user-centric e-Government view. The assessment models criteria could be interconnected with the models and there is a need to assess, if the criteria are intended for that quality assessment area.

Quality assessment was executed as an external expert self-assessment with exploratory testing techniques [ISTQB Glossary Working Party (2010)]. The testing ideas were produced for one or more specific e-service or web page part and generalized for overall quality assessment. The test ideas were combined to use only publicly available materials. There should be more thorough testing with every e-service in the portal but the overall model components can be assessed. Some quality criteria need non-public information for assessment and the criteria or detailed element is excluded from the assessment. The publicly used materials used for assessment are from Estonian Administration system for the state information system called RIHA [RIHA (2012a); RIHA (2012b)] and organizations' websites. For additional information, that should be publicly available (at least the fact that the information or documents are drafted), questions were asked from the portals' project managers. The questions were presented and answered by e-mail.

Buckley contends that "e-service quality in the public sector is predicated on the public service meeting the three key criteria of homogeneous consumer groups, definable tasks and measurable outcomes. In other words public sector organisations with limited complexity of mission and client group are more suited to e-service delivery and high quality e-service

provision." The intention was to choose the system under test that provides these criteria and the other that does not. [Buckley J. (2003)]

The systems under tests, the state portal eesti.ee and Agricultural Registers and Information Board client portal e-PRIA, were chosen for different reasons. Both have services for individuals (G2C), entrepreneurs (G2B) and public sector agencies offering services (G2G). The state portal has e-services from various organizations and has a wide mission. The portal e-PRIA has defined tasks and clear mission. The state portal is intended for all the citizens and e-PRIA is intended for a definite group of citizens, mainly located in rural areas and connected to agriculture. The chosen e-services reflect three e-service levels 1, 3 and 4 – information, two-way interaction and transactional e-services.

Quality assessment benchmarking is not an objective, because there are many criteria that cannot be assessed and the systems under test are intended for different user groups and purposes. The objective is to find out the weaker and stronger criteria of the systems under test. The weakest criteria are the two lowest scores (in the tables' column "W"). The strongest criteria are the two highest scores (in the tables' column "S"). There is also a need to show the medium score (in the tables' column "M") and the not applicable criteria (in the tables' column "N/A"). The not applicable criteria show that the assessment could not be executed. The not applicable count for Finnish quality model shows that one or many elements could not be assessed (including all the elements).

4.1 E-GovQual

E-GovQual is a multiple-item scale e-Government service quality model for measuring e-Government service quality of government sites, where citizens seek either information or service [Papadomichelaki, X., Mentzas, G. (2011)].

The model is based on classical theories and the model is proposed under the framework of SERVQUAL model which posits four dimensions influential to e-Government site quality – efficiency, trust, reliability, citizen support. [Papadomichelaki, X., Mentzas, G. (2011)]

The model focuses on future research on extending the knowledge of quality dimensions affecting e-Government websites in order to more fully develop guidelines for governmental site development and provides both researchers and practitioners with a tool to aid both

academic research and the construction of e-Government sites. [Papadomichelaki, X., Mentzas, G. (2011)]

4.1.1   Quality assessment areas, quality criteria and elements

The e-GovQual has 21 quality criteria (attributes) classified under four quality assessment areas (dimensions):

- Efficiency – the ease of using the site: the presentation and layout of it, like the proper use of colour, graphics, and size of web pages; and the quality of information (7 criteria).

- Trust – the degree to which the citizen believes the site is safe from intrusion and protects personal information (4 criteria);

- Reliability – the feasibility and speed of accessing, using, and receiving services of the site (6 criteria);

- Citizen Support – the ability to get help when needed (4 criteria). [Papadomichelaki, X., Mentzas, G. (2011)]

The 21 quality criteria are following by the study [Papadomichelaki, X., Mentzas, G. (2011)]:

Efficiency

1. This e-government site's structure is clear and easy to follow.

2. This e-government site's search engine is effective.

3. This e-government site's site map is well organized.

4. This e-government site is well customized to individual users' needs.

5. The information displayed in this e-government site is appropriate detailed.

6. The information displayed in this e-government site is fresh.

7. Information about field's completion in this e-government site is enough.

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Trust

1. Acquisition of username and password in this e-government site is secure.

2. Only necessary personal data are provided for authentication on this e-government site.

3. Data provided by users in this e-government site are archived securely.

4. Data provided in this e-government site are used only for the reason submitted.

Reliability

1. Forms in this e-government site are downloaded in short time.

2. This e-government site is available and accessible whenever you need it.

3. This e-government site performs the service successfully upon first request.

4. This e-government site provides services in time.

5. E-government site's pages are downloaded quickly enough.

6. This e-government site works properly with your default browser.

Citizen Support

1. Employees showed a sincere interest in solving users' problem.

2. Employees give prompt replies to users' inquiries.

3. Employees have the knowledge to answer users' questions.

4. Employees have the ability to convey trust and confidence.

For the purpose of cross-reference between quality assessments' frameworks the quality criteria were added identification numbers (ID) in the format three letters of e-GovQual framework name (EGQ), hyphen, the first letter of the assessment area and the order number of quality criteria in assessment area, e.g. the Efficiency assessment area criterion "This e-

Government site's structure is clear and easy to follow" ID is EGQ-E1. The order of the quality criteria was extracted from the study [Papadomichelaki, X., Mentzas, G. (2011), Table 12].

4.1.2 Metrics

The e-GovQual model used Likert scale [Likert, R. (1932)] in their user survey and added the points to the scale:

1. Strongly disagree (1 point);

2. Disagree (2 points);

3. Neither agree nor disagree (3 points);

4. Agree (4 points);

5. Strongly agree (5 points);

The metrics used in this thesis practical assessment are following:

1. Strongly disagree (1 point) – only negative findings;

2. Disagree (2 points) – more negative findings than positive;

3. Neither agree nor disagree (3 points) – negative findings are the same as positive;

4. Agree (4 points) – more positive findings than negative;

5. Strongly agree (5 points) – there is only positive findings;

6. Not Applicable (N/A) – the criterion is irrelevant to the assessed web service or there is a Finnish standard or legislation, that does not apply to Estonia or there are no public information available for assessment.

The assessment was carried out with accordance to Finnish Ministry of Finance quality assessment results and metrics. The quality criteria from e-GovQual were interconnected with the COBRAS criteria and criteria elements of Finnish quality framework (see APPENDIX 1, Interconnections between e-GovQual to COBRAS and Finnish quality model). The Finnish

quality framework assessment metrics and points were transformed to e-GovQual metrics and points. The lowest score in Finnish framework - zero points was transformed to one point in e-GovQual and the highest score in Finnish framework four points was transformed to five points in e-GovQual. If there was no interconnection, the criterion was assessed separately.

4.1.3   Assessment tools

There is no official tool for assessment. Estonian portals' practical quality assessment was prepared and carried out in Microsoft® Excel™ table in English language (see Attachments). The file includes a cross-table with criteria, points, author's comment, positive and negative findings. The additional information is the e-GovQual inter-connection to COBRAS and Finnish Ministry of Finance quality assessment model. The table for e-GovQual quality model assessment with scoring results to eesti.ee and e-PRIA can be found in attachments (see Attachments).

4.2   COBRAS[2]

The COBRAS is a quality assessment framework to evaluate e-Government services. The COBRAS is a holistic and citizen-centric evaluation framework with four dimensions: **C**osts, **O**pportunities, **B**enefits and **R**isks **A**nalysis for **S**atisfaction [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)].

The COBRAS quality framework development is carried out under the project called "C-E-E-S - **C**itizen-oriented **E**valuation of **E**-Government **S**ervices: A Reference Process Model". The project is funded by the European Union 7th Framework People Program FP7-PEOPLE. The project started in 2009 and will end on 2013. The project partners are Brunel University (UK), American University of Beirut (Lebanon) and Turksat (Turkey). [CORDIS (2009)]

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[2] The name of the framework varies from COBRA [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V., (2011b)] to COBRAS [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V., (2011a)] but the project contact has confirmed by e-mail (11.04.2012) that the official name will be COBRAS.

The COBRAS quality model also proposes levels of a maturity modelling for e-Government services in the field trial:

- Maturity Level 1, Information: General information services (categorized content, announcements, daily-updated info on exchange rate or weather conditions) that can be accessed without authentication and authorization

- Maturity Level 2, Interaction: General e-services that can be accessed with authentication and authorization, and that rely on simple data exchange

- Maturity Level 3, Transaction: More sophisticated services that have, for instance, financial transactions, value-added information processing etc...

- Maturity Level 4, Personalization (as there are no fully Integrated services): Services that can be personalized by citizens on their personal page. [Turksat (2010)]

In the COBRAS model is missing one level compared to EU e-service maturity levels [Capgemini (2010)]. The COBRAS Maturity level 2 is divided into two levels 2 and 3 in EU e-service maturity levels.

4.2.1 Quality assessment areas, quality criteria and elements

The model development methodology follows a grounded theory approach in which an extensive literature review on existing e-service assessment models is conducted to identify the various fragmented success factors (key performance indicators, KPIs). The identified KPIs (factors/constructs) are then classified into four main groups (assessment areas): cost; benefit; risk; and opportunity. The cost and benefit variables are mostly tangible and are often easy to measure, whereas risk and opportunities are mostly intangible. [Osman I. H., Anouze A., Irani Z., Lee H., Weerakkody V. (2011a)]

The proposed model is based on SERVQUAL, Customer satisfaction index (CSI), IS success model and VMM model. Based on SERVQUAL, the quality of dimensions is the main driver of user satisfaction. User satisfaction is defined as the difference between perceived quality and expected quality. The SERVQUAL expanded and updated by different researchers and new models (e.g. E-SQUAL, e-ServEval and e-GovQual) were proposed to measure user

satisfaction. The CSI model outcome of user trust replaces the price-related outcomes found in the private sector model. IS success model is a reference model for benefits. The VMM model perceives e-service success as a trade-off between value (benefit) and cost and risk. [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)]

The quality framework COBRAS uses four assessment areas:

- **Cost** - the factor is divided into two factors: time and money. Monetary cost includes authorisation cost for authentication and registration with the site cost. Whereas, time cost involves access time (number of attempts to find the requested service on the site) and post-interaction time (time to receive confirmation of submission or waiting time to receive the requested service);

- **Opportunity -** presented by the environment or country within which the e-service operate and grouped in two main groups: e-service support and technical opportunities;

- **Benefit** – benefit items to the user are grouped into two categories: *tangible* and *intangible* benefits. Tangible benefits involve saving time and saving money, whereas intangible benefits include the quality of information, service, and system.

- **Risk -** six categories of perceived risk: financial, performance, social, personal, privacy and time risks. [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)]

All the areas are related to user satisfaction (see Figure 4). The relationships between user satisfaction with both benefit and opportunity constructs are positive, whereas it is negative with both cost and risk constructs. [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)]
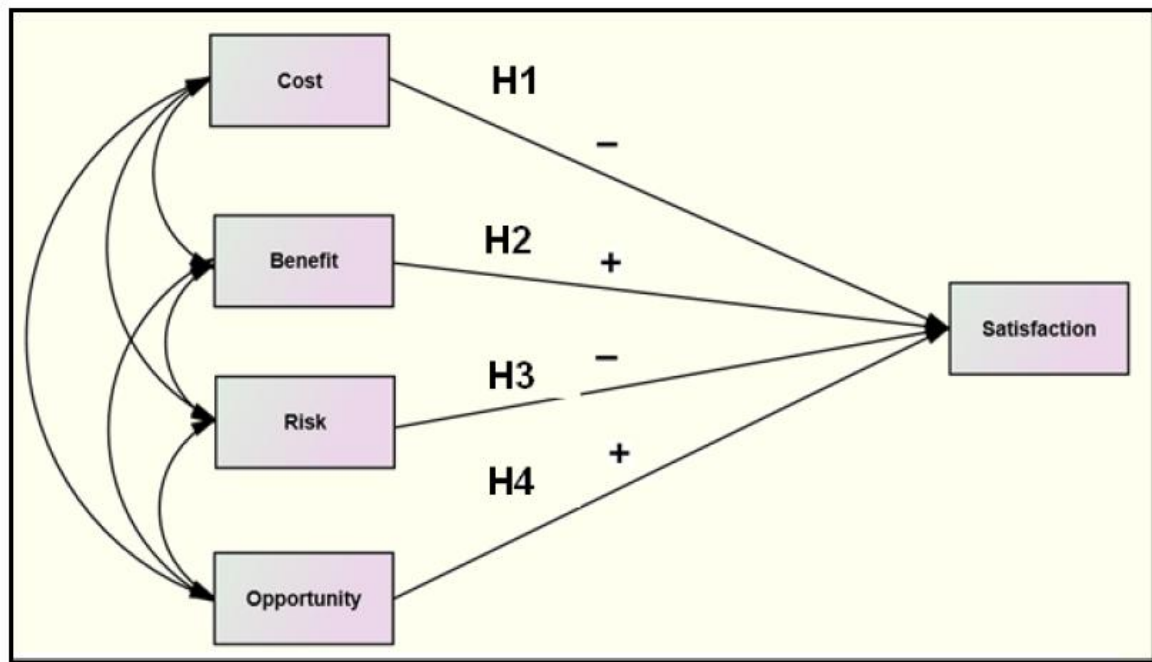
Figure 4. The COBRAS model for user satisfaction [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b)]

The quality criteria are proposed by 49 criteria and no additional elements and guidelines are provided. Cost money factor consists of 7 quality questions. Cost time factor uses 2 quality criteria. Altogether 9 quality criteria are proposed for cost. The opportunity assessment area has 13 criteria; risk assessment area has 5 criteria and benefit assessment area has 18 criteria. The criteria for all assessment areas can be found in the practical assessment appendices (see APPENDIX 2, Interconnections between COBRAS and Finnish Ministry of Finance quality model).

