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Paperless Management as a Foundation for the Application of e-Governance in Local Governments

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Declaration:
I hereby declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology, has not been submitted for any academic degree.

/Ingrid Pappel/

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INFORMAATIKA JA SÜSTEEMITEHNIKA C91

Digitaalne asjaajamine kui alus e-valitsemise rakendamisel kohalikes omavalitsustes

INGRID PAPPEL

TTÜ
KIRJASTUS

KOKKUVÕTE

Eesti e-Riigi eduloo on taganud tehnoloogiliselt edukad ümberkorralduslikud saavutused e-valitsemise võtete rakendamisel. Olles aastate jooksul osalenud mitmes e-valitsemisega seotud riigi arendusprojektis ning kokku puutunud puudujääkidega omavalitsuste süsteemide rakendamisel, tuleb tõdeda, et e-valitsemisele üleminek kohalike omavalitsuste tasandil on komplitseeritud.

Käesolev doktoritöö on väljakujunenud viimase kümne aasta tegevustest kohalike omavalitsuse arendamisel, mille eesmärgiks on olnud omavalitsuste töökorralduse tõhustamine infotehnoloogiliste rakenduste toel. Uurimisteema peamiseks ajendiks on olnud elektroonilise dokumendihaldussüsteemi (EDHS) Amphora arendustegevus aastast 2003, andes aluse dokumendihalduse ja asjaajamise digitaliseerimiseks. Hoolimata asjaolust, et EDHSi arendamine, rakendamine ja uute lahendustega eksperimenteerimine on toimunud väga pika perioodi jooksul, on aastatega saavutatu võimaldanud välja töötada omavalitsusspetsiifilise e-valitsemise raamistiku ja juurutusmetoodika.

Eksperimendid, arendustegevus ja uuringud koostöös riiklike partnerite ja kohalike omavalitsustega on doktorandil praktiku ja uurijana võimaldanud analüüsida arendatava EDRMSi rakendamist ja paberivabale asjaajamisele üleminekut Amphora näitel ligi pooltes Eesti omavalitsustes. Siinjuures on oluliseks väärtuseks doktoritöös pakutud esmased mõõdetavad tunnused omavalitsuste muutumise hindamiseks EDRMS rakendumisel. Loodud raamistiku eri osad võimaldavad semantika täiendamise ja muutmisega väljatöötatud põhimõtteid rakendada ja juurutada ka teistel EDRMS platvormidel. Käesolevas dissertatsioonis esitatakse omavalitsuste e-valitsemisele ülemineku raamistik ning hinnatakse ja põhjendatakse selle raamistiku kasutatavust interdistsiplinaarsest vaatest lähtuvalt, hõlmates nii juriidilisi, tehnilisi kui ka sotsiaalseid aspekte.

Töö tulemus on valdkonnaülene. Nii näiteks saab olulise panusena käsitleda omavalitsuste digitaalsele asjaajamisele ülemineku käivitamist ning koosvõime loomist riigi süsteemidega EDRMSi vahendite abil. Esmalt oli oluline välja töötada e-valitsemisele ülemineku raamistiku omavalitsuslik mudel (e-LocGov) ja juurutusmetoodika, rakendumiseks aga valdkondlikud arendusstruktuurid. Kohaliku omavalitsuse e-valitsemisele ülemineku tõhususe ning digitaalse võimekuse mõõtmiseks töötati antud doktoritöö raames välja tagasiside- ja hindamissüsteemid. Olulist rolli kohaliku omavalitsuse e-valitsemisele ülemineku juures mängib ka ametkonna teadlikkuse tõstmine, mille tarvis on koostöös Tallinna Tehnikaülikooli ning eriala ekspertidega loonud e-Riigi Tehnoloogiad ja Teenused õppekava ning e-Riigi Tehnoloogiate Laboratooriumi, arendanud koostööd nii era- kui ka riigisektori ekspertide ja ametnikkonnaga.

Käesolev dissertatsioon põhineb valitud teaduslikel artiklitel, mis on esitatud konverentsidel ja avaldatud konverentsi kogumikes ning monograafilistel osadel, mis annavad tervikülevaate käsitletud valdkonnast. Antud uurimusega antakse kompleksne ülevaade omavalitsuste e-valitsemise komponentide rakendamise osas, mille õigsust on ka praktikas uuritud. Ühtseks tervikuks on seotud e-valitsemisele üleminemise mudel paberivaba asjaaajamise rakendamise näol ning välja pakutakse metoodika antud mudeli rakendamiseks. Töö tulemus ei seisne vaid kirjeldatud mudelis, see on ka praktikasse viidud, läbi testitud, kohandatud ning saadud tulemusi hinnatud enam kui 100 omavalitsuse näitel.

SUMMARY

Technological and re-organisational achievements in the implementation of e-governance solutions in Estonia have been successful at the state level, while the transition process has been more complicated for local governments. My participation in numerous e-governance development projects led to the discovery of several shortcomings in implementing related systems in local governments.

This doctoral thesis aims to develop a framework for local governments along with potential solutions for managing the organisational processes and work flows more efficiently. The main incentive for this research topic has been the development of Electronic Document and Records Management System (EDRMS) Amphora since 2003. As both a practitioner and a researcher, I have been able to conduct the experiments and development work as well in collaboration with different state partners and half of the local governments of Estonia. The results of this research have been tested and implemented on the basis of EDRMS Amphora. Although the development and implementation of EDRMS and experimenting with new solutions has been a continuous process, the results achieved over the recent years have made it possible to develop an e-governance framework and a concept for the transition into e-governance specifically for the use of local governments.

The concept for the transition into e-governance – the basis of which is suitable to multiple EDRMS platforms by supplementing and altering semantics – assesses and substantiates its utility. This is done from an interdisciplinary point of view that includes legal, technical, organisational and social aspects. The results of this work are related to the development activities in many areas such as launching paperless management in local governments with EDRMS facilities by creating interoperability with state registries, external and internal systems; the establishment of the work environment for the transition into e-governance in local governments as a local government specific approach (e-LocGov model); the creation of an implementation methodology for efficient paperless management that considers the aspects of organisational change; the creation of a feedback and assessment system for the evaluation of change in local government efficiency and digital capabilities. An additional crucial component has been the establishment of an e-State Laboratory and International Masters Programme e-Governance Technologies and Services within Tallinn University of Technology in cooperation with field experts and public sector facilities as a centre of expertise to ensure constant research and development and for creating awareness in local governments in the field of e-governance.

The thesis is based on selected scientific articles that have been presented at conferences and published in conference collections and on monographic series that give a comprehensive overview of the relevant area. The framework proposed in this thesis in a form of e-LocGov model for the transition into e-governance has been compiled in the form of paperless management and this work puts forth the method of implementation as well. In addition to developing the aforementioned model, it has also been implemented, tested, adjusted and the results evaluated with the use of over 100 local governments as a test base. To conclude, this dissertation provides a complex overview of the implementation of the components of e-governance in local governments and, notably, the accuracy of this has also been studied in practice.

ACKNOWLEDGMENTS

I dedicate this thesis to my children, Karl Ivory and Mirell Maria. You are the greatest achievement of my life and I know how much my work has taken me away from you. Without your love and acceptance my PhD studies would not have been possible. You are the greatest guiding light to me!

P.S to all of you helping me through these years and difficult times: I will always be grateful for being surrounded by you. Thank you all!

Ingrid Pappel,
Keila, 2014

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1. Pappel, I., Pappel, I. & Saarmann, M. (2012b) Digital Records Keeping to Information Governance in Estonian Local Governments. in (Eds.) Shoniregun C. A. & Akmayeva G. A. i-Society 2012 Proceedings: i-Society 2012, June 25-28, 2012, London, UK.. London: Published by Infonomics Society, pp 199–204
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3. Pappel, I. & Pappel, I. (2012b) The service-oriented state and local authority: service orientation in public administration in (Eds.) Nunes, M. B., Peng, G. C., Roth, J., Weghorn, H. & Isaías, P. *Proceedings of the IADIS International Conference Internet Applications and Research 2012: IADIS International Conference Internet Applications and Research* Lisbon, Portugal, 17–19 July 2012. IADIS Press, pp 111–116
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7. Pappel, I. & Pappel, I. (2011b) Using e-learning methods in the (e-) implementation of e-governance software at local governments. Case study of the Estonian way in (Ed.) Jose, A. *Advances in Digital Library Development: International Conference on Digital Libraries and Knowledge Organization ICDK 2011*, Gurgaon, India, 14-16.02.2011. Delhi: Macmillan Publishers Ltd, pp 413–419

8. Pappel, I. & Pappel, I. (2011a) Implementation of service-based e-government and establishment of state IT components interoperability at local authorities in *The Proceedings of the 3rd IEEE International Conference on Advanced Computer Control (ICACC 2011),* Harbin, Hiina, 18–20.01.2011, Singapore: Institute of Electronics and Computer Science, pp 371–378

AUTHOR´S CONTRIBUTION TO THE PUBLICATIONS

This thesis is based on both monographic parts and also the findings of eight research papers on the developments and research activities in local governments moving towards e-governance by implementing paperless management and the activities regarding the development of the e-LocGov model. A short overview and my own contribution to the research is listed below in a chronological order:

"Implementation of service-based e-government and establishment of state IT components interoperability at local authorities", Ingrid Pappel, Ingmar Pappel. I drafted the plan as the first author of the article. Having worked out software specifications during the development of EDRMS Amphora, I had a vision and an overview of the necessary architecture for an interoperable and central management system. The article sums up the necessary prerequisites for and the needs of local governments for the transformation into paperless records management and explains the importance of interoperability. The article gives an overview of external IT systems that have to interact with EDRMS Amphora. I presented the results of the article in Harbin, China in January 2011.

"Using e-learning methods in the (e-)implementation of e-governance software at local governments. Case study in Estonian way", Ingmar Pappel, Ingrid Pappel. I was the second author of this article and I contributed to the gathering and relaying of information for this article. In the implementation of EDRMS Amphora, I have carried out most of the training and have received direct feedback about the chosen methods of teaching. Years of implementation of the EDRMS Amphora and other e-governance systems provide very important input information for shaping the teaching methods. This resulted in previously adjusted and pre-defined EDRMS Amphora work environments for implementing the software and an optimised (meaning shortened) implementation process.