The quality criteria for six cost (all the cost-time) assessment area and all the five risk assessment area should be paraphrased in negative form, because to get maximum points. These criteria are:

- "It takes a long time to arrange access to the e-service" – "It takes a short time to arrange access to the e-service";

- "It takes a long time to upload the e-service homepage" – "It takes a short time to upload the e-service homepage";

- "It takes a long-time to find my needed information" – "It takes a short-time to find my needed information";

- "It takes a long-time to download/ fill the e-service application" – "It takes a short-time to download/ fill the e-service application";

- "It takes several attempts to complete the service due to system breakdowns" – "It takes one attempt to complete the service due to system breakdowns";

- "It takes a long-time to acknowledge the completion of e-service" – "It takes a short-time to acknowledge the completion of e-service";

- "I am afraid my personal data may be used for other purposes" – "I am not afraid my personal data may be used for other purposes";

- "E-service obliges me to keep a record of documents in case of future audit" – "E-service does not oblige me to keep a record of documents in case of future audit";

- "The e-service may lead to a wrong payment that needs further correction" – "The e-service may lead to a right payment that needs no further correction";

- "I worry about conducting transactions online requiring personal financial information" – "I do not worry about conducting transactions online requiring personal financial information";

- "Using e-service leads to fewer interactions with people" – "Using e-service leads to more interactions with people".

For the purpose of cross-reference between quality assessments' frameworks the quality criteria were added identification numbers (ID) in the format first letter of COBRAS framework name, hyphen, the first letter of the assessment area and the order number of quality criteria in assessment area, e.g. the risk assessment area criterion "I am afraid my personal data may be used for other purposes" ID is C-R1. The order of the quality criteria was extracted from the COBRAS framework working paper [Osman, I. H., Anouze, A., Irani, Z., Lee, H., Weerakkody, V. (2011b), Table 2].

4.2.2 Metrics

Due to the fact that the project is on-going, the COBRAS framework is not fully mature. Thus, there is no comprehensive quality metrics standardized and no guidelines provided for quality criteria. The Likert scale [Likert, R. (1932)] and additional point metric (1,3,5,7,9) are used to assess the criteria in field study [Turksat (2010)] but there is no point metric system like in Finnish Ministry of Finance quality assessment model [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]. The COBRAS model used Likert scale [Likert, R. (1932)] in their field trial [Turksat (2010)] and added the points and not applicable to the scale:

1. Strongly disagree (1 point);

2. Disagree (3 points);

3. Neither agree nor disagree (5 points);

4. Agree (7 points);

5. Strongly agree (9 points);

6. Not Applicable (0 points).

The metrics used in this thesis practical assessment are following:

1. Strongly disagree (1 point) – only negative findings;

2. Disagree (3 points) – more negative findings than positive;

3. Neither agree nor disagree (5 points) – negative findings are the same as positive;

4. Agree (7 points) – more positive findings than negative;;

5. Strongly agree (9 points) – there is only positive findings;;

6. Not Applicable (N/A) – the criterion is irrelevant to the assessed web service or there is a Finnish standard or legislation, that does not apply to Estonia or there are no public information available for assessment.

The maximum score is 441 points and all the criteria are applicable to Estonian context. There is a possibility, that the maximum score could be reduced due to the fact that there is no public information available.

The assessment was carried out with accordance to Finnish Ministry of Finance quality assessment results and metrics. The quality criteria from COBRAS were interconnected with the criteria elements of Finnish quality model (see APPENDIX 2, Interconnections between COBRAS and Finnish Ministry of Finance quality model). The Finnish quality model assessment metrics and points were transformed to COBRAS metrics and points. The lowest score in Finnish framework - zero points was transformed to one point in COBRAS and the highest score in Finnish framework four points was transformed to nine points in COBRAS. If there were not an interconnection, the criterion was assessed.

4.2.3   Assessment tools

There is no official tool for assessment. Estonian portals' practical quality assessment was prepared and carried out in Microsoft® Excel™ table in English language (see Attachments). The file includes a cross-table with criteria, points, author's comment, positive and negative findings. The additional information is the inter-connection between COBRAS and Finnish Ministry of Finance quality assessment model. The table for COBRAS quality model assessment with scoring results to eesti.ee and e-PRIA can be found in attachments (see Attachments).

4.3   Finnish Ministry of Finance quality assessment model "Quality criteria for web service

Finland is in top 10 in European Union Benchmarking Survey [Capgemini (2011)]. Finnish Ministry of Finance quality assessment model was developed in year 2008, the work began in year 2002 [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]. Correlation has not been measured but there is an indication that there is correlation between the quality model and the benchmarking. The idea could be studied further in the future studies.

The main purpose for the quality criteria is to offer tools for developing and for assessing the quality of public web services, to improve the quality and to increase the benefits from public

web services. The quality criteria can be applied to a wide range of web services starting from informational and ending with transactional web services [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008); Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)].

The structure of the quality model is divided into five assessment areas, each are has quality criteria and every criteria has elements. The elements have also descriptions, which are guidelines to assess the elements. [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]

4.3.1   Quality assessment areas, quality criteria and elements

Finnish Ministry of Finance quality assessment model quality criteria embrace five assessment areas (see Figure 5):

1. **Use** encompasses how well the web service functions from the standpoint of its end users. The criteria in this assessment area are designed to ensure that the target groups are able to use the service to begin with, that it is easy enough and that it meets their needs and expectations as much as possible. The relevant perspectives here include the accessibility of the service, how easy and effortless its use is, and how communicative its structure and expression are;

2. **Content** deals with the content of the web service, i.e., how relevant, up-to-date, comprehensive and understandable it is and how clear a structure it has. The criteria in this area focus in particular on the user's perspective; that is, they can be used to ensure that the web service adheres to the needs of its target group. The perspectives on content dealt with here are the information content of the web service and its degree of interactivity;

3. **Leadership** encompasses how the web service and its development are managed within the organisation. The quality of management is closely linked to the strategic planning of the service and how production of the service production is organised and monitored;

4. **Production** embraces the quality issues that merit attention in implementing, developing and maintaining the web service. The quality of production is examined from several perspectives: how the service has been constructed, how user-centred it

is, how well content production is managed, and the security and functionality of the production process;

5. **Benefits** deal with the benefits realised by the user of the web service and theorganisation producing the service. [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]
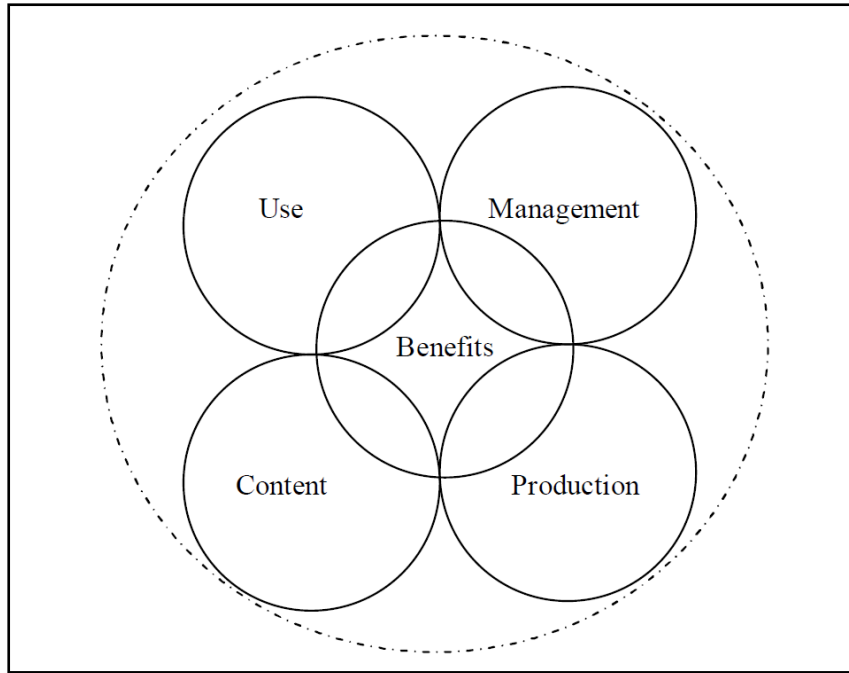
Figure 5. Structure of the criteria. [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]

The assessment areas contains a total of 41 criteria in the English version, with each criterion being broken down into two to seven concrete elements [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]. The new Finnish version (2.1) of the quality model has 40 criteria; the 4.7 criterion "Extensive updates are conducted as well-managed projects" is removed. There are 168 elements to be assessed, which point adds up to criterion points. Every criterion is connected with meta-data keywords for easier finding. [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]

The Finnish language version (2.1) changed the order of the criteria from English to Finnish version: 1.8 to 1.9, 1.9 to 1.10, 1.10 to 1.11, 1.12 to 1.8, 3.2 to 3.1, 3.1 to 3.2, 3.4 to 3.3, 3.3 to

3.4, 5.3 to 5.2 and 5.2 to 5.3. The element 3.4.2 has been added and the 3.4.2-3.4.4 is now 3.4.3-3.4.5. The element 2.2.3 has been added to element 2.2.2 description. The element 3.1.2 has been removed and added to element 3.1.1 description. The element 4.2.2 has been removed and added to element 4.2.1 description. The element 4.8.7 has been moved to new element 4.9.4. The element 5.4.3 is removed and Finnish version 5.4.4 is moved to 5.4.3.

The criteria examine web services from two perspectives: user's point of view and service provider's view. In addition, the criteria consist of web service benefits which are offered to users and services providers [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]. The perspectives are depicted in Figure 6.
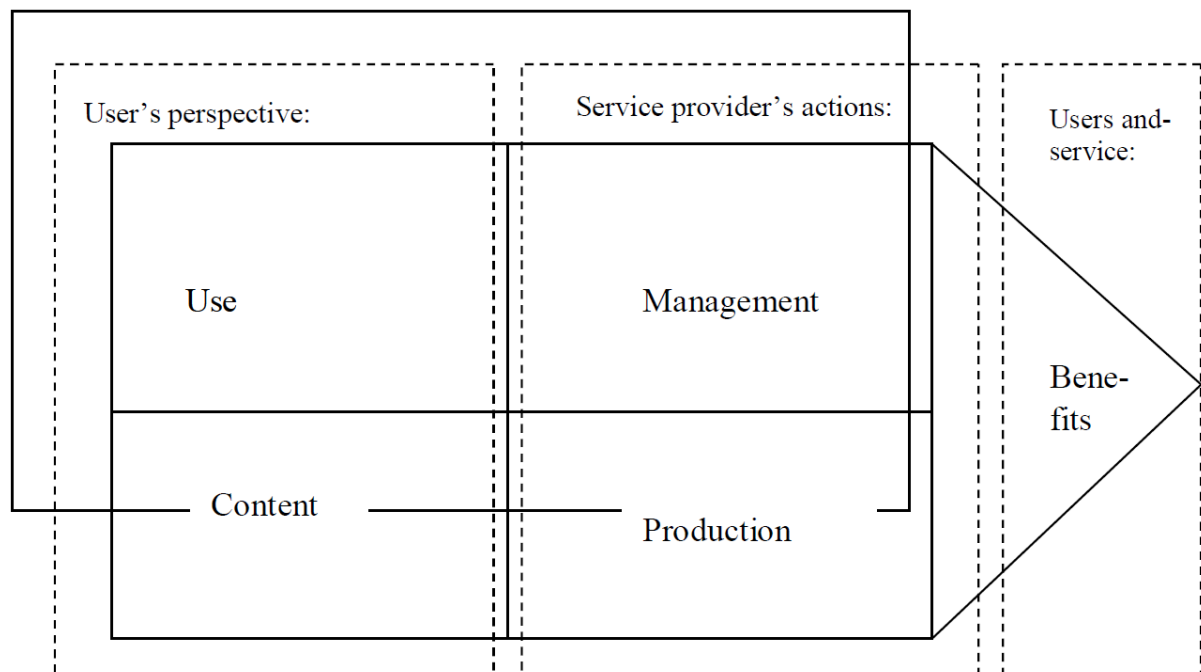
Figure 6. Perspectives on web services [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]

4.3.1.1   Essential criteria

The quality model has also emphasis on essential criteria. They are the most important items to consider in electronic services. The essential criteria can be used for quick reference quality control checklist when an overview of the big picture is needed. The essential criteria cannot ensure the comprehensive quality of e-services, only full set of criteria can ensure

comprehensive quality of e-services [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008); Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)].

The essential criteria are:

1. Use

1.3 The web service can be used in a variety of technical environments.

1.5 Use feels secure and reliable.

1.7 Navigating and finding information are easy.

1.8 Links are descriptive and functional.

1.9 The user interface is clear, uniform and understandable.

2. Content

2.1 The structure is organised appropriately.

2.2 The content is trustworthy and up-to-date.

2.4 The text content is easy to understand and legible.

3. Management

3.1 The web service supports the organisation's strategy and goals.

3.2 Applicable legislation is observed in the web service and its development.

3.4 The web service has a management infrastructure.

4. Production

4.2 User groups, users' needs and use situations have been taken into consideration.

4.5 Content production is systematic.

4.6 Technical maintenance is controlled.

5. Benefits

5.1 The web service is of benefit to the organization.

5.4 The web service provides the user with added value.

[Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]

4.3.2 Metrics

Every quality criteria's element is assessed from zero to four (0-4) points and with not applicable:

- The case does not occur (0 point);

- The case is realized poorly (1 point);

- The case is realized satisfactory (2 points);

- The case is realized good (3 points);

- The case is realized excellent (4 points);

- Not applicable (N/A).

An additional metric was added to calculate the scale. The model documentation has additional, even more quantitative explanations to give more information to help the assessment. For example criteria "2.4.4 Tables are drafted to be highly legible" has an explanation:

"It is easy for the user to read tables row by row. Rows and columns have headings. Row and column headings are differentiated from the information content using a mark-up language (e.g. HTML). Tables are only used in the presentation of tabular information. If necessary, the accessibility of tables (e.g. using a screen reader program) is supported by means of the technical specifications given in the Web Content Accessibility Guidelines (WCAG)" [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]. The explanation can be divided into three, more quantitative criterion to be assessed:

- "It is easy for the user to read tables row by row. Rows and columns have headings. Row and column headings are differentiated from the information content using a markup language (e.g. HTML)."

- "Tables are only used in the presentation of tabular information."

- "If necessary, the accessibility of tables (e.g. using a screen reader program) is supported by means of the technical specifications given in the Web Content Accessibility Guidelines (WCAG)." [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]

All the quality criteria explanations were divided into more quantitative questions but the qualitative assessment remains. Every additional question was assessed and there were four levels of metrics added:

- The case does not occur (0 point) – only negative findings;

- The case is realized poorly (1 point) – more negative findings than positive;

- The case is realized satisfactory (2 points) – negative findings are the same as positive;

- The case is realized good (3 points) – more positive findings than negative;

- The case is realized excellent (4 points) – there is only positive findings;

- Not applicable (N/A) - the criterion is irrelevant to the assessed web service or there is a Finnish standard or legislation, that does not apply to Estonia or there are no public information available for assessment.

Element points were calculated with average value with mathematical rounding rules. Criteria point values were summed up on elements points.

The maximum score for all the criteria in Finnish quality model is 672 points. The maximum score for essential criteria in Finnish quality model is 260, it is ~39% of the all the criteria' maximum score. The points are divided by the assessment areas that way that user-centric assessment areas "1. Use" and "2. Content" takes over half of the assessment areas points (see Table 1).

Assessment area	Maximum	% of Total	Essential criteria	% of essential criteria total
1. Use	256	38,10%	92,00	35,38%
2. Content	96	14,29%	52,00	20,00%
3. Leadership	100	14,88%	44,00	16,92%
4. Production	176	26,19%	48,00	18,46%
5. Benefits	44	6,55%	24,00	9,23%
Total	672	100,00%	260	100,00%

Table 1. Finnish quality model assessment areas' points

The maximum criteria score for Estonian assessment is calculated by the element without "N/A", because they reference to Finnish documents or because there is no other official language in Estonia. These include "1.2.1 The web service can be used in a manner compliant with the Language Acts", "3.2.1 Applicable legislation is observed in the production of content and content management", "3.2.2 Applicable legislation is taken into consideration in technical implementation", "3.2.3 Procurements are made in accordance with public procurement legislation" and "3.4.5 Service contracts as well as co-operative and outsourcing agreements are drafted by experts". This means Estonian quality criteria maximum score is decreased by 16 points to 652 points. Some of the Finnish documents and abbreviations referenced in elements' descriptions were changed to Estonian context, like "VETUMA electronic authentication" and "Katso authentication and authorization service" are replaced with Estonian ID-card, mobile-ID and bank authentication context. The maximum score for every assessment can vary, because there may be not public documents or information available.

4.3.3   Assessment tools

There is an assessment tool called Network Services Evaluation tool and it can be accessed from http://www.arviointityokalu.fi/. The tool is in Finnish and Swedish language. The tool

can help to assess the e-Government services and it will guide the assessor through the process. It is possible to register an account and save, modify, share the assessment and report with others. The deliverable for the tool is a report with scoring results. The results can be downloaded in CSV format. The assessment tool should have two more text fields: Positive and negative findings.

Estonian quality assessment was prepared and carried out in Microsoft$^{®}$ Excel$^{™}$ table in English language. The file includes a cross-table with assessment area, criteria, element, descriptions, points, author's comment, positive and negative findings. The table for Finnish quality model assessment with scoring results to eesti.ee and e-PRIA can be found in attachments (see Attachments). The assessment should take 1-2 days to complete [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)].

5   PRACTICAL QUALITY ASSESSMENT – STATE PORTAL EESTI.EE

The Estonian State Portal http://www.eesti.ee is a secure Internet environment through which Estonian residents can easily access the state's e-services and information. It contains articles on how to resolve important or frequently occurring issues (such as applying for family benefits) and advice on what to do in certain situations (such as where to turn to if the neighbours are making a racket in the middle of the night) [RIA state portal information (2012)].

A personal, user-based environment has been created in the portal as a part of a complete redesign. The user can create documents, sign them digitally and send them to others for signing, send e-mails, order public sector information services and review the services the user has used most recently [RIA state portal information (2012)]. The redesign was completed in 26th of November 2011 [RIA (2011)].

The state portal can be used by individuals (G2C), entrepreneurs (G2B) and public sector agencies offering services (G2G) [RIA state portal information (2012)].

The e-services for the citizen were chosen for assessment. The state portal e-services for testing were Population registers five transactional e-services: "Submitting a notice of residence", "Justified request of an owner of residential rooms", "Ordering the entering of a vital statistics document", "Registering the birth of a child", "Ordering a repeat certificate", One of the transactional e-service "Submitting a notice of residence" is part of the benchmarking of the e-services in Europe called "Announcement of moving" [Capgemini (2007); Capgemini (2009); Capgemini (2011)]. The confidential information e-service tested was "Health Insurance and family physician".

5.1   E-GovQual quality model assessment results

The e-GovQual quality model assessment maximum score for eesti.ee is 90 points (e-GovQual overall maximum score 105 points), because of the publicly not available documents for assessment of the elements.

The assessment area highest percentage is "Trust" – 93,33% and lowest is "Efficiency" – 77,14% (see Table 2). Validity of the results can be argued as the citizen support and Trust have over 50% and 25% of N/A elements from overall criteria. Efficiency and reliability are valid results for comparing.

All the results for criteria can be found in appendices (see APPENDIX 3, State portal eesti.ee e-GovQual quality model assessment results).

Assessment area	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[3]	W[4]	M[5]	S[6]
Citizen Support	8	10	80,00%	2	0	1	1
Efficiency	27	35	77,14%	0	1	1	5
Reliability	27	30	90,00%	0	0	1	5
Trust	14	15	93,33%	1	0	0	3
Total	**76**	**90**	**84,44%**	**3**	**1**	**3**	**14**

Table 2. State portal Eesti.ee e-GovQual quality model assessment results for all criteria.

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[3] The count for not applicable criteria "N/A"
[4] The count for the weakest criteria (the two lowest scores) "W"
[5] The count for medium score "M"
[6] The count for the strongest criteria (the two highest scores) "S"

5.2 COBRAS quality model assessment results

The COBRAS assessment maximum score for eesti.ee is 441 points overall maximum score 441 points). Every quality criteria is assessed.

The assessment area highest percentage is "Cost" – 96,58% and lowest is "Risk" – 68,89% (see Table 3). All the results are valid for comparing, as there are no N/A criteria.

All the results for criteria can be found in appendices (see APPENDIX 4, State portal eesti.ee COBRAS quality model assessment results).

Assessment area	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[7]	W[8]	M[9]	S[10]
Benefit	112	162	69,14%	0	4	4	10
Cost	113	117	96,58%	0	0	1	12
Risk	31	45	68,89%	0	1	2	2
Opportunity	101	117	86,63%	0	1	2	10
Total	352	441	80,95%	0	6	9	34

Table 3. State portal Eesti.ee COBRAS quality model assessment results for all criteria.

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[7] The count for not applicable criteria "N/A"
[8] The count for the weakest criteria (the two lowest scores) "W"
[9] The count for medium score "M"
[10] The count for the strongest criteria (the two highest scores) "S"

5.3 Finnish Ministry of Finance quality model assessment results

5.3.1 All criteria assessment results

The maximum score of state portal is 548 points, because of the publicly not available documents for assessment of the elements or the elements are not applicable to state portal eesti.ee assessment, e.g. 4.1.10 element is about passwords and the state portal does not use passwords as an authentication mechanism. The Finnish quality model assessment score is 383 (69,89% of total). The assessment area highest percentage is "3. Leadership" – 79,17% and lowest is "5. Benefits" – 60,00% (see Table 4). Validity of the results can be argued as the leadership and production have over 30% of N/A elements from overall criteria elements. The information about the assessment area is not valid and should be assessed further in the future. Use and benefits have one element with N/A as there were no data available. Use has one element that is not applicable to Estonian context. Use and content can be studied further. Content has no N/A elements and the results are valid.

Assessment area	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A [11]	W [12]	M [13]	S [14]
1. Use	175	248	70,56%	2	11	13	38
2. Content	71	96	73,96%	0	4	4	16
3. Leadership	38	48	79,17%	13	2	1	9
4. Production	75	116	64,66%	15	6	8	15
5. Benefits	24	40	60,00%	1	3	2	5
Total	**383**	**548**	**69,89%**	**31**	**26**	**28**	**83**

Table 4. State portal Eesti.ee Finnish quality model assessment results for all criteria.

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[11] The count for not applicable criteria elements "N/A"
[12] The count for the weakest criteria (the two lowest scores) "W"
[13] The count for medium score "M"
[14] The count for the strongest criteria (the two highest scores) "S"

All the results for criteria can be found in appendices (see APPENDIX 5, State portal eesti.ee Finnish quality model assessment results).