"Concept and Activity Directions for Training and Science Centre supporting development of Estonian e-State Technologies", Ingrid Pappel, Ingmar Pappel, Monika Saarmann. I was the main author of this article and contributed to the drafting of the main plan. This article gives an overview of parallel actions in the development of EDRMS Amphora because, in addition to development, there was a need for the creation of a more specific structure of local governments. It became important to also create an infrastructure which dealt more thoroughly with the transition of local governments into e-governance. The article discusses the objectives and principles which laid the foundation for the e-State Technologies Laboratory and the creation of the Master's programme e-Governance Technologies and Services. I was one of the creators of the relevant institutions for both projects.

"Methodology for Measuring the Digital Capability of Local Governments", Ingmar Pappel, Ingrid Pappel. I was the second author of this article and contributed to the gathering and relaying of information. The first development principles of the digital performance index for local governments were detailed here. I was responsible for describing the criteria and

measurements for local governments. In addition, I conducted the surveys and analysed the results.

“Integral and secure cloud architecture based system for backup and retention of public sector information”, Ingmar Pappel, Ingrid Pappel. I was the second author of this article and I contributed to the gathering and relaying of information. EDRMS is described here as an archiving system for organisations, also the cloud-based service is thoroughly discussed.

“The Service-oriented State and Local Authority: service orientation in public administration” Ingmar Pappel, Ingrid Pappel. I was the second author of this article and contributed to the gathering and relaying of information. The article thoroughly discusses the transformation of services from paper-based into digital form and touches upon the possibility of its application from technological and social aspects. The central services repository (Public Services System (PSS) in the vocabulary of the authors) is discussed more thoroughly, which would allow for unifying and reusing the descriptions of services in all the interested local governments.

"Development of Information Society and e-Government by Improving Electronic Records Management Solution at Estonian Local Authorities", Ingmar Pappel, Ingrid Pappel, Monika Saarmann. I was the second author in composition of the article and contributed to the gathering and relaying of relevant information. The article gives a more thorough overview of EDRMS Amphora development activities within the Structural Funds project “Citizen’s view of paperless records management and development of participatory democracy solutions in local municipalities” in 2008-2009 wherein preconditions were created for a more efficient implementation of e-governance in local municipalities. The article describes the main activities of the development project, and some of the results concerning the implementation of e-governance have been brought out which in turn were created as a result of the development project. I was involved as the project manager on the developer’s side and was responsible for the quality of the project results.

"Digital Records Keeping to Information Governance in Estonian Local Governments", Ingrid Pappel, Ingmar Pappel, Monika Saarmann. I was the first author in composing this article and drafted its plan. The article describes the different parts of the e-LocGov model and analyses the possible implementation of its components in local governments. Having implemented most of the components, I described the main principles and the nature of Local Government Systems and the e-LocGov model. I also denoted current shortcomings (IT systems on the prototype level) that inhibit the application of the e-LocGov model. I presented the results of the article in London, United Kingdom in June 2012.

LIST OF ABBREVIATIONS AND DEFINITIONS

AME (EMOL)	www.emovl.ee Association of Estonian Municipalities
AEC (ELL)	www.ell.ee Association of Estonian Cities
EDRMS	Electronic Document and Records Management System
DEC (DVK)	Document Exchange Center
SODI (ADIT)	Service of Official Documents Infrastructure
UAM	Universal archiving module
the e-LocGov model	Model for e-Local Government
PSS	Public Services System
EISA (RIA)	Estonian Information System's Authority https://www.ria.ee/
SIS (RISO)	State Information System http://www.riso.ee/en/
P-men	Financial software used by most Estonian local governments

- **E-governance** - E-governance is the application of information and communication technology (ICT) for delivering government services, exchange of information communication transactions, integration of various stand-alone systems and services between government-to-customer (G2C), government-to-business (G2B), government-to-government (G2G) as well as back office processes and interactions within the entire government framework (Saugata & Masud, 2007). In this work the term e-governance is used because of its diversity where through e-governance, government services are made available to citizens in a convenient, efficient, and transparent manner.
- **E-government** – E-government (short for electronic government, also known as e-gov, Internet government, digital government, online government, or connected government) consists of the digital interactions between a government and citizens (G2C), government and businesses/commerce (G2B), government and employees (G2E), between government and governments /agencies (G2G), as well as citizen interaction with their government (C2G).
- **E-governance principles** – how local governments should use IT solutions in their every day work in order to achieve an outcome where government services are made available to citizens in a convenient, efficient and transparent manner.
- **Digital performance index** – consists of different criteria, which allow assessing and measuring the digital capability of local governments.
- **Digital capability** – the ability of a local government as regards digital management and its association with their work processes.

- **E-local government contract** – a contract that regulates the cooperation of joined local governments in the application of various parts of the local governments' systems and the e-LocGov model. The contract sets out A, B and C levels wherein each level sets different demands for the application of the e-LocGov model. At the highest level (A), local governments have the chance to receive a free assistance for applying all systems, which results in a platform for improved application of e-governance.
- **e-LocGov model** – a framework for local governments implementing paperless management in the form of EDRMS towards e-governance. It incorporates a technological platform and implementation methodology both as regards information technology and local government process descriptions, and a feedback and assessment system.
- **e-Raplamaa** – the local governments of Rapla County throughout several development and research projects. Plenty of implementation work has been done within the e-Raplamaa framework in order to apply different parts of the e-LocGov. The developments of primary metrics systems that have been carried out are based on e-Raplamaa. Furthermore, the input has been obtained after the projects workfor specifying the digital performance index.
- **e-State Technologies Laboratory** – a specific direction of research under the TUT Institute of Informatics which must facilitate and encourage research on the topic of local governments, create new solutions, and prototype and test them. e-Raplamaa (Rapla County) has been the test base so far.
- **Interoperability** – in this research the EDRMS's ability to communicate with other systems. EDRMS must have this ability, which facilitates data exchange with other systems.
- **Local Government Systems** – systems with specified rules and IT components that are based on EDRMS Amphora and other systems interoperable with it. Local Government Systems are applicable in the everyday work of local governments. That includes for instance the legal acts system within the local government system which allows local governments to consolidate their legal acts within the EDRMS. Also, the digitalisation of earlier legal acts on paper.
- **Paperless management (digital records management, digital management)** – incoming documents are digitalised (scanned), processed digitally within the EDRMS and relayed digitally to other parties. Digital signing is used, digital channels such as DEC or e-mail are used to send or receive documents.
- **Public Services System (PSS)** – a system described by authors that should allow to describe local government services, standardise them

and apply them in all local governments. The PSS should be compatible with EDRMS Amphora and the Citizen Portal; data descriptions should be downloadable and usable in all local governments. The services used by local governments should be analogous and hence it is reasonable to create a unified system to facilitate the repeated use of the described services.

- **Public view** – EDRMS Amphora has a public interface where the document register of local governments is published and citizens are given a chance to use e-services. Through authentication citizens also have a chance to monitor information processing that concerns them in particular. Council decisions and agendas are published. Citizens are allowed to comment on documents. It is a foundation for the formation of participation democracy.
- **Records' Management** – the management of documents and records using EDRMS where it is possible to process documents and follow all processes relating to a document in a Web environment.
- **Service-oriented approach** – a means for local governments of offering services in a manner that is expected by the citizens. Services must be offered in such a way that meets expectations of all target groups. If a specific service could be best used in an electronic way, then an option must be created for bringing it into life as an e-service. A local government must also have a chance to monitor the service providing process and its flow to assess the quality of the service and the time designated for it. EDRMS Amphora allows monitoring deadlines and the taskflow.

INTRODUCTION

This thesis reflects ten years of research and development activities for innovative paperless management in Estonian local governments. The objective of this research is to improve the work environment and increase the e-governance ability of local governments by finding, analysing and developing appropriate solutions. The topic of e-governance is rather broad and complex, and it should be emphasized that the main aspects examined in this research are related to the service provision and application of e-services in local governments. Generally, governance denotes a set of rules for carrying out processes and decisions through the use of laws, norms, power, language, etc., in order to define actions, grant power and verify performance (Bevir, 2013). Governance is perceived as a means of controlling people and their behaviour. This research, however, looks at governance as a way of providing better services to citizens and making the day-to-day work in local governments more efficient by using paperless management.

The foundation of any e-governance initiative presupposes the existence of a sufficient governance structure that operates within a transparent legal and policy framework. The governing entity has policies, processes, and procedures that enable electronic governance to take place – all supported by transparent laws. Although e-governance involves many different areas such as e-democracy, including human rights (freedom of speech, freedom of information and knowledge) and e-commerce building opportunities for the private sector, the focus of e-governance in this research is towards the process of automating the delivery of efficient and effective government services to citizens. However, as efficient service provision and e-services are a significant aspect of e-governance and so-called "good governance", this research touches upon these areas but they are not major themes. Even though these topics are discussed here with delimitations, the main focus remains on the digitalisation of the processes and services of local governments by implementing the required technological tools.

Technological solutions are an increasingly dominating factor in the move towards e-governance realisations. Electronic Document and Records Management System (EDRMS) was chosen as the first software platform to facilitate the transformation of records management into digital form. The use of EDRMS allows for digitalising the processes inside the institution and, thus, is one of the most popular inter-governmental services in e-Government projects (Ngoepe, 2008; Hung et al., 2009; Yaacob & Mapong, 2011). The main focus of the thesis is on paperless management as the foundation for e-governance. The research activities were derived from the inability to find a comprehensive solution for implementing e-governance in local governments that incorporate modifiability and extensibility. Hence, the aim of the research has been to determine the necessary aspects for enrolling e-governance in local governments and, by doing so, to develop a local government specific framework, including EDRMS, procedures for implementation and the criteria for measuring organisational change. Although an all-encompassing solution that includes a

software platform as well as deals with the related nuances is difficult to fit into one framework, the research seeks to accomplish that. Hence, this dissertation is focussed on improving the work environment in local governments for more efficient service provision to citizens. Using paperless management as the foundation for e-governance, the digitalisation of the work processes of an organisation is an initial step in the transition process. This approach is expected, firstly, to increase the efficiency of work routines in local governments; secondly, to transform services and give current traditionally rendered services a new form; thirdly, to make it easier for organisations to adapt to technological changes.

The research domain of e-governance is an interdisciplinary field that, apart from technology, also includes economic, social, organisational and legal aspects. Therefore, a socio-technical approach provides the widest means of examining the problems tackled in this research. According to Cherns (1976), based on the socio-technical system theory, technical as well as social factors should be considered upon furthering change within an organisation. Hence, many obstacles are not just technologically or organisationally driven, but the human factor also significantly influences the outcome.