5.3.2   Essential criteria assessment results

The essential criteria maximum score could be 212 points, because of the publicly not available documents for assessment. The actual assessment score is 147 (69,34% of Total). The assessment area highest percentage is "1. Use" – 70,65% and lowest is "5. Benefits" – 66,67% (see Table 5). Validity of the results can be argued as the leadership and production have over 30% of N/A elements from overall criteria. The information about the assessment area is not valid and should be assessed further in the future. Use, content and benefits have no N/A elements and the results are valid.

All the results for essential criteria can be found in appendices (see APPENDIX 6, State portal eesti.ee Finnish quality model assessment results for essential criteria).

Assessment area	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A [15]	W [16]	M [17]	S [18]
1. Use	65,00	92,00	70,65%	0	2	8	13
2. Content	36,00	52,00	69,23%	0	3	1	9
3. Leadership	8,00	12,00	66,67%	8	1	0	2
4. Production	22,00	32,00	68,75%	4	0	4	4
5. Benefits	16,00	24,00	66,67%	0	2	0	4
Total	**147,00**	**212,00**	**69,34%**	**12**	**8**	**13**	**32**

Table 5. State portal Eesti.ee Finnish quality model assessment results for essential criteria.

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[15] The count for not applicable criteria elements "N/A"
[16] The count for the weakest criteria elements (the two lowest scores) "W"
[17] The count for medium score criteria elements "M"
[18] The count for the strongest criteria elements (the two highest scores) "S"

6 PRACTICAL QUALITY ASSESSMENT – CLIENT PORTAL E-PRIA

E-PRIA https://epria.eesti.ee/epria/ is the client portal of the Agricultural Registers and Information Board, through which clients can submit documents to ARIB and check their details in ARIB's registers. The portal represents a convenient way for our clients to exchange information online. The portal can be used only in Estonian. The e-PRIA users are animal keepers and applicants for support. [PRIA (2012)]

The e-PRIA portal e-services for testing were "Taotleja kliendiandmete vaatamine ja muutmine" (in English "Applicant client data viewing and editing") and "Pindalatoetuste taotlus" (in English "Area-based support application"). For testing the informational part, PRIA's official information website for e-PRIA is used http://www.pria.ee/et/ePRIA [PRIA (2012].

6.1 E-GovQual quality model assessment results

The e-GovQual quality model assessment maximum score for e-PRIA is 90 points (e-GovQual overall maximum score 105 points), because of the publicly not available documents for assessment of the elements.

The assessment area highest percentage is "Trust" – 100,00% and lowest is "Efficiency" – 40,00% (see Table 6). Validity of the results can be argued as the citizen support and Trust have over 50% and 25% of N/A elements from overall criteria. Efficiency and reliability are valid results for comparing.

All the results for criteria can be found in appendices (see APPENDIX 7, e-PRIA e-GovQual quality model assessment results).

Assessment area	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[19]	W[20]	M[21]	S[22]
Citizen Support	10	10	100,00%	2	0	0	2
Efficiency	14	35	40,00%	0	5	1	1
Reliability	28	30	93,33%	0	0	1	5
Trust	11	15	73,33%	1	0	2	1
Total	**63**	**90**	**70,00%**	**3**	**5**	**4**	**9**

Table 6. e-PRIA e-GovQual quality model assessment results for all criteria.

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[19] The count for not applicable criteria "N/A"
[20] The count for the weakest criteria (the two lowest scores) "W"
[21] The count for medium score "M"
[22] The count for the strongest criteria (the two highest scores) "S"

6.2 COBRAS quality model assessment results

The COBRAS assessment maximum score for e-PRIA is 423 points overall maximum score 441 points), because e-PRIA does not include any payable e-services (two times mentioned).

The assessment area highest percentage is "Cost" – 89,74% and lowest is "Benefit" – 64,20% (see Table 7). Validity of the results can be argued as the Risk has over 40% of N/A elements from overall criteria. Benefit, cost and opportunity are valid results for comparing.

All the results for criteria can be found in appendices (see APPENDIX 8, e-PRIA COBRAS quality model assessment results).

Assessment area	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[23]	W[24]	M[25]	S[26]
Benefit	104	162	64,20%	0	5	5	8
Cost	105	117	89,74%	0	1	1	11
Risk	19	27	70,37%	2	0	2	1
Opportunity	93	117	79,49%	0	2	1	10
Total	321	423	75,89%	2	8	9	30

Table 7. e-PRIA COBRAS quality model assessment results for all criteria.

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[23] The count for not applicable criteria "N/A"
[24] The count for the weakest criteria (the two lowest scores) "W"
[25] The count for medium score "M"
[26] The count for the strongest criteria (the two highest scores) "S"

6.3 Finnish Ministry of Finance quality model assessment results

6.3.1 All criteria assessment results

The maximum score of e-PRIA is 532 points, because of the publicly not available documents for assessment of the elements or the elements are not applicable to client portal e-PRIA assessment, e.g. "1.12 The section of the web service subject to charges is clearly distinguished from the rest of the service" as there are no chargeable e-services in e-PRIA.

The Finnish model assessment score is 352 (66,17% of total). The assessment area highest percentage is "3. Leadership" – 75,00% and lowest is "5. Benefits" – 47,73% (see Table 8). Validity of the results can be argued as the leadership and production have over 30% of N/A elements from overall elements. The information about the assessment area is not valid and should be assessed further in the future. Use has five N/A elements, as there were no data available (1), not applicable to Estonian context (1)" as there are no chargeable e-services in e-PRIA (3). Overall result for use can be used. Benefits and content have no N/A elements and the results are valid.

Assessment area	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[27]	W[28]	M[29]	S[30]
1. Use	168	236	71,19%	5	7	17	35
2. Content	54	96	56,25%	0	10	3	11
3. Leadership	30	40	75,00%	15	1	2	7
4. Production	79	116	68,10%	15	6	5	18
5. Benefits	21	44	47,73%	0	4	3	4
Total	**352**	**532**	**66,17%**	**35**	**28**	**30**	**75**

Table 8. e-PRIA Finnish quality model assessment results for all criteria.

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[27] The count for not applicable criteria elements "N/A"
[28] The count for the weakest criteria (the two lowest scores) "W"
[29] The count for medium score "M"
[30] The count for the strongest criteria (the two highest scores) "S"

All the results for criteria can be found in appendices (see APPENDIX 9, e-PRIA Finnish quality model assessment results).

6.3.2 Essential criteria assessment results

The essential criteria maximum score could be 212 points, because of the publicly not available documents for assessment. The actual assessment score is 135 (63,68% of Total). The assessment area highest percentage is "1. Use" – 68,48% and lowest is "5. Benefits" – 54,17% (see Table 5). Validity of the results can be argued as the leadership and production have over 30% of N/A elements from overall elements. The information about the assessment area is not valid and should be assessed further in the future. Use, benefits and content have no N/A elements and the results are valid.

All the results for essential criteria can be found in appendices (see APPENDIX 10, e-PRIA Finnish quality model assessment results for essential criteria).

Assessment area	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[31]	W[32]	M[33]	S[34]
1. Use	63,00	92,00	68,48%	0	2	8	13
2. Content	31,00	52,00	59,62%	0	4	3	6
3. Leadership	8,00	12,00	66,67%	8	1	0	2
4. Production	20,00	32,00	62,50%	4	2	1	5
5. Benefits	13,00	24,00	54,17%	0	2	1	3
Total	**135,00**	**212,00**	**63,68%**	**12**	**11**	**13**	**29**

Table 9. e-PRIA Finnish quality model assessment results for essential criteria.

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[31] The count for not applicable criteria elements "N/A"
[32] The count for the weakest criteria (the two lowest scores) "W"
[33] The count for medium score "M"
[34] The count for the strongest criteria (the two highest scores) "S"

7   SUMMARY OF PRACTICAL ASSESSMENT RESULTS

Comparing the practical assessment results between state portal eesti.ee and client portal e-PRIA in self-assessment way are not 100% comprehensive for benchmarking. It is not possible to make concrete conclusions from the practical assessment results. The assessment results are an indication to the organizations, which assessment areas for the system under test are weaker and which are stronger. The assessment results show that there is a need for thorough assessment in the technical and process performance part of the quality layers. The self-assessment could be executed by the organizations with experts included but not by outside experts alone.

E-GovQual, COBRAS and Finnish Ministry of Finance quality assessment models' results for the state portal eesti.ee and the client portal e-PRIA indicate that the user-centric e-Government approach in both portals is above average score. E-PRIA showed only in e-GovQual efficiency assessment area (40%) below average score.

The e-GovQual and COBRAS quality model are not mature. The models need more explanations for the criteria, dividing the criteria to more detail like in Finnish Ministry of Finance quality assessment model. COBRAS and e-GovQual quality assessment models should have concrete metrics in place. The Finnish Ministry of Finance quality assessment model should have the metrics explained more in detail. All the models should have maturity levels for the site to be assessed, for benchmarking purposes. The maturity levels should take into account the non-applicable criteria.

The e-GovQual and COBRAS quality assessment models are interconnected with Finnish Ministry of Finance quality assessment model. The interconnection means that the e-GovQual and COBRAS quality criterion is similar to one or many Finnish quality model's assessment area and/or criteria and/or element. The COBRAS model's criteria are connected to Finnish quality model in 39 criteria out of 49. The e-GovQual model's criteria are connected to Finnish quality model in 19 criteria out of 21. The e-GovQual model's criteria are connected to COBRAS quality model in 9 criteria out of 21. The interconnections should be assessed further in the future studies.

The tools created for Estonian e-Government practical assessment can be used for other assessments but the tools have constraints, e.g. are not fully automated for results handling.

The e-GovQual and COBRAS quality assessment models cannot be implemented in full extent in Estonia. The e-GovQual and COBRAS quality model's assessment can be executed in full extent as external expert, not knowing the organization's internal processes. The focus is on site quality. These models could be used before, during and after implementing the e-Government e-services.

Finnish Ministry of Finance quality assessment model cannot be implemented in full extent in Estonia. There are quality criteria and elements that refer to Finnish legislation or Finnish e-Government service guidelines or Finnish key enablers of e-Government (e.g. VETUMA authentication) or other Finnish guidelines applicable to the criteria elements.

7.1   E-GovQual – findings

The state portal eesti.ee and the client portal e-PRIA citizen support and trust assessment area cannot be compared because there were not applicable criteria (marked with red, see Table 10). The efficiency and reliability can be compared (marked as green, see Table 10). The indicative scores show that eesti.ee is more user-centric in efficiency assessment area than e-PRIA and in reliability shows that both are almost equal.

Assessment area	Eesti.ee points	Eesti.ee maximum points	% of eesti.ee maximum	e-PRIA points	e-PRIA maximum points	% of e-PRIA maximum
Citizen Support	8	10	80,00%	10	10	100,00%
Efficiency	27	35	77,14%	14	35	40,00%
Reliability	27	30	90,00%	28	30	93,33%
Trust	14	15	93,33%	11	15	73,33%
Total	**76**	**90**	**84,44%**	**63**	**90**	**70,00%**

Table 10 e-GovQual model results' comparison of eesti.ee and e-PRIA

7.2   COBRAS – findings

The COBRAS model proposes risk assessment area criteria for chargeable e-services. As e-PRIA does not have any chargeable services, the risk assessment area cannot be compared to eesti.ee (marked with red, see Table 11). The benefit, cost and opportunity can be compared (marked as green, see Table 11). The indicative scores show that slightly eesti.ee is more user-centric than e-PRIA.

Assessment area	Eesti.ee points	Eesti.ee maximum points	% of eesti.ee maximum	e-PRIA points	e-PRIA maximum points	% of e-PRIA maximum
Benefit	**112**	162	69,14%	104	162	64,20%
Cost	**113**	117	96,58%	105	117	89,74%
Risk	**31**	45	68,89%	19	27	70,37%
Opportunity	**101**	117	86,63%	93	117	79,49%
Total	**352**	**441**	**80,95%**	**321**	**423**	**75,89%**

Table 11. COBRAS model results' comparison of eesti.ee and e-PRIA

7.3   Finnish Ministry of Finance quality assessment model - findings

Finnish Ministry of Finance quality model assessment cannot be executed in full extent as external expert, not knowing the organization's internal processes.

The first, second and fifth quality assessment areas, "Use", "Content" and "Benefits", could be executed by external expert but there is needed some information, that must be publicly available. The data about maintenance times, performance, technical environment, help instructions must be published at least. The third and fourth quality assessment areas, "Leadership" and "Production", have 13 and 15 not applicable elements in state portal eesti.ee (see Table 4) and both 15 not applicable elements in client portal e-PRIA assessment results (see Table 8). Full assessment can be executed only knowing additional information and data, which could be publicly available or confidential.

There is a need for additional documents for "Leadership" assessment area: organization's strategy (including vision, mission and goals), working (operational) plans, e-Government service strategy, e-Government service quality goals, budget for e-Government service development, marketing strategy for external and internal people, marketing operational plan,

job descriptions for e-Government responsibilities – marketing, personnel training plans and contingency (crisis) plans for e-Government services.

There is a need for additional documents for "Production" assessment area: organization's e-Government service processes and integration with information systems, operational plan for maintenance, project plans for development, usability guidelines and assessment results, accessibility guidelines and assessment results, statistics gathering plans and procedures and logs, content administration procedures, technical maintenance procedures, continuity plans, project management procedures, performance test results, content management system documentation, system documentation, security procedures, security training plans for personnel, monitoring procedures, backup procedure and service support procedures.

Essential criteria's assessment areas use, content and benefits can be compared, as the results are valid and the maximum points are the same (marked with green, see Table 12). Leadership and production cannot be compared (marked with red, see Table 12). The comparison table (see Table 12) indicates that eesti.ee has a slight advantage in the quality but as the differences are marginal, it cannot be concluded that one has more quality than other. The results cannot be used as a benchmark for user-centric e-Government service. The information of weaknesses can be useful for improving the portals and strengthen the provided e-services.

Assessment area	Eesti.ee points	e-PRIA points	Maximum points	% of eesti.ee maximum	% of e-PRIA maximum
1. Use	65,00	63,00	92,00	70,65%	68,48%
2. Content	36,00	31,00	52,00	69,23%	59,62%
3. Leadership	8,00	8,00	12,00	66,67%	66,67%
4. Production	22,00	20,00	32,00	68,75%	62,50%
5. Benefits	16,00	13,00	24,00	66,67%	54,17%
Total	147,00	135,00	212,00	69,34%	63,68%

Table 12. Finnish quality model results' comparison of eesti.ee and e-PRIA

8 CONCLUSION AND SUGGESTIONS

To conclude the thesis, we first go back to the questions posed at the start of the study and we provide answers to each question based on the insights gained from the study. Next we provide some suggestions and directions for the development of an Estonian e-Government sector.

8.1 Recap

What is e-Government quality and e-service quality?

The e-Government service quality definition can be combined with e-service quality definition as the extent to which government website facilitates efficient and effective delivery of public services. Efficiency and effectiveness can be measured through quality assessment and benchmarking.

The theoretical and practical study shows that there is a high need to emphasise on user-centric e-Government and its quality. The thinking model for the governmental organizations needs to change from governmental to user-centric e-services. The shift is on-going and European Union high-level organizations have started to develop and benchmark for user-centric e-Government.

Why measure e-Government and its quality?

Numerous research studies have argued and put forward evidence that the quality of e-Government services has a direct relationship to user (citizen) satisfaction. The measurement of e-Government service quality is a basic instrument to proactively manage these services in order to ensure that they satisfy citizens' need for efficient and effective public services. Additionally, there is a need to compare and benchmark the e-Government service quality and maturity between countries, to provide information to European Union legislative organizations and to the countries themselves.

What are the e-Government services quality assessment frameworks (models) and could these be implemented in Estonia?

The practical assessment showed that e-GovQual and COBRAS e-Government quality assessment models are less mature and comprehensive than the Finnish Ministry of Finance quality assessment model. All the models emphasise the user-centric e-Government quality needs. The Finnish Ministry of Finance quality assessment model is adjusted to Finland e-Government needs – legislation and guidelines; it needs some modifications to be implemented in other countries. The e-Government quality models e-GovQual and COBRAS can be used more widely and with few modifications. But every country has its own legislation and guidelines, so the quality models should be developed for the special needs of the countries. All of the practically tested e-Government quality models: e-GovQual, COBRAS and the Finnish Ministry of Finance quality assessment model should be studied further in detail and are a good starting point for developing Estonian e-Government quality assessment model.

Estonia has fulfilled all the criteria for the e-Government back-office key enablers (e.g. ID-card) now it is time to emphasize more on the front-office and the user-centric view of e-Government. The new version of Estonian state portal eesti.ee and client portal e-PRIA are an example of user-centric e-Government services but the quality should be raised. The Estonian e-Government service quality model for assessing user-centric e-Government services is needed and should be developed.

How to assess and measure the quality of e-Government and e-services?

Firstly, it is important to start with the questions, which e-Government service quality assessment area should be assessed – benefits, cost etc.; and what is the purpose for the assessment – self-assessment or benchmarking with other e-Government services. Secondly, the quality measurement process for e-Government services follows: choose an e-Government service quality assessment model, study the model and prepare all the needed publicly and non-publicly available data, prepare the needed tools for the assessment, execute the assessment, collect and analyse the assessment results. If possible, compare the results with other assessments' results.

The chosen e-Government quality assessment model should be comprehensive throughout the e-Government service lifecycle – before, during and after development (in operation); and through all the quality assessment layers – process performance, technical performance, site quality and user satisfaction. The quality model should also be mature and up-do-date.

8.2 Suggestions for Estonian e-Government quality model development

Estonia should develop and implement e-Government quality model for Estonian purposes. The Estonian quality model should take into account the European Union e-Government policies and guidelines, the European eGovernment Action Plan 2011-2015 [European Commission (2010)], the European Interoperability Framework [European Commission (2004)], the Common Assessment Framework [CAF (2006)] and European e-Government benchmarking methods [Capgemini (2010)].

The Estonian e-Government quality assessment model should have connections to the Estonian interoperability framework [(MKM, RISO (2011)] and all the specific documents (e.g. Framework for websites [(MKM, RISO (2012)]), Estonian security standard ISKE [RIA (2012)]. The usability guidelines [Trinidad Consulting (2009)] include some criteria from Finnish Ministry of Finance quality assessment model and are a good starting point for Estonian quality assessment model criteria for usability. There is a wide range of practical e-Government quality assessment models (e.g. COBRAS, e-GovQual etc.) to be considered and studied further.

The quality model development process steps should be conceptualization, design and normalization [Papadomichelaki X., Mentzas G. (2011); Aladwani, A. M., Palvia, P. C. (2002)]. "In the first step a model is conceptualized after an extensive literature survey. The second step focuses on construct validity and reliability analysis. In this step the refining of the sample of items takes place—in order to come up with an initial scale—deciding on such operational issues as question types and question sequence. The third and last step concerns the effort to normalize the scale that has been developed. It involves the important steps of subsequent independent verification and validation." [Papadomichelaki X., Mentzas G. (2011)]

Dealing with other languages of quality assessment models, than the mother language, it is possible to misunderstand the criteria and guidelines, especially, if the framework is translated from other language, like the Finnish quality assessment model is translated to English [Koskenniemi, H., Saastamoinen, M., Eerola, P. (2008)]. There must be an official quality framework in local language and if necessary, official translation to other EU languages, e.g. English. These translations should be kept up-to-date.

Given the breadth of aspects encompassed by e-service quality, the development of a quality assessment model ought to be driven by a working group with members from different specialties: governmental and financial specialists, scholars, representatives from information technology and communications unions, e-Government specialists, quality managers, auditors, information technology specialists in the field of usability, security and quality assurance.

The Estonian e-Government quality assessment model and all the related information should be published in one certain website or portal. It could be RISO or RIA or state portal eesti.ee thematic webpage or RIHA. The concerning documents should be formally published and get an International Standard Serial Number (ISSN) or International Standard Book Number (ISBN) or similar standards' publication numbers (e.g. Finnish government has published their quality model formally with ISSN and ISBN [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]).

The Estonian quality assessment model should be kept up-to-date with new emerging technologies, hardware and concepts, as the "GOV 2.0" [Capgemini (2009)] and Government 2.0 [Capgemini 2010] emerges. The new hardware includes smartphones, tablets etc. The new web-based technologies (e.g. HTML5, CSS3, etc.) technologies should be considered. The concepts, like social networks, Government 2.0, user-centric e-services, should be considered in the development process [Capgemini 2010].

The Estonian e-Government quality assessment model should have the essential criteria (e.g. Finnish quality model [Lehtimäki H., Alho O., Vainio A., Huhta E. (2012)]) and also full assessment available with public documents. If there are quality criteria that cannot be assessed by public documents it should be mentioned. The essential criteria should include only publicly available information.

European Union benchmarking should be a top priority for e-services to be assessed. There are 20 e-services to be assessed by European Union [Capgemini (2010)]. The assessment results should be publicly available.

There should be more user-surveys focused on user-centric e-Government service development and user-satisfaction. These surveys must be regular and inter-connected to the quality assessment model. The regularity of the assessed e-service portals eesti.ee [Turu-uuringute AS (2009); TNS Emor (2010)] and e-PRIA [Faktum & Ariko (2008), Turu-uuringute AS (2010);] is good but the regularity cannot be assessed because there is no working plan activities for user satisfaction surveys. The user satisfaction surveys should be part of the quality model or inter-connected to the Estonian e-Government quality assessment model.

KOKKUVÕTE

"E-Valitsuse teenuste kvaliteedi hindamine"

Magistritöö (30 EAP)

Hannes Lehemets

Magistritöö esimeseks eesmärgiks oli uurida teoreetilist tausta, mis on seotud e-Valitsuse teenuste kvaliteedi hindamisega. Uuringud näitavad ja kinnitavad, et Euroopa Liit ja kogu maailm on liikumas kasutajakeskse e-Valitsuse teenuste paradigma suunas. E-Valitsuse teenuse ja selle kvaliteedi mõiste on erinevate organisatsioonides semantiliselt erinev, kuid lõppeesmärk jääb samaks, pakkuda veebis kodanikule tõhusaid ja tulemuslikke avaliku sektori teenuseid. E-Valitsuse teenuste kvaliteeti on võimalik hinnata neljal erineval tasandil: protsessi võimekuse, tehnilise võimekuse, veebi kasutatavuse ja kasutaja rahulolu tasandil. Erinevaid mudeleid on mitmeid, sealhulgas käesoleva magistriöö praktiliseks hindamiseks valitud e-GovQual, COBRAS ja Soome Rahandusministeeriumi kvaliteedi hindamise mudelid. Valitud kvaliteedi hindamise mudelid keskenduvad kasutajakeskse e-Valitsuse teenuste hindamisele ning on suunatud kasutaja rahuolu saavutamiseks e-teenuste kasutamisel. Need mudelid sisaldavad erinevaid kvaliteedi hindamise valdkondi nagu näiteks kasutatavus, sisu, maksumus ja võimalused.

Magistritöö teiseks eesmärgiks oli hinnata praktiliselt kolme kvaliteedi hindamise mudelit e-GovQual, COBRAS ja Soome Rahandusministeeriumi mudelit kahel erineval Eesti e-Valitsuse teenuste portaalil eesti.ee ning Põllumajanduse Registrite ja Informatsiooni Ameti kliendiportaalil e-PRIA. Hindamise tulemusel selgus, et ühtegi valitud mudelit pole võimalik üks-üheselt Eesti Vabariigis kasutusele võtta ja need vajavad kohandamist Eesti oludele. E-GovQual ja COBRAS on üldisemad ja keskenduvad kasutajakeskse veebilehekülje hindamise tasandile, samas kui Soome kvaliteedimudel on täiuslikum ning hindab nii protsesse, tehnilist poolt kui ka veebi kvaliteedi tasandit. Magistriöö annab soovitusi edaspidisteks uuringuteks, kuidas välja töötada Eesti e-Valitsuse teenuste kvaliteedi hindamise mudel.