Different methods of dealing with social systems have been explored in literature. According to Long (2013), who looked at the dynamic operation of the unconscious at a systemic level, the methodology should reveal hidden dynamics to people in order to show how they influence, aid, or inhibit their practices. The activities in the thesis at hand have also been affected by the human ability to deal with changes that occur during new developments. However, providing individuals with precise rules and procedures can help overcome these issues.

For this research, action design science as an established research method (Sein et al, 2011) was employed that is elaborated upon in Section 2. Argyrys (1985) notes that action science encompasses the unintended consequences of formal organisational structures, executive leadership, control systems, and management information systems to individuals by monitoring the changes in organisations, especially the behaviour of upper-level executives. In accordance with the chosen research method, several cycles of investigation were performed.

In its initial form, the preliminary framework for local governments – the basic components and processes of a local government called the e-LocGov model – was empirically described and already presented to local governments in 2006. Consequently, the model has experienced continuous improvements and adaptations. To date, these results have been put into practice in more than 100 local government entities. The e-LocGov model does not merely contain a set of rules and regulations deploying e-governance, but also provides a technological platform, including measurement sets. Thus, it enables to deploy e-governance, including software, its implementation methodology and criteria for measuring changes during a transformation process.

Finally, as similar terms “e-government” and “e-governance” are used simultaneously, defining these terms is necessary. In this research, e-government denotes the bidirectional relationships between the government on the one hand and citizens, businesses, and civil society organisations (SCO) on the other (Gil-Garcia, 2005; Fountain, 2001). E-governance is seen as e-government that is extended by the engagement and participation of citizens and SCOs in governance. We view progressing from e-government to e-governance as an evolutionary process. In this research, the term “e-government” is used only when referring to literature that uses the term.

Outline of the Thesis

The thesis is comprised of an introduction and six sections. In the introduction, background information on commencing the research and development activities is provided, the chosen platform is explained, and the research problems, aims and questions are discussed. The motivation for this research will be explained and an overview of the ICT capability of the local governments will be given.

The first section presents the existing body of knowledge for the current thesis, where the main related works in the field of e-governance which cover problems that were raised through this research will be discussed. Although the main focus of the thesis has been the implementation of paperless management, this research involves many different aspects of e-governance which should be considered and observed when engaging in new developments.

The second section is devoted to the methodology and research approaches used in the research. This thesis presents an interdisciplinary study, which combines theories, experiments, development activities, discourses, practices and methods from the domain related to the socio-technical approach. This is a suitable approach to the complex organisational work design that recognises the interaction between people and technology wherein a good opportunity arose in this research to combine software engineering with processes that required descriptions. This socio-technical view pertains to the theory about the social aspects of people and society and the technical aspects of organisational structure and processes. Hence, it enabled to analyse and systematise the activities carries out in this research.

The practical background along with an analysis of the needs is described in the third section. It will elaborate on the topic of the main precondition for the transition into e-governance – the application of a digital document management system in order to achieve interoperability with the necessary parties in the everyday work of local governments. The different needs and prerequisites for paperless management will be discussed. An important objective of this research has been to find out whether it is possible to fully digitalise the work of local governments and offer citizens high-quality e-services by using EDRMS as a primary platform. Many concepts, problems and solutions were presented at conferences in China (Pappel & Pappel, 2011a), the UK (Pappel, Pappel & Saarmann, 2012b), Germany (Pappel, Pappel & Saarmann, 2012a) and Portugal (Pappel & Pappel, 2012b).

The findings and results related to the e-LocGov model are presented in the fourth section; the research sought to determine the possibility of developing a framework for bringing local governments closer to e-governance that would include (IT) systems, an implementation methodology, and result evaluation. The e-LocGov model has been offered as a possible solution to this issue. The development of the e-LocGov model will be explained in this section, and the different parts of the e-LocGov model will be presented. The described components of the model and its related systems were first presented in Portugal (Pappel & Pappel, 2012b) and the e-LocGov model was more thoroughly described in London (Pappel, Pappel & Saarmann, 2012b). The implementation principles will be discussed; different learning and training approaches for local governments which were presented in India (Pappel & Pappel, 2011b) will be explained. The necessity of the different forms of cooperation will be discussed; the main principles related to the research and education were presented at a conference in Tallinn (Pappel, Pappel & Saarmann, 2011) in form of the e-State laboratory and the corresponding Master's programme.

The evaluation of the digital capability of local governments will be discussed in the fifth section. This part of the thesis presents the assessment needs for measuring the efficiency change during the application of the e-LocGov model. The assessment principles and measuring criteria for local governments (Pappel, Pappel & Saarmann 2012b) will be discussed; two case studies illustrating the changes in local governments will be presented. An important input for the case studies described in this section was provided by an EU project "Paperless records management and development of participatory democracy in local governments" (Pappel, Pappel & Saarmann, 2012b). The approach for measuring the digital capability of local governments was presented at a conference in Tallinn (Pappel & Pappel, 2011c). The application of the e-LocGov model will be considered in this section, open problems will be indicated and different factors which can influence the outcomes of the implementation paperless management will be discussed.

The sixth section contains the concluding remarks and directions for future research.

Motivation for the Research

Estonia as a key contributor to the development of information technology and e-services can be used as a great example of the aforementioned processes. Estonia has been recognised in Europe for their digital management and e-governance – among other awards, the country won the European e-governance *best practice project title*[1] for its transition into paperless records management in 2009. Cutting costs and saving time as well as transparency and movement of information are great benefits of e-governance for both the citizen

[1] European Commission conducted a contest of projects best supporting the implementation of the European Union's e-governance strategy within the fifth meeting and conference of e-governance ministers on 19–20 November 2009.

and the government, but support for societal change should be considered more in the context of good governance. However, the Estonian success has been built on a technological platform, which sometimes excludes certain other aspects. Estonia's experience has provided an example of a novel country that has implemented innovative e-government practices in a short time period with limited resources (Sirendi, 2012). Nevertheless, the sense of security and satisfaction with the state is not fulfilled for a citizen by merely having convenient technological solutions; the society in general must also evolve. Social (e.g. healthcare), financial (e.g. salary, pension) and political aspects that are supported by an information technology platform are also essential for the society. Kitsing´s work (Kitsing 2010) gives a critical review of e-government in Estonia and comments on several concomitant issues; e-government readiness is also evaluated on a larger scale.

Developing EDRMS Amphora provided an opportunity for me to glance into the inner circle of local governments and to analyse their ICT capability in a broader sense which sparked my interest to further study this topic. The problems connected to Estonian governments have been reflected in different documents, such as the Annual Report No. OSV-2-6/06/85 "State support for developing information society for local governments" (RISO, 2006), the policy analysis by PRAXIS "How to develop local public services in cooperation with local governments and non-profit associations?" (Praxis, 2009), and "Overview of the operation of public sector to enhance working with digital documents" (RIA, 2011), among others. Although the documents indicated the problems with local governments, the practical methods for improving the situation were inadequate. The lack of ICT capability in local governments has been a problem for years.

ICT capability does not only consist of the software platform and its implementation, but also of the general know-how of the field and the ability to change the organisation in accordance with social changes. Curiosity and personal interest were strong motivators in finding out whether a local government can be transformed from one way of governance into another. Transformation encompasses the perspective of enhancing the efficiency, digitising, and implementing record management and other work processes. Ten years ago, the main problems were related to the monitoring efficiency of the records management processes of local governments. This, in turn, became the main starting point for the research into local governments.

Although the starting point of this dissertation was the implementation of EDRMS, it should be noted that this is not the only focus. The development and implementation of EDRMS Amphora has enabled to gradually expand the research field. Over the last years, my objectives have been broadly connected with:

- Enhancing the quality of the governance service through paperless management and finding supporting measures by applying ICT in the work processes of local governments and developing the necessary means of implementation.

- The unification of the work processes of local governments in order to ensure the wider implementation of e-services. That includes the development of a paperless management implementation methodology.
- Monitoring the changes in the digital performance of local governments in order to practice continuous quality improvements; focussing on identifying common evaluation criteria that provides feedback on changes.

In order to reach these objectives, problems related to local governments work processes must be identified and analysed in order to find the needed solutions through research exhibits, which include problem formulation, building and intervention together with reflection and learning for the formalisation of research activities. The development of the integrated solutions along with activities directed to the application of paperless management in local governments are conducted. This includes agreed upon sets of rules and transition strategies which permit satisfying the interests of all parties. Such rules and strategies must be developed to facilitate the transformation into e-governance. Gil-García & Pardo (2005) suggest that the state and local governments must cooperate in exploring the strategies in order to further their e-governance goals. In addition, this would aid the application of IT solutions. Hence, the development of the information society and IT usage will undoubtedly create additional preconditions and possibilities for local governments to offer services and improve the daily life of people and enterprises. All this involves reorganising and adjusting the practices in use today. The points required for restructuring will emerge along with the changes that affect the behaviour of the organisation on different scales.

Research Problems and Questions

The importance of this thesis lies in integrating an interdisciplinary research approach that ranges from analysing the needs of local governments as regards e-governance to actually designing and developing the required systems for that. Considering the fact that paperless management is the foundation for all conducted research activities, the ICT capabilities of local governments need to be improved by implementing digital records management system, and in doing so, analysing the impact on the new environment as well. Consequently, the overall research question is:

- How to enrol e-governance in local governments?

The running case for this research is the transition of local governments to e-governance in order to implement paperless management based on EDRMS. Therefore, evaluating and comparing different factors is a necessary process that accompanies the transition into the new platform. The aim is to monitor the effect of paperless management on the efficiency of local government work processes. This, in turn, permits to assess change management in local governments. Finally, after the implementation and evaluation process, whether

and to what extent an increase in efficiency exists, is measured. Furthermore, an aim is to obtain constant input for new research topics and development needs through the implementation of the achieved results. In order to achieve smoother application of e-governance, an important objective is to find the proper methodology for implementation that allows local governments to implement paperless management by creating the necessary work environment through EDRMS. Including the emergence of new work routines and also the growth of efficiency while simultaneously moving away from the old way of governance to the newer one. The research questions are connected to identifying and implementing the necessary tools in this field. The focus is on observing the changes in the following phenomena and, thus, answers are sought to the following questions:

- RQ 1 How does paperless management increase the efficiency in local governments?

The purpose is to find out how IT solutions and systems can increase the efficiency of paperless management. It is important to analyse what kind of services could be transformed into the electronic form, including the optimisation of the organisational processes and the harmonisation for common use. This approach facilitates the use of e-services for all local governments in an efficient manner because the services offered by local governments are very often the same. Harmonised and commonly described services provide the opportunity for e-services and their wider application by local governments. Taking into account the importance of interoperability, achieving the interoperability capability of systems has the potential to ensure a fully digital approach.