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APPENDICES

APPENDIX 1, Interconnections between e-GovQual to COBRAS and Finnish quality model

Assessment area	ID	Criteria	Connection to Finnish model elements	Connection to COBRAS criteria
Efficiency	**EGQ-E1**	This e-government site's structure is clear and easy to follow.	2.1.1-2.1.4	n/a
Efficiency	**EGQ-E2**	This e-government site's search engine is effective.	1.7.4 Additional question 1	C-C10
Efficiency	**EGQ-E3**	This e-government site's site map is well organized.	n/a	n/a
Efficiency	**EGQ-E4**	This e-government site is well customized to individual users' needs.	4.2.3	n/a
Efficiency	**EGQ-E5**	The information displayed in this e-government site is appropriate detailed.	2.3.1-2.3.6	C-B8, C-B10, C-B12, CB-13
Efficiency	**EGQ-E6**	The information displayed in this e-government site is fresh.	1.8.4, 2.2.4	C-B16

Assessment area	ID	Criteria	Connection to Finnish model elements	Connection to COBRAS criteria
Efficiency	**EGQ-E7**	Information about field's completion in this e-government site is enough.	1.11.4	n/a
Trust	**EGQ-T1**	Acquisition of username and password in this e-government site is secure.	4.10.2	n/a
Trust	**EGQ-T2**	Only necessary personal data are provided for authentication on this e-government site.	1.5.3	C-R1
Trust	**EGQ-T3**	Data provided by users in this e-government site are archived securely.	4.4.4	n/a
Trust	**EGQ-T4**	Data provided in this e-government site are used only for the reason submitted.	4.9.1	C-R4
Reliability	**EGQ-R1**	Forms in this e-government site are downloaded in short time.	1.6.3	C-C11
Reliability	**EGQ-R2**	This e-government site is available and accessible whenever you need it.	1.4.1-1.4.2, 5.4.1	C-O4, C-O5
Reliability	**EGQ-R3**	This e-government site performs the service successfully upon first request.	4.6.2	C-C12

Assessment area	ID	Criteria	Connection to Finnish model elements	Connection to COBRAS criteria
Reliability	**EGQ-R4**	This e-government site provides services in time.	4.6.3 Additional question 3	n/a
Reliability	**EGQ-R5**	E-government site's pages are downloaded quickly enough.	1.6.1	n/a
Reliability	**EGQ-R6**	This e-government site works properly with your default browser.	1.3.1 Additional question 1	C-B6
Citizen Support	**EQG-CS1**	Employees showed a sincere interest in solving users' problem.	n/a	n/a
Citizen Support	**EQG-CS2**	Employees give prompt replies to users' inquiries.	5.3.2	n/a
Citizen Support	**EQG-CS3**	Employees have the knowledge to answer users' questions.	3.4.4	n/a
Citizen Support	**EQG-CS4**	Employees have the ability to convey trust and confidence.	4.9.4	n/a

Table 13. Interconnections between e-GovQual to COBRAS and Finnish quality model

APPENDIX 2, Interconnections between COBRAS and Finnish Ministry of Finance quality model

Assessment area	ID	Criteria	Connection to Finnish model elements
Benefit	C-B1	The e-service is easy to find	1.1.1-1.1.5
Benefit	C-B2	The e-service is easy to navigate	1.7.3
Benefit	C-B3	The description of each link is provided	1.8.1
Benefit	C-B4	The e-service information is easy to read	2.4.3
Benefit	C-B5	The e-service is accomplished quickly	1.6.3
Benefit	C-B6	The e-service requires no technical knowledge	1.3.1-1.3.5
Benefit	C-B7	The instructions are easy to understand	1.10.5
Benefit	C-B8	The e-service information is well organized	2.3.1
Benefit	C-B9	The drop-down menu facilitates completion of the e-service	1.11.1 Additional question 3

Assessment area	ID	Criteria	Connection to Finnish model elements
Benefit	C-B10	New updates on the e-service are highlighted	2.3.2
Benefit	C-B11	The requested information is uploaded quickly	1.6.3
Benefit	C-B12	The information is relevant to my service	2.3.3
Benefit	C-B13	The e-service information covers a wide range of topics	2.3.2
Benefit	C-B14	The e-service information is accurate	2.2.1
Benefit	C-B15	The e-service operations are well integrated	2.5.3
Benefit	C-B16	The e-service information is up-to-date	1.8.4, 2.2.4
Benefit	C-B17	The instructions on performing e-service are helpful	1.10.4
Benefit	C-B18	The referral links provided are useful	n/a
Opportunity	C-O1	The Frequently Asked Questions (FAQs) are relevant	1.10.6 Addtionial question 1

Assessment area	ID	Criteria	Connection to Finnish model elements
Opportunity	C-O2	The provided multimedia services facilitate contact with e-service staff	2.5.1 Additional question 3
Opportunity	C-O3	I can share my experiences with other e-service users	5.4.2
Opportunity	C-O4	The e-service can be accessed at any time	1.4.1-1.4.2
Opportunity	C-O5	The e-service can be reached from anywhere	5.4.1
Opportunity	C-O6	The information needed for using the e-service is accessible	1.14.4, 1.10.2 Addtional question 3
Opportunity	C-O7	The e-service points me to the place of errors, if any, during a transaction	1.11.2 Addtional question 1
Opportunity	C-O8	The e-service allows me to update my records online	2.5.4
Opportunity	C-O9	The e-service can be completed incrementally (at different times)	1.11.2 Addtional question 2
Opportunity	C-O10	The e-service offers tools for users with special needs (touch screen)	1.14.4

Assessment area	ID	Criteria	Connection to Finnish model elements
Opportunity	C-O11	The information is provided in different languages	1.2.1-1.2.5
Opportunity	C-O12	The e-service provides a summary report	2.5.5 Addtional question 1
Opportunity	C-O13	There is a strong incentive for using e-service	5.4.3
Cost	C-C1	Using the e-service saved me time	n/a
Cost	C-C2	Using the e-service saved me money	n/a
Cost	C-C3	The e-service removes any potential under table cost to get the service	n/a
Cost	C-C4	The e-service reduces the bureaucratic process	5.3.1
Cost	C-C5	The password and renewal costs of e-service are reasonable	n/a
Cost	C-C6	The internet subscription cost is reasonable	n/a
Cost	C-C7	The e-service reduces my travel costs to get the service	n/a

Assessment area	ID	Criteria	Connection to Finnish model elements
Cost	C-C8	It takes a long time to arrange access to the e-service	n/a
Cost	C-C9	It takes a long-time to upload the e-service homepage	1.6.1
Cost	C-C10	It takes a long-time to find my needed information	1.7.4
Cost	C-C11	It takes a long-time to download/ fill the e-service application	1.6.3
Cost	C-C12	It takes several attempts to complete the service due to system breakdowns	4.6.2
Cost	C-C13	It takes a long-time to acknowledge the completion of e-service.	2.5.5 Addtional question 2
Risk	C-R1	I am afraid my personal data may be used for other purposes	1.5.3
Risk	C-R2	E-service obliges me to keep a record of documents in case of future audit	n/a
Risk	C-R3	The e-service may lead to a wrong payment that needs further correction	1.12.2

Assessment area	ID	Criteria	Connection to Finnish model elements
Risk	C-R4	I worry about conducting transactions online requiring personal financial information	1.12.1, 4.9.1, 4.9.2
Risk	C-R5	Using e-service leads to fewer interactions with people	n/a

Table 14 Interconnections between COBRAS and Finnish Ministry of Finance quality model

APPENDIX 3, State portal eesti.ee e-GovQual quality model assessment results

Assessment area	ID	Criteria	Points	N/A[35]	W[36]	M[37]	S[38]
Citizen Support	EQG-CS1	Employees showed a sincere interest in solving users' problem.	5	0	0	0	1
Citizen Support	EQG-CS2	Employees give prompt replies to users' inquiries.	3	0	0	1	0
Citizen Support	EQG-CS3	Employees have the knowledge to answer users' questions.	0	1	0	0	0
Citizen Support	EQG-CS4	Employees have the ability to convey trust and confidence.	0	1	0	0	0
Efficiency	EGQ-E1	This e-government site's structure is clear and easy to follow.	5	0	0	0	1
Efficiency	EGQ-E2	This e-government site's search engine is effective.	5	0	0	0	1
Efficiency	EGQ-E3	This e-government site's site map is well organized.	5	0	0	0	1
Efficiency	EGQ-E4	This e-government site is well customized to individual users' needs.	3	0	0	1	0

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[35] The count for not applicable criteria "N/A"
[36] The count for the weakest criteria (the two lowest scores) "W"
[37] The count for medium score "M"
[38] The count for the strongest criteria (the two highest scores) "S"

Assessment area	ID	Criteria	Points	N/A[35]	W[36]	M[37]	S[38]
Efficiency	EGQ-E5	The information displayed in this e-government site is appropriate detailed.	4	0	0	0	1
Efficiency	EGQ-E6	The information displayed in this e-government site is fresh.	1	0	1	0	0
Efficiency	EGQ-E7	Information about field's completion in this e-government site is enough.	4	0	0	0	1
Reliability	EGQ-R1	Forms in this e-government site are downloaded in short time.	3	0	0	1	0
Reliability	EGQ-R2	This e-government site is available and accessible whenever you need it.	5	0	0	0	1
Reliability	EGQ-R3	This e-government site performs the service successfully upon first request.	5	0	0	0	1
Reliability	EGQ-R4	This e-government site provides services in time.	5	0	0	0	1
Reliability	EGQ-R5	E-government site's pages are downloaded quickly enough.	5	0	0	0	1
Reliability	EGQ-R6	This e-government site works properly with your default	4	0	0	0	1

Assessment area	ID	Criteria	Points	N/A[35]	W[36]	M[37]	S[38]
		browser.					
Trust	EGQ-T1	Acquisition of username and password in this e-government site is secure.	5	0	0	0	1
Trust	EGQ-T2	Only necessary personal data are provided for authentication on this e-government site.	4	0	0	0	1
Trust	EGQ-T3	Data provided by users in this e-government site are archived securely.	0	1	0	0	0
Trust	EGQ-T4	Data provided in this e-government site are used only for the reason submitted.	5	0	0	0	1
Total			**76**	**3**	**1**	**3**	**14**

Table 15 State portal eesti.ee e-GovQual quality model assessment results

APPENDIX 4, State portal eesti.ee COBRAS quality model assessment results

Assessment area	ID	Criteria	Points	N/A[39]	W[40]	M[41]	S[42]
Benefit	**C-B1**	The e-service is easy to find	7	0	0	0	1
Benefit	**C-B10**	New updates on the e-service are highlighted	3	0	1	0	0
Benefit	**C-B11**	The requested information is uploaded quickly	5	0	0	1	0
Benefit	**C-B12**	The information is relevant to my service	9	0	0	0	1
Benefit	**C-B13**	The e-service information covers a wide range of topics	3	0	1	0	0
Benefit	**C-B14**	The e-service information is accurate	5	0	0	1	0
Benefit	**C-B15**	The e-service operations are well integrated	9	0	0	0	1
Benefit	**C-B16**	The e-service information is up-to-date	3	0	1	0	0

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[39] The count for not applicable criteria "N/A"
[40] The count for the weakest criteria (the two lowest scores) "W"
[41] The count for medium score "M"
[42] The count for the strongest criteria (the two highest scores) "S"

Benefit	**C-B17**	The instructions on performing e-service are helpful	5	0	0	1	0
Benefit	**C-B18**	The referral links provided are useful	9	0	0	0	1
Benefit	**C-B2**	The e-service is easy to navigate	7	0	0	0	1
Benefit	**C-B3**	The description of each link is provided	3	0	1	0	0
Benefit	**C-B4**	The e-service information is easy to read	9	0	0	0	1
Benefit	**C-B5**	The e-service is accomplished quickly	5	0	0	1	0
Benefit	**C-B6**	The e-service requires no technical knowledge	7	0	0	0	1
Benefit	**C-B7**	The instructions are easy to understand	9	0	0	0	1
Benefit	**C-B8**	The e-service information is well organized	7	0	0	0	1
Benefit	**C-B9**	The drop-down menu facilitates completion of the e-service	7	0	0	0	1
Cost	**C-C1**	Using the e-service saved me time	9	0	0	0	1
Cost	**C-C10**	It takes a long-time to find my needed information	9	0	0	0	1
Cost	**C-C11**	It takes a long-time to download/ fill the e-service application	5	0	0	1	0