- RQ 2 How can the implementation process bring about organisational changes?

Organising and improving the everyday work of local governments primarily requires analysing the existing processes. This will clarify whether it is possible to unify the systems of local governments and provides useful input for understanding how the implementation of new systems should be organised. Moreover, analysing the factors that influence the changes in the systems and governance methods will give important feedback for creating a local government specific approach. The objective is to understand whether a unified implementation methodology is possible for implementing EDRMS and its relevant systems.

- RQ 3 How to measure organisational change?

The necessity of evaluating organisational change stems from measuring the efficiency gains in the newly implemented system. Describing certain measurable attributes and criteria will help to measure the growth of paperless management and digital workflows. Current research activities will help to find

out what can be evaluated in local governments to measure their digital capability. In order to evaluate the results of this work, feedback on organisational change caused by implementing ERDMS Amphora is necessary. The outcome will demonstrate how it is possible to use qualitative and quantitative research methods in order to evaluate the internal and external processes of local governments.

ICT Capabilities in Local Governments

The readiness of local governments to utilise e-governance possibilities has for years been modest and greatly dependent on the awareness of local government executives and the scarce budget resources. There has been limited coordinated cooperation in developing e-governance for local governments. County governments have been enterprising the most on the county level where local government unions have started joint projects[2] in this field. ICT capabilities of local governments can vary vastly in different regions of Estonia. If information society is developed separately on the state and local levels, the losing party will be the citizen.

The Estonian Information Society Strategy 2013 (Estonian Ministry of Economic Affairs and Communications, 2009) determined electronic, service-based, and user-centred objectives. The next Estonian Information Society Strategy 2020 (Estonian Ministry of Economic Affairs and Communications, 2013b) addresses the same aspects by adding a more service-oriented and citizen-centric approach. It places the citizen in the centre of the service provision process and concentrates more on interoperability between different services. The public, private, and third sector must be able to act in the same secure electronic services environment, in which access is made available to all groups of the society, including handicapped people. In addition to a technological (IT) environment, the necessary knowledge and skills must be guaranteed in order to meet the needs of the information society. According to the Survey of Electronic Records Management in the Public Sector Agencies of Estonia, this trend has not occurred the way it was expected to happen in local governments (Estonian Ministry of Economic Affairs and Communications, 2011). While ministries can coordinate the activities related to mapping services, the situation can be more complicated for local governments. The awareness of local governments and the need for more service-oriented solutions has increased in relation to the application of further developments of the state registers in the public sector. This has, in turn, caused the application of new technological solutions in local governments and the need to raise ICT awareness and readiness. From time to time, local governments have to use a

2 The construction of Internet connections across the country and the improvement of its quality in the project *Külatee* (Village Road), mutual web portals KOVTP (LGP), document management projects from the resources of EU structural funds.

solution without having the necessary technological platform and ability to adapt to it[3], thus, needing to "force" the implementation process.

In mid-2000s, the interaction between local governments, citizens, and public offices was mainly paper-based. Electronic environments, for example the websites of local governments, were only of an informative nature and citizens did not have a real opportunity to digitally interact with the local government. By 2012, the involved parties were granted a common secure service environment through the Citizen Portal and the public interface of the websites of local governments. This facilitates using public services and interacting with the state, entrepreneurs and other citizens in a common environment. EDRMS has become the managerial tool for internal and external digital and paperless management. The activities of a local government have been gathered into one unified electronic environment, and so the transfer of work processes has been guaranteed.

Although information technological changes have forced local governments to implement reforms that have not been always centrally thought through, as far as readiness is concerned, there is a certain preparedness within the ICT capabilities of the local governments as regards paperless management. For instance, according to the Survey of Electronic Records Management in the Public Sector Agencies of Estonia (Estonian Ministry of Economic Affairs and Communications, 2011), EDRMS is used in 85% of all local governments (the usage of EDRMSs is shown on Figure 1). In ministries and their subdivisions, the use of EDRMSs is 100%.

[3] A database for legal acts, eRT (eState Gazette) – where local governments have to send their legal acts, was not financed in order to connect EDRMS and eRT directly into the XML format. Today, local governments have to enter legal acts both to EDRMS and eRT, thus doing the same work twice.

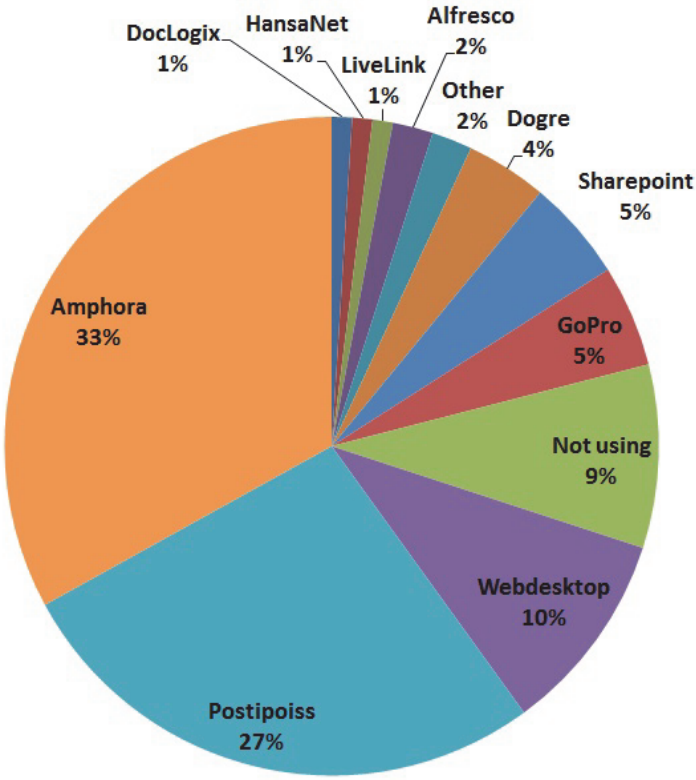

Figure 1 Usage of different EDRMS software´s in the Estonian public sector in 2011.

The growth of ICT capabilities would be more noteworthy if further resources could be allocated to the application of the necessary systems as mentioned in the Survey of Electronic Records Management in the Public Sector Agencies of Estonia (Estonian Ministry of Economic Affairs and Communications, 2011). An important hindering factor in the implementation of systems and IT solutions is linked to a lack of coordination. As previously mentioned, there is no consistent coordination of the ICT development of local governments on the state level. There is certain cooperation on setting new goals and principles[4], but actual work on the development of a necessary IT platform and the relevant infrastructure in all local governments has been quite chaotic. Many central IT solutions have been created to solve specific cases[5], but unfortunately this has not been done in an all-encompassing capacity. The implementation of state-created IT solutions has been left for every local government to decide. This, in turn, impedes the wider implementation of

[4] In 2009, Ministry of the Interior initiated development projects' mutual web portal LGP (KOVTP), the council legal acts management system, and the development of the new document list, but in practice, these were implemented relatively inefficiently.

[5] An example is Document Exchange Centre (DEC) that enables to exchange documents digitally but the data sent lacks procedural data and responsibilities. This in turn hinders intermural procedures as the procedural notations must be made separately.

already existing systems. Furthermore, local governments often lack the know-how for implementing technological solutions in the work environment and for connecting them to the processes of the organisations. Therefore, the development and research described in this thesis are an attempt at harmonising the application of the IT systems, doing the necessary preliminary work for the developer and applying all the components based on the same methodology that has been developed in this framework.

The development of the information society and the use of information technology undoubtedly create additional preconditions and prospects and, thus, opportunities for a better way of life for citizens and enterprises. That involves local governments and their service provision as well. A great deal of research has been conducted to find suitable approaches or models for this phenomenon. However, achieving e-governance is not just a technological matter; it also involves legislative issues. Building new IT solutions based on an outdated legislative framework must be avoided. A significant proportion of the legislation has become obsolete and incapable of supporting improved technological solutions, hence, using a legal system in need of updating as a foundation cannot produce effective outcomes. For instance, a study conducted in the United States in 2008 (Coursey & Norris, 2008) observed that many e-government initiatives that build up e-government models are using normative models which were created decades ago and do not always follow real-time needs. The authors of this research present empirical evidence from three surveys of local e-government in the United States to test whether these models are accurate or useful for understanding the actual development of e-government. Coursey & Norris (2008) claim that these models, though intellectually interesting, are purely speculative, having been developed without linkage to the literature about information technology and government. That indicates a clear need to change today's normative principles and legal acts. In addition, this requires reorganising and adapting models and new management techniques involving the legal framework as well. The society needs actual and working solutions instead of speculative and theoretically provable models, and methodology which could be employed in real life. The given work offers one possible approach, which could assist local governments in using e-governance components.

Background of the EDRMS Amphora

Before we commenced the work with EDRMS Amphora, the records management in local governments was mainly paper-based as regards digital workflows and the use and exchange of digital documents. In the mid-2000's, local governments maintained a list of open cases, and the documents received were kept in paper files. Epkin´s research (2004) showed that in 2002, the use of EDRMS-s in Estonia was relatively high, but these systems were mainly for document registries. At this point, awareness of paperless management was not very high. The need to use EDRMS-s was regulated by the law.

The development of EDRMS Amphora started in 1998. Its main goal was to develop software that would enable public sector organisations to implement paperless document management. Implementing EDRMS during that period proved difficult, as the speed of Internet and its penetration did not allow for efficient and sufficient realisation of the software. Previous owners of the EDRMS software Amphora declared bankruptcy in 2002 and in 2003 it was bought by the author's company, Interinx Ltd, together with Amphora's existing clients (23 local governments together with other organisations). The goal was to develop software that would help local governments implement paperless management in their organisations.

In 2002, EDRMS Amphora was used in 44 local governments (Epkin, 2004), but many of the clients discontinued the use of the platform after the takeover in 2003. The fastest adoption of the platform by local governments took place in 2006 and 2007 when the primary rules and principles of EDRMS Amphora were introduced in order to implement paperless management. The primary task of EDRMS was to publicise document registries on the websites of local governments. However, since 2006, there has been a significant trend towards paperless management. In the period of 2006-2007, different projects were conducted at the state level. These facilitated the deeper implementation of paperless management. During that time, the Document Exchange Centre (DEC) was developed which permitted document exchange between different EDRMSs. Moreover, the Citizen Portal and EDRMS Amphora were integrated. All of this enabled to start exchanging different applications in the form of e-forms between citizens and local governments. It was the beginning of the application of e-services. I was the project manager in the described projects, and also the person who helped implement these developments in local governments. It can be said that it was a good starting point for the increasing evolution of local governments towards paperless management and e-governance in general.

1 EXISTING BODY OF KNOWLEDGE

The following sections will give an overview of the works related to the field of e-governance. It has been difficult to find a specific e-governance framework for local governments that consists of a technological part and specific application procedures for implementation. Due to this, many disciplines and approaches have been considered throughout this research, all of which will be discussed in the next sections. It is imperative to bear in mind that paperless management is linked with several other dimensions of e-governance – more than just a means of service provision to the citizen, various aspects must be considered upon its implementation and these will be discussed below. Furthermore, the necessity of EDRMSs will be discussed. Due to my conviction that paperless management should be the starting platform, I chose EDRMS as the main tool for enhancing paperless management and in order to start building the necessary communication between local governments and citizens. Hence, a short overview of the EDRMSs will be given.

1.1 Related Works in the Field of the e-Governance

The aim of this section is to provide a literature review on the research and practices in the domain of e-governance. As the main result of this literature review, I will identify and argument my own position regarding these ideas. The current research is focused on paperless management. However, the problems related to paperless management and e-governance on a larger scale contain many issues that need to be address in order to provide a wider perspective.

The field of e-governance has advanced rapidly in the last decades and this has created the preconditions for the necessary platforms. The theoretical starting points have given practicians the means, which have enabled to build both the technological and organisational structures from the facet of e-governance. Considerable progress in the structures for technologies came with the development of service-oriented architectures (Thomas, 2005), workflow management methodologies, semantic web services (Cardoso & Sheth, 2005) and extensive demand for a reliable way of handling sensitive user information. The aforementioned progress has created several information technological possibilities for building an information society. It has enabled organisations to successfully integrate their business model with the field of information technology. To help public administrators think about e-government and relevant organisations, it should described different stages of e-government development and a ‘stages of growth’ model for fully functional e-government should be proposed (Layne & Lee, 2001). The development stages can concisely describe the dynamics of the transition into e-governance.

Often, specific methods or deployment plans for e-governance systems have not been fully developed for local governments. On the other hand, local governments and their e-governance capabilities are widely researched (Moon, 2002; Moon & Norris, 2005; Bäck, 2003; Ferro & Sorrentino, 2010; Attour-Oueslati, et al., 2007; Cassel & Hoornbeek, 2010; Sandoval-Almaan & Gil-

Garcia, 2012, Rufin et al., 2012). The transformations related to e-governance in general have been researched and dealt with, but it has rather been about the different aspects than using the technology and new rules for the benefit of the whole system (Arthur, 1988; Castells, 2000; Rotmans et al., 2001; Rodrigues, 2003; Dada, 2006; Gupta & Jana, 2003; Esteves & Joseph, 2008). The principles of e-government, a new possible model of governing, have been highly esteemed (Drechsler, 2004; Bekkers & Homburg, 2007; Streib & Navarro, 2008, Calista et al., 2010; Coursey & Norris, 2008; Davison & Wagner, 2005; Affisco & Soliman, 2006; Dawes & Prefontaine, 2003; Attour-Oueslati et al., 2007). The field related to people and the wider backdrop of e-governance has been researched extensively. Transitions related to e-governance along with offering good governing principles and services have also been widely discussed (Synnerström, 2002; Carter & Belanger, 2005; Irani et al., 2007; Teo et al., 2009; Calista & Melitski, 2007, 2008; Uzzaman, 2010; Homburg & Dijikshoorn, 2011). On the one hand, changes in the field are related to the trust of the citizens in the new governing model for offering services (Carter & Belanger, 2005; Grimmelikhuijsen 2012); on the other hand, public sector organisations are facing a great challenge in reorganising the way of governing by following the new principles (Gil-Garcia et al., 2007; Gil-Garcia & Pardo, 2005; Klievink & Janssen, 2009; Swenson, 2010). The transition into a new form of governance has been viewed as an adaptation of new models, wherein traditional New Public Management (NPM) and others (Bäck, 2003; May, 2003; Heeks & Bailur, 2007; Grimmelikhuijsen, 2012) are unified with new trends.

The new approach demands integrating technology with already existing devices. This, in turn, means that the use of technological solutions presumes the reorganisation of the work routines currently in use. For this reason, the application of e-governance has been comparatively studied with the synergy of models such as Technology Acceptance Model TAM and others (Venkatesh & Davis, 2000; Chau & Hu, 2001; Rufin et al., 2012). The acceptance of new solutions has been the prerequisite for success when adapting to new situations (Sirendi, 2012). Different stages have been researched and handled in the reforming of an organisation (Mintzberg, 1996). Stage models are predictable patterns, which exist in the growth of organisations (Klievink & Janssen, 2009). Different frameworks have been researched and offered for the transition into e-governance (Grant & Chau, 2005; Rahman & Ahsan, 2011) but papers have so far only covered certain parts of the whole. Analyses have been made on the levels of people and governance; solutions have been offered to implement technologies, or research done on the influence of legislation on changes taking place in the society, and also on interoperability. All these nuances, which cover the principles of e-governance as a whole, are difficult to fit into one picture.

The transformation of services is an important aspect of the general framework of e-governance and not merely a technical matter but an organisational and political one as well. The developments of information society affect both organisations and individuals. New norms of conduct are required in a situation where the offering of services has been transformed by

new principles. Taking services to a new level is linked to reorganising security principles, which is contradictory in the context of different cultural spaces. One thing is clear – transparency in the decision-making process helps overcome the gap (Carter & Belanger, 2005; Welch et al., 2005; Grimmelikhuijsen, 2012) between the state and the individual. It must be guaranteed that the citizens are informed about the daily work of the organisation and it needs to be taken into account that the interests of different parties as regards the level of transparency could be different. The expectations of citizens can vary (Belanger & Hiller, 2006; Belanger & Carter, 2008). Proper balance between governmental secrecy and open government is at the forefront of contemporary public debate. Citizens have different degrees of interest in and demand for governmental transparency (Piotrowski & Van Ryzin, 2007; Syväjärvi & Kaurahalme, 2010; Uzzaman, 2010).

The personalisation of services is important for good service provision, which can be guaranteed with different means of authentication. Personalisation is positively associated with the size of municipalities but not with e-government and policy innovation statements, nor with explicit political responsibility as regards the development of e-government (Homburg & Dijkshoorn, 2011). E-services and their different aspects have been widely dealt with (Hassan et al., 2011; Horst et al., 2007; Anthopoulos et al., 2007; Featherman & Pavlou, 2003). Risks have to be assessed during the application process (Featherman & Pavlou, 2003) but it is equally important to evaluate the risks and find the circumstances and aspects that concern e-services (Hassan et al., 2011). The citizen using the service is an important gauge (Horst et al., 2007). The digital divide and the bringing of services online cannot compromise the principle of equal treatment. Rather, a different type of digital divide "may continue to exist if counties with less wealthy citizens cannot find ways to overcome barriers to increasing their level of e-government service offerings" (Baird et al., 2012). In a situation where everyone might be without the resources to use Internet-based services, traditional, i.e. non web-based ways must be guaranteed. It is important to analyse the different factors which affect citizens using the web on a wider scale, including Internet culture and communication through the websites of different institutions. The success of e-governance is related to the level of communication through one's own website (Fawkes & Gregory, 2000). Trust in e-government websites is positively linked with information, system, and service quality. The quality constructs have different effects on "intention to continue" using the website and "satisfaction" with the website (Teo et al., 2009). The nature of usage (active versus passive users) may help us better understand the interrelationships among the success dimensions. It is important to consider the role of trust as well as various website quality attributes in understanding e-government success (Teo et al., 2009).

Government Internet portals such as Citizen Portal, which have also been used in Estonia, must be a common web space for serving the citizens. From the rhetorical possibility of e-government (Moon, 2002) has evolved the fact that a common electronic space must be present in order to guarantee successful

e-government. In fact, portals could be seen not only as channels for providing government information and services, but also as powerful tools for exchanging information and knowledge between different social actors and government entities and for facilitating participation in collective decision-making efforts as regards important public affairs (Sandoval-Almazan & Gil-Garcia, 2012). The relative effort and performance in developing local e-administration needs to be identified based on the particular socio-economic characteristics of the communes (Attour-Oueslati et al., 2007). There must be well-organised feedback about the use of electronic communication in the chain of communication between citizens and the public sector. Furthermore, it is important to measure the involvement of citizens in order to assess citizen-government engagement in a variety of areas (Cassell & Hoornbeek, 2010).

E-governance has introduced new dimensions into the concept of trust and therefore has been broadly discussed (Corritore et al., 2003; Welch et al., 2005; Carter & Bélanger, 2005; Bélanger & Carter, 2008; Teo et al., 2009; Cassell & Hoornbeek, 2010; Bannister & Connolly, 2011). Some results of this examination suggest that the expectation that technology-enabled change has the ability to increase the trust of citizens, thereby transforming governance, may be too high, but that further research is required (Bannister & Connolly, 2011). The involvement of citizens in the web is in correlation with trust in information technology on a wider scale. New web possibilities create a new level of communication, service provision and consumption, but the issues of trust and privacy must be overcome. Trust is emerging as a key element of success in the on-line environment (Corritore et al., 2003). The accessibility of services has a lot to do with the interoperability and communication between systems. Among the defining purposes of e-government, highly agile, citizen-centric, accountable, transparent, effective, and efficient government operations and services have high rank (Scholl & Klischewski, 2007). In order to reach these goals, the integration of government information resources and processes, and ultimately, the interoperation of independent e-government information systems appear essential (Scholl & Klischewski, 2007). Interoperable systems are inevitable in developing an e-LocGov model. Communication between different databases and reciprocal exchange of information allows optimising the work processes and avoiding the duplication of data. The field is related to creating effectiveness as regards e-governance; research has focused on analysing the risk factors and the readiness of the organisation. Improved interoperability between public organisations, as well as between public and private organisations, is of critical importance for making digital governance more successful (Gottschalk, 2009).