Cost	C-C12	It takes several attempts to complete the service due to system breakdowns	9	0	0	0	1
Cost	C-C13	It takes a long-time to acknowledge the completion of e-service.	9	0	0	0	1
Cost	C-C2	Using the e-service saved me money	9	0	0	0	1
Cost	C-C3	The e-service removes any potential under table cost to get the service	9	0	0	0	1
Cost	C-C4	The e-service reduces the bureaucratic process	9	0	0	0	1
Cost	C-C5	The password and renewal costs of e-service are reasonable	9	0	0	0	1
Cost	C-C6	The internet subscription cost is reasonable	9	0	0	0	1
Cost	C-C7	The e-service reduces my travel costs to get the service	9	0	0	0	1
Cost	C-C8	It takes a long time to arrange access to the e-service	9	0	0	0	1
Cost	C-C9	It takes a long-time to upload the e-service homepage	9	0	0	0	1
Risk	C-R1	I am afraid my personal data may be used for other purposes	9	0	0	0	1

Risk	**C-R2**	E-service obliges me to keep a record of documents in case of future audit	9	0	0	0	1
Risk	**C-R3**	The e-service may lead to a wrong payment that needs further correction	3	0	1	0	0
Risk	**C-R4**	I worry about conducting transactions online requiring personal financial information	5	0	0	1	0
Risk	**C-R5**	Using e-service leads to fewer interactions with people	5	0	0	1	0
Opportunity	**C-O1**	The Frequently Asked Questions (FAQs) are relevant	1	0	1	0	0
Opportunity	**C-O10**	The e-service offers tools for users with special needs (touch screen)	9	0	0	0	1
Opportunity	**C-O11**	The information is provided in different languages	9	0	0	0	1
Opportunity	**C-O12**	The e-service provides a summary report	9	0	0	0	1
Opportunity	**C-O13**	There is a strong incentive for using e-service	9	0	0	0	1
Opportunity	**C-O2**	The provided multimedia services facilitate contact with e-service staff	5	0	0	1	0

Opportunity	**C-O3**	I can share my experiences with other e-service users	5	0	0	1	0
Opportunity	**C-O4**	The e-service can be accessed at any time	9	0	0	0	1
Opportunity	**C-O5**	The e-service can be reached from anywhere	9	0	0	0	1
Opportunity	**C-O6**	The information needed for using the e-service is accessible	9	0	0	0	1
Opportunity	**C-O7**	The e-service points me to the place of errors, if any, during a transaction	9	0	0	0	1
Opportunity	**C-O8**	The e-service allows me to update my records online	9	0	0	0	1
Opportunity	**C-O9**	The e-service can be completed incrementally (at different times)	9	0	0	0	1
Total			**357**	**0**	**6**	**9**	**34**

Table 16 State portal eesti.ee COBRAS quality model assessment results

APPENDIX 5, State portal eesti.ee Finnish quality model assessment results

Criteria	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[43]	W[44]	M[45]	S[46]
1.1 The web service is easy to find	13	20	65,00%	0	1	1	3
1.2 The web service can be used appropriately in different languages.	16	16	100,00%	1	0	0	4
1.3 The web service can be used in a variety of technical environments.	17	20	85,00%	0	0	1	4
1.4 The web service is available throughout the day.	4	4	100,00%	1	0	0	1
1.5 Use feels secure and reliable.	15	16	93,75%	0	0	0	4
1.6 Use is fast and efficient.	14	20	70,00%	0	1	1	3
1.7 Navigating and finding information are easy.	21	28	75,00%	0	0	2	5

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[43] The count for not applicable criteria elements "N/A"
[44] The count for the weakest criteria (the two lowest scores) "W"
[45] The count for medium score "M"
[46] The count for the strongest criteria (the two highest scores) "S"

Criteria	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[43]	W[44]	M[45]	S[46]
1.8 Links are descriptive and functional.	7	16	43,75%	0	1	3	0
1.9 The user interface is clear, uniform and understandable.	5	12	41,67%	0	1	2	0
1.10 The user is provided with instructions and advice on the use of the web service.	17	28	60,71%	0	2	2	3
1.11 The web service prevents, tolerates and helps to correct errors.	14	24	58,33%	0	2	0	4
1.12 The section of the web service subject to charges is clearly distinguished from the rest of the service.	4	12	33,33%	0	2	1	0
1.13 Visual elements and sound are used appropriately.	13	16	81,25%	0	1	0	3
1.14 Layout and visual appearance are executed with an emphasis on communication and accessibility.	15	16	93,75%	0	0	0	4
2.1 The structure is organised appropriately.	15	16	93,75%	0	0	0	4
2.2 The content is trustworthy and up-to-date.	6	20	30,00%	0	3	1	1

Criteria	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[43]	W[44]	M[45]	S[46]
2.3 The content is comprehensive.	17	24	70,83%	0	1	2	3
2.4 The text content is easy to understand and legible.	15	16	93,75%	0	0	0	4
2.5 The web service provides the user with good service.	18	20	90,00%	0	0	1	4
3.1 The web service supports the organisation's strategy and goals.	4	8	50,00%	1	1	0	1
3.2 Applicable legislation is observed in the web service and its development.	0	0	N/A	3	0	0	0
3.3 A sound rationale has been provided for the decision to develop the web service.	8	8	100,00%	2	0	0	2
3.4 The web service has a management infrastructure.	4	4	100,00%	4	0	0	1
3.5 The benefits of co-operation have been utilised in development of the web service.	5	8	62,50%	0	1	0	1
3.6 Attention is given to communication and marketing of the web service.	13	16	81,25%	0	0	1	3
3.7 Exceptional situations have been taken into consideration.	4	4	100,00%	3	0	0	1

Criteria	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[43]	W[44]	M[45]	S[46]
4.1 The web service processes have been assessed and integrated with maintenance.	12	16	75,00%	1	1	0	3
4.2 User groups, users' needs and use situations have been taken into consideration.	4	8	50,00%	2	0	2	0
4.3 Usability and accessibility have been assessed and ensured.	5	16	31,25%	0	3	0	1
4.4 Use monitoring is systematic and results are taken into consideration in development.	3	8	37,50%	3	1	1	0
4.5 Content production is systematic.	8	12	66,67%	2	0	1	2
4.6 Technical maintenance is controlled	10	12	83,33%	0	0	1	2
4.7 The web service has been produced using an appropriate system.	8	12	66,67%	1	1	0	2
4.8 Data transfer and the server environment have been secured.	8	8	100,00%	4	0	0	2
4.9 The confidentiality and integrity of information has been ensured.	8	12	66,67%	1	0	2	1

Criteria	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A[43]	W[44]	M[45]	S[46]
4.10 User rights are managed.	9	12	75,00%	1	0	1	2
5.1 The web service is of benefit to the organisation.	7	12	58,33%	0	1	0	2
5.2 The web service is well known.	3	4	75,00%	1	0	0	1
5.3 The web service gives users the chance to exert their influence.	5	12	41,67%	0	1	2	0
5.4 The web service provides the user with added value.	9	12	75,00%	0	1	0	2
Total	**383**	**548**	**69,89%**	**31**	**26**	**28**	**83**

Table 17 State portal eesti.ee Finnish quality model assessment results

APPENDIX 6, State portal eesti.ee Finnish quality model assessment results for essential criteria

Assessment area and criteria	Points	Eesti.ee maximum points	% of eesti.ee maximum	N/A [47]	W [48]	M [49]	S [50]
1. Use	**17**	**20**	**85,00%**	**0**	**0**	**1**	**4**
1.3 The web service can be used in a variety of technical environments.	15	16	93,75%	0	0	0	4
1.5 Use feels secure and reliable.	21	28	75,00%	0	0	2	5
1.7 Navigating and finding information are easy.	7	16	43,75%	0	1	3	0
1.8 Links are descriptive and work properly.	5	12	41,67%	0	1	2	0
1.9 The user interface is clear, uniform and understandable.	65	92	70,65%	0	2	8	13
2. Content	**15**	**16**	**93,75%**	**0**	**0**	**0**	**4**
2.1 The structure is organized appropriately.	6	20	30,00%	0	3	1	1

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[47] The count for not applicable criteria elements "N/A"
[48] The count for the weakest criteria (the two lowest scores) "W"
[49] The count for medium score "M"
[50] The count for the strongest criteria (the two highest scores) "S"

2.2 The content is trustworthy and up-to-date.	15	16	93,75%	0	0	0	4
2.4 The text content is easy to understand and legible.	36	52	69,23%	0	3	1	9
3. Management	**4**	**8**	**50,00%**	**1**	**1**	**0**	**1**
3.1 Applicable legislation is observed in the web service and its development.	0	0	N/A	3	0	0	0
3.2 The web service supports the organization's strategy and goals.	4	4	100,00%	4	0	0	1
3.4 The web service has a management infrastructure.	8	12	66,67%	8	1	0	2
4. Production	**4**	**8**	**50,00%**	**2**	**0**	**2**	**0**
4.2 User groups, users' needs and use situations have been taken into consideration.	8	12	66,67%	2	0	1	2
4.5 Content production is systematic.	10	12	83,33%	0	0	1	2
4.6 Technical maintenance is controlled.	22	32	68,75%	4	0	4	4
5. Benefits	**7**	**12**	**58,33%**	**0**	**1**	**0**	**2**
5.1 The web service is of benefit to the organization.	9	12	75,00%	0	1	0	2

5.4 The web service provides the user with added value.	16	24	0	2	0	4
Total	**147**	**212**	**12**	**8**	**13**	**32**

Table 18. State portal eesti.ee Finnish quality model assessment results for essential criteria

APPENDIX 7, e-PRIA e-GovQual quality model assessment results

Assessment area	ID	Criteria	Points	N/A[51]	W[52]	M[53]	S[54]
Citizen Support	EQG-CS1	Employees showed a sincere interest in solving users' problem.	5	0	0	1	0
Citizen Support	EQG-CS2	Employees give prompt replies to users' inquiries.	5	0	0	1	0
Citizen Support	EQG-CS3	Employees have the knowledge to answer users' questions.	0	0	0	0	0
Citizen Support	EQG-CS4	Employees have the ability to convey trust and confidence.	0	0	0	0	0
Efficiency	EGQ-E1	This e-government site's structure is clear and easy to follow.	3	0	1	0	0
Efficiency	EGQ-E2	This e-government site's search engine is effective.	2	1	0	0	1
Efficiency	EGQ-E3	This e-government site's site map is well organized.	1	1	0	0	1
Efficiency	EGQ-E4	This e-government site is well customized to individual users'	1	1	0	0	1

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[51] The count for not applicable criteria "N/A"
[52] The count for the weakest criteria (the two lowest scores) "W"
[53] The count for medium score "M"
[54] The count for the strongest criteria (the two highest scores) "S"

Assessment area	ID	Criteria	Points	N/A[51]	W[52]	M[53]	S[54]
		needs.					
Efficiency	EGQ-E5	The information displayed in this e-government site is appropriate detailed.	2	1	0	0	1
Efficiency	EGQ-E6	The information displayed in this e-government site is fresh.	1	1	0	0	1
Efficiency	EGQ-E7	Information about field's completion in this e-government site is enough.	4	0	0	1	0
Reliability	EGQ-R1	Forms in this e-government site are downloaded in short time.	5	0	0	1	0
Reliability	EGQ-R2	This e-government site is available and accessible whenever you need it.	5	0	0	1	0
Reliability	EGQ-R3	This e-government site performs the service successfully upon first request.	5	0	0	1	0
Reliability	EGQ-R4	This e-government site provides services in time.	5	0	0	1	0
Reliability	EGQ-R5	E-government site's pages are downloaded quickly enough.	5	0	0	1	0

Assessment area	ID	Criteria	Points	N/A[51]	W[52]	M[53]	S[54]
Reliability	EGQ-R6	This e-government site works properly with your default browser.	3	0	1	0	0
Trust	EGQ-T1	Acquisition of username and password in this e-government site is secure.	5	0	0	1	0
Trust	EGQ-T2	Only necessary personal data are provided for authentication on this e-government site.	3	0	1	0	0
Trust	EGQ-T3	Data provided by users in this e-government site are archived securely.	0	0	0	0	0
Trust	EGQ-T4	Data provided in this e-government site are used only for the reason submitted.	3	0	1	0	0
Total			**63**	**5**	**4**	**9**	**5**