The acceptance of technologies depends greatly on software implementation and its success. In this research, software implementation plays a significant role in regards to implementing paperless management in local governments. Therefore, different learning options for software implementation have been widely observed. It is important to connect the phases of implementation with the convenient possibilities for study (David et al., 1998; Evans et al., 2006;

Taylor et al., 2007) where the use of e-learning methods has already shown good results. However, it must be admitted that the creation of an infrastructure for e-learning is not easy and technology itself can become the biggest obstacle (Phusavat & Anussornnitisan, 2007; Ayere et al., 2010). It is possible to create a very cost-effective learning system for the future by applying and adjusting policies and strategies (Langford & Seaborne, 2003, Valderrama et al., 2005; Uhomoibhi, 2006) related to e-learning. The frameworks in today's world create many possibilities, for instance WEB 3.0 creates new limits (Giannakos & Lapatas, 2010) driving the evolution of the current Web by enabling users to find, share, and combine information more easily.

A new level of services and the expanded ways of offering/consumption have become universally used. It is not known how the new level of services improves the quality of work and life because it requires feedback using the help of corresponding measuring techniques. The measuring and evaluation of the effectiveness of services is, to a great extent, in developmental difficulties, and thus a widely discussed field (Gouscos et al., 2007; Halaris et al., 2007; Rotchanakitumnuai, 2008; Steyaert, 2004; Heazlewood, 2010). The evaluation of success in the effectiveness of e-governance and rendering services is difficult because different parties working together often have contradicting interests. The organisation certainly needs methods for evaluating its activities. Today, the metrics of satisfaction and availability are considered the most when evaluating e-services; it is even possible to apply marketing model principles (Steyaert, 2004) in their evaluation. E-GOVSQUAL-RISK model has been proposed for measuring the quality of services and risk prevention (Rotshanakitumnuai, 2008) and a framework for the evaluation of the performance and quality of one-stop services (Gouscos et al., 2007). The e-LocGov model of this thesis offers its own preliminary metrics, which were initiated in 2011. The long-term goal of my work has been to describe the criteria for measuring the digital performance index of local governments, where initial studies have been carried out. One main goal has been to develop common criteria for measuring the digital capability of local governments after the implementation of paperless management by using the developed evaluation criteria. The work is ongoing in this field: the current thesis primarily presents the initial information about the developed and implemented solutions.

The evolution of e-governance should be taken as an expected change of process, whereby local governments have to either a) adapt to changes or b) dissolve during a possible administrative reform. From the point of view of Estonia's administration level, it could be possible to minimise resources to the extent that only information desks are left in the administrative units and the county administrations could even cover 4-5 administrative units due to short distances. Nevertheless, the e-LocGov model proposed in this work offers a chance to adapt and reorganise the existing processes, since the purpose of information technology is not (only) to replace people.

1.2 EDRMSs in Governmental Processes

The connection between information governance and the management of organisation processes and workflows, along with digitalisation, has been a clear trend in recent years. Digital information is currently mostly perceived essential, but also difficult to manage. The main aim of EDRMSs in the public sector is to store, manipulate, diffuse, and preserve knowledge in order to achieve the effectiveness of e-governance. Electronic document management plays an important role in contemporary e-government applications and technologies. A flexible and adaptable document management system is needed in order to cope with the modern challenges that authorities and decision-makers are facing. These include issues such as increasing the efficiency and quality while decreasing the duration of government processes. Document management systems are also used to ease the communication between different parties: citizens, officials, contractors, decision-makers, and many more (Sar & Wong, 2012). These systems provide structure and organisation to an authority's documentation relating to the shared processes and activities (Deloitte, 2011).

Defined standards and regulations are needed to increase the efficiency and transparency of the administration activities of governments. Furthermore, these are particularly important as up to 80% of the day-to-day activities of officials are "of routine in nature and workflow driven" (Kumar, n.d.). Estonia's Government Office has defined regulations on standards, procedures, methods, and products to assist the modern IT-evolution processes (Government Office, 2002). These standards are set to ensure the development of wholesome, authentic and reliable document management and information systems. In addition to Estonian regulations, the European Union project, "Model Requirements for the Management of Electronic Records" (MoReq) (DLM Forum Foundation, 2011) also defines the basic requirements for document management. The list of provided requirements is very detailed and based on the ISO 15489 standard (International Organization of Standardization - ISO, 2001). In addition to the requirements for EDRMSs, MoReq defines the criteria for document functions, e.g. workflows, email and electronic signatures. The specification solely specifies the requirements and provides no implemented solution as we do. Furthermore, the "Document Management and Electronic Archiving in Electronic Courses of Business" (DOMEA) concept (KBsT, 2005b) is the basis of the German Government for achieving the goal of a paperless office. Particularly, DOMEA introduces the concepts and criteria that should lead to paperless offices in the administrations. The three-pieced modular structure of DOMEA consists of documents, records and files. In contrast to EDRMS Amphora, the issues of hierarchical process execution and security in the distributed process execution are not addressed. At the Estonian level, there are many regulations (Public Information Act, active since 2001; Personal Data Protection Act, active since 2003; General Procedural Actions Act, active since 2001; Administration Procedure Act, active since 2002 (Riigi Teataja, 2001a; 2001b, 2002, 2003)), which coordinate the use of electronic document

management systems. A closer overview of these regulations will be given in the following sections.

This section provided just a short insight into the literature on electronic document management systems. Although, electronic document management systems are broadly discussed, not much is written about how document management systems can be basic working stations and main platforms for governmental institutions moving towards e-governance. Still, there are many research projects conducted in the discipline of records management and the modern view of archiving as an integrated, dynamic part of a business. However, this research shows that EDRMS can be used as a basic work platform in local governments. It should be admitted that the field of document management systems is wide and the scope of this research is based on the need to use these systems as a basic managerial tool in local governments.

2 RESEARCH DESIGN AND METHODS

The following sections will explain the approaches considered and used throughout this research. Considering that the aim of this research has been to determine the possibility of fully digitalising the work of local governments, offering citizens high-quality e-services, and bringing about organisational changes in the span of ten years, exploring various development approaches has been necessary in the course of the research. Hence, this work employs a combination of several research strategies including action research, design and creation, case studies and surveys. Below, different approaches will be examined as research directions taken over the years.

2.1 Considerations for Research Approaches

Different approaches have been explored as a research direction in order to formulate research questions in an operational – or in some cases – a rigorous way. While in the rigorous way the research questions are well defined, in the operational way it is possible to use feasible means to adapt and choose an adequate research method in order to execute the research process until the valid and useful outcomes have been produced, e.g. new knowledge and possible artefacts including computer-supported systems (Oates 2006). In new developments and research projects it is not always possible to identify the major parts of the problems in a single way. Soft System Methodology (SMM), however, is a system approach that is used for analysis and problem-solving in complex situations, where "systematic thinking" is used in a cycle of action research, learning and reflection in order to understand the various ideas and perceptions involved in the situation. This approach is applicable in many domains, including change management, information system planning, human resource management, and expert system development. It seeks to explore the problematic situations that arise from human activity. Soft systems strive to learn from the different perceptions that exist in the minds of various people involved in the situation (Andrews, 2000). Checkland (1999) has attempted to transform these ideas of system theory in to a practical methodology. SMM may be used to analyse any problem or situation, but it is most appropriate where the problem "cannot be formulated as a search for an efficient means of achieving a defined end; a problem in which ends, goals, purposes are themselves problematic" (Checkland 1999, p. 316).

Immediately suitable solutions are nearly impossible to develop due to the constant societal changes in the background and hence initially the action research principles (O'Brien, 1998)[6] were used in the early stages of this research. This approach is suitable for the study of an introduced social process

[6] "If you want it done right, you may as well do it yourself." More and more people are beginning to realise it can also apply to large corporations, community development projects, and even national governments. Such entities exist increasingly in an interdependent world, and are relying on Action Research as a means of coming to grips with their constantly changing and turbulent environment.

and its diffusion over time. The action research approach highlights a line of "social enquiry" (Baskerville, 1999, p.5), a proposed framework through the e-LocGov model in a bounded social which sets rather than undertakes the research from a more positive perspective. The differences between the objectives of positivistic science and action research could also be compared (Susman & Evered, 1978). As this thesis covers research activities conducted in the time span of ten years in the aforementioned rapidly evolving research fields, there are some unavoidable dynamics in the approaches taken. The interpretation of the work results has been largely based on the feedback and evaluations received from local governments based on which viewpoints and personal convictions are formed.

Various data handling methods have been used where main input has been obtained from the interviews and questionnaires carried out in local governments. The viewpoints presented here may not be scientifically (including quantitatively) proven, but on the basis of action research logics, the gradual changes of local governments, as a result of research, are in accordance with the changes in the societal processes. From this point of view, action researchers should be able to enact a process based on a declared-in-advance methodology that incorporates a particular framework of ideas so that the process could be retrieved by anyone interested in subjecting the research to critical scrutiny. A "declared-in-advance methodology" aids researchers in their ability to demonstrate the "recoverability" of an action research study that, while not able to make claims of scientific replicability, makes a much stronger case for validity than the mere "plausibility" of a story (Checkland & Howell, 1998). The validation of the results could be based on the measurements carried out in local governments that reflect the changes therein (e.g. increase in the number of digitally signed documents) during the performed research and development activities.

The presented research meets the requirement for recoverability as well, "to declare in advance the epistemology in terms of which a piece of AR will acquire what counts as knowledge" (Checkland & Howell 1998, p.18). Diagnosis, planning, and assessment are critical activities in the action-change process, which are linked to each other. These conditions require the researcher to diagnose the organisational situation independently, plan for action that aims to improve organisational performance, and evaluate the outcomes of interventions (Davison et al., 2012). Constant and close cooperation with local governments and related state parties has faciliated research the results of which have been concluded in the form of the e-LocGov model.

In the design science paradigm in information systems research, "knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact" (Hevner et al., 2004, p. 75). According to Oates (2006), design and creation are particularly relevant within disciplines where the design and development of artefacts such as application systems and software have always played an important role. Thus, the question has been raised whether the development of an artefact could actually qualify as

a piece of research linking the developer to the academic degree. The answer by Oates (2006) is yes and no. The development of an artefact could be part of a research project, but the artefact as such cannot be the only output, it must be associated with other outputs in order give valuable knowledge to the academic field (Oates 2006).

An important factor is reducing the risk of developing systems that are eventually underutilised or rejected by users. It is common practice to obtain input from potential users in the early stages of the system development process. Some projects, which have been carried out for this research, can be described as the investigation of a longitudinal interpretative case study (Pettigrew, 1990; Walsham, 1993) that is based on extensive collaboration with local governments through various research and development projects between local governments and the researcher-developer (as an owner of Interinx Ltd). This approach allows us to analyse in detail how the adoption of e-governance principles has evolved over time and to link the findings to the theoretical debate around it. The current thesis gives a glimpse into an ongoing process of change in local governments in order to bring them closer to e-governance. The timeline and the related aspects of this paper's focus include punctuating (otherwise) relatively stable periods of evolution (Cho et al., 2006; Newman & Robey, 1992; Newman & Sabherwal, 1996). Over the years, the criteria for contextual, process-related and pluralist data have been applied to shift between personal experiences through involvement, documentary and archive data, observational material, and in-depth interviews. Knowledge has been gained from direct involvement in the improvement efforts in the field of local governments at different times and in different roles.

The neo-institutional theory[7] has been taken as one of the theoretical starting points of the thesis in addition to the above-mentioned research methods and theories. Through the theory, the possibility of innovation in local governments, the innovation process and the innovation system and the nature of technological interoperability are viewed. The application of the theory, particularly at the very start of the project, may be counter-productive (McTaggart, 1991; Bunning, 1995). As noted by Cunningham "the researcher cannot always know definitely and in advance the exact theory that will be used or developed" (Cunningham, 1993). The increased centrality of e-government in the modernisation of public administration has led to several predictions concerning the changes e-government will bring about, ranging from overly pessimistic to overly optimistic (Bekkers & Homburg, 2005). It should be mentioned that new governmental institutions will widely change the infrastructure. This thesis originates from the starting point of where ICT capabilities have been extremely low in local governments. Many years of work are connected to the management

[7] Neoinstitutional economics is an interdisciplinary approach that encompasses law, organisation theory, political science, sociology and anthropology to understand how social, political and economic institutions work and how the management of changes takes place.

of changes in the organisation and the analysis of opportunities, and how to better cope with changes.

However, many dilemmas exist regarding social sciences. According to Oates (2006), within the natural sciences the physical world exists in an objective way, independently of the existence of human beings, and it can be explored by objective observations, measurements, and experiments. The positivistic world view has dominated for a long time and this research approach has been extremely successful. Nevertheless, there are still explorations to do in social sciences. Social researchers tried to study the socio-economic aspects of our world, first using, by analogy, the same research methods that had proved to be so successful in the natural sciences. Sometimes such studies were successful, but more often they turned out to be problematic (Oates 2006). However, overcoming these issues has been a challenge in this research. According to Oates (2006), so far no single research method has established itself with such power, acceptance, and obviousness as positivist methods have within the natural sciences. Generally, there is a continuous quest to find research paradigms and research strategies that are more suitable for social research. Hence, using combinations of different research strategies can help overcome this gap.

2.2 Research Design

The practical outputs of this thesis are created on the basis of different development projects where the theoretical starting points have been validated by implementing concrete systems. The results of this thesis have emerged from different projects[8]. As was mentioned before, the research design here combines different research strategies such as action research (with different derivatives based on AR), design and creation, surveys and case studies.

The research reflects the hypothesis in the research questions. Hypotheses are typically used in logical positivist research, hence, in this research the term hypothesis can be equated to research questions. However, the hypotheses may be reformulated as research questions and vice versa. This thesis proposes research questions for which the answers are generated by employing the methods described below. Nevertheless, the essence of it has remained the same: is it possible to enforce e-governance in local governments by implementing paperless management using EDRMS to ensure interoperability with all necessary parties? The basic platform for dealing with the question is built upon EDRMS Amphora. This choice was made because of the possibility of taking over the aforementioned system from a previous developer, which provided the preconditions for conducting the research. The development of the EDRMS system started in accordance with the analysis of the needs of local governments.

[8] Many of them have been financed by the Estonian Information System's Authority, i.e. DEC, SODI, and financial software Pmen integration with EDRMS Amphora. One project, which was financed by SF funds, is presented in Appendix A, together with two case studies that will be discussed in this thesis.

After the first cycle of implementation, evaluation, and feedback, the system was expanded to include a wider functionality and integration with other systems as well as business processes. At first, all the requirements of the system were unknown. Immediately suitable solutions are often nearly impossible to develop due to constant societal changes in the background, and hence the action research approach facilitated a wider interpretation of this field. The restructuring points emerged with changes, which affect the behaviour of the organisation on both a small and a large scale.

As action research can be used particularly by professionals who want to investigate and improve their own working practices, this participative approach suited the research activities. Considering the fact that this field of research has developed mostly through practice, action research (AR) methods have proven to be useful in the process for understanding the needs of local governments. AR has had a growing interest for many years and it has gained more legitimacy within IS due to important compilations (Kock & Lau, 2001; Baskerville & Myers, 2004; Kock, 2007). Action research has been used in real situations, rather than in contrived, experimental studies, since its primary focus is on solving real problems. However, some of the downsides related to action research are that artefacts are not a primary goal in research projects which have been an important focus in this research. According to Oates (2006), sometimes action research projects may not lead to practical achievements, even if they are deemed successful by academic researchers.

The use of the action research approach is at once a dynamic force of change within the social setting as well as a highly effective method of studying and evaluating this change. It has been a very effective tool for answering the research questions, because these principles are iterative in nature (repeated cycles), have a rigorous and well-articulated structure (definition of researchers and subjects, qualification of their actions in the context of the study, definition of the benefits and boundaries of the research, entry and exit of the researchers), are collaborative (the researcher works closely with the subjects), and add both to the development of the organisation and the body of knowledge about the phenomenon under study (McKay & Marshall, 2001; Susman & Evered, 1978). The action researcher serves at least two demanding masters – the client and the academic community (Kock et al., 1999). However, a doctoral thesis has only one demanding master: the academic community although some research activities has been initiated by people in different roles. Several activities have been initiated by an entrepreneur in the role of the executor and the client as well as a researcher searching for answers, all of which has influenced the different dimensions of the work.

As an advancement of action research, the canonical action research (CAR) principles have also been utilised where the CAR Process Model (Davison et al. 2004) was initially occasionally followed (see Figure 2). Although, in their later work the authors criticised the model (Davison et al. 2012), in current research this approach met the expectations.

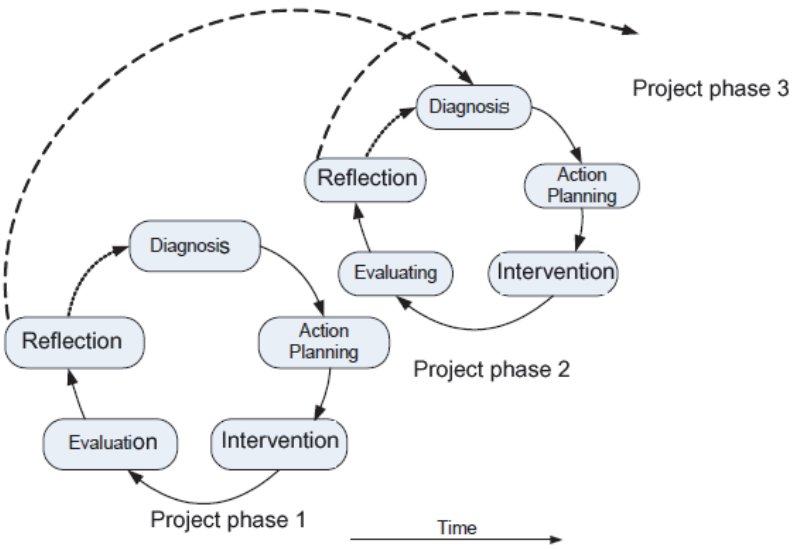

Figure 2 The research and development cycles modification based on CAR Model (Davison et al. 2004)

Development and research activities have taken several years (activities are pointed out in Figure 3), where all-encompassing development principles of the research have been highlighted on the figure below (see Figure 3) following the logic of the CAR model.

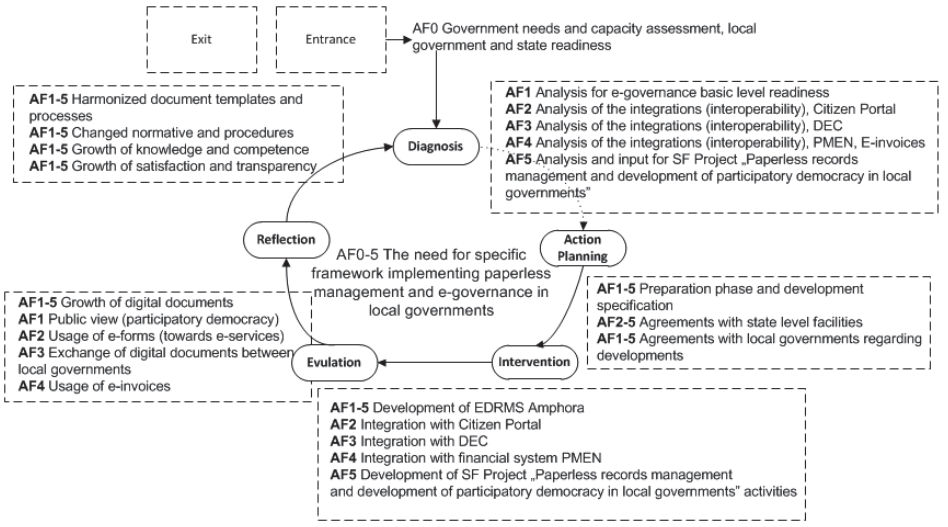

Figure 3 Research and development activities in 2003–2011

It should be mentioned here that when talking about different IT domain approaches, design research (DR) has prominent research approaches in the information systems subject area. In compliance with Goldkuhl, these two research approaches (AR and DR) have been claimed to be similar according to several conducted comparisons (Goldkuhl, 2012). In many cases there is a need to choose between AR and DR or to use them jointly (Goldkuhl, 2012). His paper also offers a third option - practice research (Goldkuhl, 2011; 2012).

According to Sein et al (2011), existing DR methods focus on building the artefact and relegate evaluation to a subsequent and separate phase. In their research, the action design research (ADR) has been proposed as a new DR method to address this problem (Sein et al, 2011). ADR reflects the premise that IT artefacts are ensembles shaped by the organisational context during development wherein the use of ADR is an extension which takes artefacts into account. Typically, in AR, the artefacts are not included as a primary goal, because it is focused more on societal concepts. During this research, the full spectrum of AR has been used as a foundation, but ADR takes into account the element of the artefact, which clearly states that the research design in this work applies to ADR (see Figure 4 below). In the IT dominant, the artefact is important, however, the research here focuses on the organisation dominant as well – the organisational changes that the artefact causes. Overall, current research focused a lot on organisational re-engineering.