Table 19. e-PRIA e-GovQual quality model assessment results

APPENDIX 8, e-PRIA COBRAS quality model assessment results

Assessment area	ID	Criteria	Points	N/A[55]	W[56]	M[57]	S[58]
Benefit	**C-B1**	The e-service is easy to find	5	0	0	1	0
Benefit	**C-B10**	New updates on the e-service are highlighted	3	0	1	0	0
Benefit	**C-B11**	The requested information is uploaded quickly	9	0	0	0	1
Benefit	**C-B12**	The information is relevant to my service	3	0	1	0	0
Benefit	**C-B13**	The e-service information covers a wide range of topics	3	0	1	0	0
Benefit	**C-B14**	The e-service information is accurate	5	0	0	1	0
Benefit	**C-B15**	The e-service operations are well integrated	9	0	0	0	1
Benefit	**C-B16**	The e-service information is up-to-date	5	0	0	1	0

[55] The count for not applicable criteria "N/A"
[56] The count for the weakest criteria (the two lowest scores) "W"
[57] The count for medium score "M"
[58] The count for the strongest criteria (the two highest scores) "S"

Benefit	**C-B17**	The instructions on performing e-service are helpful	9	0	0	0	1
Benefit	**C-B18**	The referral links provided are useful	5	0	0	1	0
Benefit	**C-B2**	The e-service is easy to navigate	3	0	1	0	0
Benefit	**C-B3**	The description of each link is provided	7	0	0	0	1
Benefit	**C-B4**	The e-service information is easy to read	7	0	0	0	1
Benefit	**C-B5**	The e-service is accomplished quickly	9	0	0	0	1
Benefit	**C-B6**	The e-service requires no technical knowledge	7	0	0	0	1
Benefit	**C-B7**	The instructions are easy to understand	5	0	0	1	0
Benefit	**C-B8**	The e-service information is well organized	1	0	1	0	0
Benefit	**C-B9**	The drop-down menu facilitates completion of the e-service	9	0	0	0	1
Cost	**C-C1**	Using the e-service saved me time	9	0	0	0	1
Cost	**C-C10**	It takes a long-time to find my needed information	3	0	1	0	0
Cost	**C-C11**	It takes a long-time to download/ fill the e-service application	9	0	0	0	1

Cost	C-C12	It takes several attempts to complete the service due to system breakdowns	9	0	0	0	1
Cost	C-C13	It takes a long-time to acknowledge the completion of e-service.	9	0	0	0	1
Cost	C-C2	Using the e-service saved me money	9	0	0	0	1
Cost	C-C3	The e-service removes any potential under table cost to get the service	9	0	0	0	1
Cost	C-C4	The e-service reduces the bureaucratic process	5	0	0	1	0
Cost	C-C5	The password and renewal costs of e-service are reasonable	9	0	0	0	1
Cost	C-C6	The internet subscription cost is reasonable	9	0	0	0	1
Cost	C-C7	The e-service reduces my travel costs to get the service	9	0	0	0	1
Cost	C-C8	It takes a long time to arrange access to the e-service	9	0	0	0	1
Cost	C-C9	It takes a long-time to upload the e-service homepage	7	0	0	0	1
Risk	C-R1	I am afraid my personal data may be used for other purposes	5	0	0	1	0

Risk	**C-R2**	E-service obliges me to keep a record of documents in case of future audit	9	0	0	0	1
Risk	**C-R3**	The e-service may lead to a wrong payment that needs further correction	0	1	0	0	0
Risk	**C-R4**	I worry about conducting transactions online requiring personal financial information	0	1	0	0	0
Risk	**C-R5**	Using e-service leads to fewer interactions with people	5	0	0	1	0
Opportunity	**C-O1**	The Frequently Asked Questions (FAQs) are relevant	9	0	0	0	1
Opportunity	**C-O10**	The e-service offers tools for users with special needs (touch screen)	7	0	0	0	1
Opportunity	**C-O11**	The information is provided in different languages	3	0	1	0	0
Opportunity	**C-O12**	The e-service provides a summary report	9	0	0	0	1
Opportunity	**C-O13**	There is a strong incentive for using e-service	5	0	0	1	0
Opportunity	**C-O2**	The provided multimedia services facilitate contact with e-service staff	7	0	0	0	1

Opportunity	**C-O3**	I can share my experiences with other e-service users	1	0	1	0	0
Opportunity	**C-O4**	The e-service can be accessed at any time	9	0	0	0	1
Opportunity	**C-O5**	The e-service can be reached from anywhere	9	0	0	0	1
Opportunity	**C-O6**	The information needed for using the e-service is accessible	7	0	0	0	1
Opportunity	**C-O7**	The e-service points me to the place of errors, if any, during a transaction	9	0	0	0	1
Opportunity	**C-O8**	The e-service allows me to update my records online	9	0	0	0	1
Opportunity	**C-O9**	The e-service can be completed incrementally (at different times)	9	0	0	0	1
Total			**321**	**2**	**8**	**9**	**30**

Table 20 e-PRIA COBRAS quality model assessment results

APPENDIX 9, e-PRIA Finnish quality model assessment results

Criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[59]	W[60]	M[61]	S[62]
1.1 The web service is easy to find	9	20	45,00%	0	2	2	1
1.2 The web service can be used appropriately in different languages.	4	16	25,00%	1	2	2	0
1.3 The web service can be used in a variety of technical environments.	13	20	65,00%	0	0	3	2
1.4 The web service is available throughout the day.	4	4	100,00%	1	0	0	1
1.5 Use feels secure and reliable.	12	16	75,00%	0	0	1	3
1.6 Use is fast and efficient.	16	20	80,00%	0	1	0	4
1.7 Navigating and finding information are easy.	17	28	60,71%	0	1	3	3
1.8 Links are descriptive and functional.	9	16	56,25%	0	1	1	2

[59] The count for not applicable criteria elements "N/A"
[60] The count for the weakest criteria (the two lowest scores) "W"
[61] The count for medium score "M"
[62] The count for the strongest criteria (the two highest scores) "S"

Criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[59]	W[60]	M[61]	S[62]
1.9 The user interface is clear, uniform and understandable.	12	12	100,00%	0	0	0	3
1.10 The user is provided with instructions and advice on the use of the web service.	24	28	85,71%	0	0	2	5
1.11 The web service prevents, tolerates and helps to correct errors.	19	24	79,17%	0	0	2	4
1.12 The section of the web service subject to charges is clearly distinguished from the rest of the service.	0	0	N/A	3	0	0	0
1.13 Visual elements and sound are used appropriately.	14	16	87,50%	0	0	1	3
1.14 Layout and visual appearance are executed with an emphasis on communication and accessibility.	15	16	93,75%	0	0	0	4
2.1 The structure is organised appropriately.	8	16	50,00%	0	1	2	1
2.2 The content is trustworthy and up-to-date.	7	20	35,00%	0	3	1	1
2.3 The content is comprehensive.	4	24	16,67%	0	6	0	0
2.4 The text content is easy to understand and legible.	16	16	100,00%	0	0	0	4

Criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[59]	W[60]	M[61]	S[62]
2.5 The web service provides the user with good service.	19	20	95,00%	0	0	0	5
3.1 The web service supports the organisation's strategy and goals.	4	8	50,00%	1	1	0	1
3.2 Applicable legislation is observed in the web service and its development.	0	0	N/A	3	0	0	0
3.3 A sound rationale has been provided for the decision to develop the web service.	2	4	50,00%	3	0	1	0
3.4 The web service has a management infrastructure.	4	4	100,00%	4	0	0	1
3.5 The benefits of co-operation have been utilised in development of the web service.	7	8	87,50%	0	0	0	2
3.6 Attention is given to communication and marketing of the web service.	13	16	81,25%	0	0	1	3
3.7 Exceptional situations have been taken into consideration.	0	0	N/A	4	0	0	0
4.1 The web service processes have been assessed and integrated with maintenance.	8	16	50,00%	1	1	2	1

Criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[59]	W[60]	M[61]	S[62]
4.2 User groups, users' needs and use situations have been taken into consideration.	7	12	58,33%	1	1	0	2
4.3 Usability and accessibility have been assessed and ensured.	7	16	43,75%	0	2	1	1
4.4 Use monitoring is systematic and results are taken into consideration in development.	4	8	50,00%	3	1	0	1
4.5 Content production is systematic.	8	12	66,67%	2	0	1	2
4.6 Technical maintenance is controlled	5	8	62,50%	1	1	0	1
4.7 The web service has been produced using an appropriate system.	10	12	83,33%	1	0	0	3
4.8 Data transfer and the server environment have been secured.	8	8	100,00%	4	0	0	2
4.9 The confidentiality and integrity of information has been ensured.	10	12	83,33%	1	0	1	2
4.10 User rights are managed.	12	12	100,00%	1	0	0	3
5.1 The web service is of benefit to the organisation.	7	12	58,33%	0	1	0	2
5.2 The web service is well known.	5	8	62,50%	0	0	1	1

Criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A[59]	W[60]	M[61]	S[62]
5.3 The web service gives users the chance to exert their influence.	3	12	25,00%	0	2	1	0
5.4 The web service provides the user with added value.	6	12	50,00%	0	1	1	1
Grand Total	**352**	**532**	**66,17%**	**35**	**28**	**30**	**75**

Table 21 e-PRIA Finnish quality model assessment results

APPENDIX 10, e-PRIA Finnish quality model assessment results for essential criteria

Assessment area and criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A [63]	W [64]	M [65]	S [66]
1. Use	**13**	**20**	**65,00%**	**0**	**0**	**3**	**2**
1.3 The web service can be used in a variety of technical environments.	12	16	75,00%	0	0	1	3
1.5 Use feels secure and reliable.	17	28	60,71%	0	1	3	3
1.7 Navigating and finding information are easy.	9	16	56,25%	0	1	1	2
1.8 Links are descriptive and work properly.	12	12	100,00%	0	0	0	3
1.9 The user interface is clear, uniform and understandable.	63	92	68,48%	0	2	8	13
2. Content	**8**	**16**	**50,00%**	**0**	**1**	**2**	**1**
2.1 The structure is organized appropriately.	7	20	35,00%	0	3	1	1

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[63] The count for not applicable criteria elements "N/A"
[64] The count for the weakest criteria (the two lowest scores) "W"
[65] The count for medium score "M"
[66] The count for the strongest criteria (the two highest scores) "S"

Assessment area and criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A [63]	W [64]	M [65]	S [66]
2.2 The content is trustworthy and up-to-date.	16	16	100,00%	0	0	0	4
2.4 The text content is easy to understand and legible.	31	52	59,62%	0	4	3	6
3. Management	**4**	**8**	**50,00%**	**1**	**1**	**0**	**1**
3.1 Applicable legislation is observed in the web service and its development.	0	0	N/A	3	0	0	0
3.2 The web service supports the organization's strategy and goals.	4	4	100,00%	4	0	0	1
3.4 The web service has a management infrastructure.	8	12	66,67%	8	1	0	2
4. Production	**7**	**12**	**58,33%**	**1**	**1**	**0**	**2**
4.2 User groups, users' needs and use situations have been taken into consideration.	8	12	66,67%	2	0	1	2
4.5 Content production is systematic.	5	8	62,50%	1	1	0	1
4.6 Technical maintenance is controlled.	20	32	62,50%	4	2	1	5

Assessment area and criteria	Points	e-PRIA maximum points	% of e-PRIA maximum	N/A [63]	W [64]	M [65]	S [66]
5. Benefits	**7**	**12**	**58,33%**	**0**	**1**	**0**	**2**
5.1 The web service is of benefit to the organization.	6	12	50,00%	0	1	1	1
5.4 The web service provides the user with added value.	13	20	65,00%	0	2	1	3
Total	**135**	**212**	**63,68%**	**12**	**11**	**13**	**29**

Table 22 e-PRIA Finnish quality model assessment results for essential criteria

ATTACHMENTS

Portal's assessment results in Excel table format can be found in ZIP format in the Tartu University's Institute of Computer Science database of MSc and BSc thesis. It can be accessed from informational site http://www.cs.ut.ee/en/thesis.