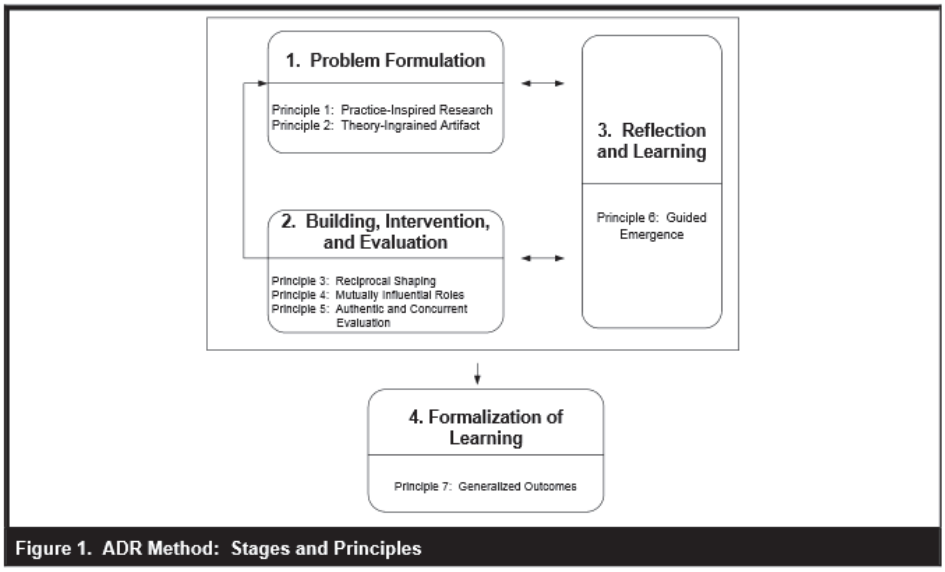

Figure 4 Action Design Research, Sein et al 2011

ADR is a research method for gaining prescriptive design knowledge through building and evaluating an ensemble of IT artefacts in an organisational setting (Sein et al, 2011). The stages in ADR methods (see Figure 4) are appropriate in research where the developed IT solutions generate organisational changes and

influence the new development needs after implementation. According to Sein et al (2011) there are many factors which keep AR and DR conceptually apart even when the two are used as part of the same research process. Iivari (2007b), research proposes the two-step approach 1) designing an IT artefact through DR and 2) evaluating the artefact through implementation in an organisation via an AR project. This research demonstrates clearly how an IT solution has emerged and been constantly updated through time – from inner local EDRMs becoming an organisational tool to achieving paperless management on every level. First, outcomes raised the need for constant development and expansion.

A survey is a suitable research strategy when there is a need to collect a relatively small set of well-defined data, facts or opinions (Oates, 2006). The researchers may study all of the population or a subset of it (here: local governments) in order to use statistical methods to draw conclusions by analysing the given data. Data collection, for obtaining input for the research and development, has been carried out systematically: by analysing sectorial legislation and standards, by carrying out questionnaires and interviews within local governments, and by organising information days and roundtables (focus groups) to collect the necessary input data. In many cases, the generalisability of the results from the interviews has been evaluated based on their natural generalisability. Furthermore, university lecturers and researchers were engaged in this research. Through these activities, it was possible to collect a diverse and rich selection of data from a variety of sources spanning a relatively long period of time. Some aspects of this data collection should be stressed here:

- Most of the data came from direct involvement in many research projects over the years. This direct participation explains a possible bias in selecting and interpreting data.
- Some of the data draws on interviews with various parties (local governments, other researchers, public sector facilities) in which the interviewees were asked to retrospectively reflect on the importance of adopting EDRMS and paperless management. According to Yin, the use of retrospective data in process studies is quite common; it involves the risk that the interviewees have forgotten or rationalise what originally happened (Yin, 1984). To reduce the effect of this occurrence, advantage has been taken of our access to many different complementary sources in order to triangulate findings.

During this research, case studies have had a significant role. As a case study focuses on one instance to be investigated (an organisation, an information system, a project, etc.), in this research case studies provide valuable output as they take place in a natural setting and not in artificial situations. A case study makes an in-depth investigation of a phenomenon, looks at the chosen case within its real-life context, taking into account all the factors, issues, politics, processes, and relationships that constitute the messiness of the real world (Oates 2006). In this research, several case studies were conducted (based on Raplamaa County) through which some insight has been gained for obtaining

knowledge which could be generalizable in other situations or expanded into other projects in the same field. The scope of this research has been ambitious in order to change and improve the work environments of local governments by bringing them closer to e-governance with the means of the application of software and organisational change. Problems have been constantly mapped in order to evaluate obstructive details in the research process. Furthermore, a continuous comparison between problems and the effectiveness of developed solutions has played an important role. Every preceding solution to a problem has been the input for the following action. That has subsequently influenced the use and validation of such various research strategies in order to achieve the results in this research.

3 DOMAIN ANALYSIS

This section gives an overview of the development needs of the local governments upon launching paperless management via EDRMS Amphora, and of its interoperable systems. Increasing the efficiency of local governments through paperless management will be discussed by reflecting on the activities of the entire organisation (Pappel, Pappel & Saarmann, 2012b). This overview explains the preliminary requirements for local governments through research activities that design the functionality of the common framework. It will be explained how we defined the needs and requirements for EDRMS Amphora and its interoperability and implementation necessities for local governments. Research was done in an environment where the specific requirements regarding the typical software development process could not be fixed. Instead, our approach was to define the **AsIs** situation trough the defined **ToBe** necessity as seen in Table 1. I have played various roles in this research and most of the basic problems requiring solutions have been worked out with my direct involvement. Being an entrepreneur has given me the chance to put all the knowledge I acquired during my studies at Tallinn Technical University directly into practice. The following sections give some insight into the activities for achieving our framework.

Table 1 Design of the research framework

Dimension	AsIs	ToBe	Activities	Results[9]
Technological	EDRMS is used as a document registry not as a paperless management tool	EDRMS should be the central work station for local governments	Mapping needs of local governments	Functionality of EDRMS Amphora
	Citizens are not electronically involved in decision-making processes	EDRMS public view should allow to involve citizens, also e-services should be developed	Transition to e-services Developing Participatory Democracy through EDRMS	A unified and developed set of e-services, common principles and repository for describing services
	Interoperability between systems is non-existent or insufficient	If using EDRMS as a basic work-station, it should be interoperable with other systems; the re-use of data needs to be added	Improving communication through interoperability	Integration of EDRMS Amphora including interoperability and cross- and re-usage of data

[9] Results will be presented in next sections

Organisational	Knowledge of how to implement e-governance is low	Awareness through common rules and principles should be developed	Analysing problems and restructuring work procedures	The description of the processes in the form of Local Government Systems consisting of the technological part and the processes for implementation
	The problems of local governments should be solved in a centralised way	Joint development projects which should be based on EDRMS	Implementing EDRMS as a platform	State funded projects for the whole community
Human resources	Knowledge regarding e-governance is very low	Common principles based on EDRMS should be developed and described	To find out how to improve awareness of paperless management efficiency	Local Government Systems are needed
	The implementation of EDRMS (and other systems) is difficult	The restructuring of work procedures is needed, including common principles for implementation process	Analyse problems regarding the implementation of EDRMS	Transition methodology based on implementation principles of EDRMS
Common rules with environment	A lack of developed procedures which are uniformly applicable to local governments	A framework should be developed based on EDRMS to enable paperless management to involve citizens and other parties in the decision-making process	Analyse the EDRMS efficiency in local government processes for present and future improvement	Framework in the form of the e-LocGov

In the next sections, it will be explained how research and development activities were processed and which considerations were taken into account when designing the environment for local governments.

3.1 Mapping the Needs of Local Governments

This thesis initiates a way of governing through the application of fully paperless management. The first prerequisite for a fully digitally managed local government is the digitalisation of their internal paper management. This would result in the ability of the local government to expand its digital communication outside the organisation. This should, in turn, allow for further transformation of services (i.e. the transition to e-services) through which a more effective way to serve citizens and entrepreneurs is reached. Hence, the assessment and analysis of the services has been considered. It is necessary to develop the methodology for describing public services and measuring satisfaction with them in order to assess the communication between the citizen and the local government.

As mentioned above, upon the commencement of our activities in 2000 the technological platform in local governments was insufficient for the implementation of paperless management. That exposed the need to develop technological solutions and analyse whether these are sufficient to ensure the transformation into e-governance. This has created prerequisites for new development needs and provided sufficient information for forming new developments. EDRMS Amphora has been developed on the basis of the specific needs of local governments (some initiatives are shown in Figure 5). At first, local governments required the ability to send, manage and transmit documents digitally. The necessity for interoperability with other systems arose from communication needs with external parties. During this development and research work, it was sought to develop a common implementation method of the new rules as well as to provide a more efficient application of paperless management. The starting points, which resulted in the research and development of local governments, were as follows (see Table 2):

Table 2 Problem formulation

Problem in the work routine of the local government	**Activity needed to solve the problem**
Internal document registry, metadata in Excel file and management of these existed only on paper.	Create central web-based repository of documents where it is possible to upload, describe and search documents. Access has to be effected according to authorisations.
Not possible to quickly find documents that were related to a problem that occurred several years ago.	The repository of documents has to enable the digitalisation of earlier documents and carry out different searches.
No overview of currently processed and unsolved matters and cases.	Digital workflows have to be possible: these should be monitored and have specific deadlines.
Services, forms, applications, petitions were only available on paper	An option for the citizen to fill in his/her petition by using a digital form and to forward it to a local government.

It was not possible to conveniently administer the (public) document registry located on the website. Pursuant to legislation, there is an obligation to make this document registry available for the citizens.	Internally used repository of documents has to be linked to the public document registry online, i.e. the document registry online is generated on the basis of the database of the internal document registry.
Not possible to manage tasks and deadlines, in some instances note boards are still used.	In the repository of documents, it has to be possible to determine tasks and mark persons responsible for the documents, which gives an opportunity to monitor the proceedings and deadlines related to the documents.
The initial materials and agendas of government meetings were compiled on paper. Upon preparing the meetings, there was no central overview of the draft acts that were to be discussed.	There has to be an option for digital preparation of a government meeting where all draft acts could be uploaded, coordinated and added to the agenda at the repository of documents.
Head of local government had no overview of the work and/or efficiency of the institution. It was not possible to assess the changes in the institution.	To create an environment that includes the possibility of statistical queries, in order to assess the work of the officials on the basis of determined criteria. There is a need for the creation of a feedback system.

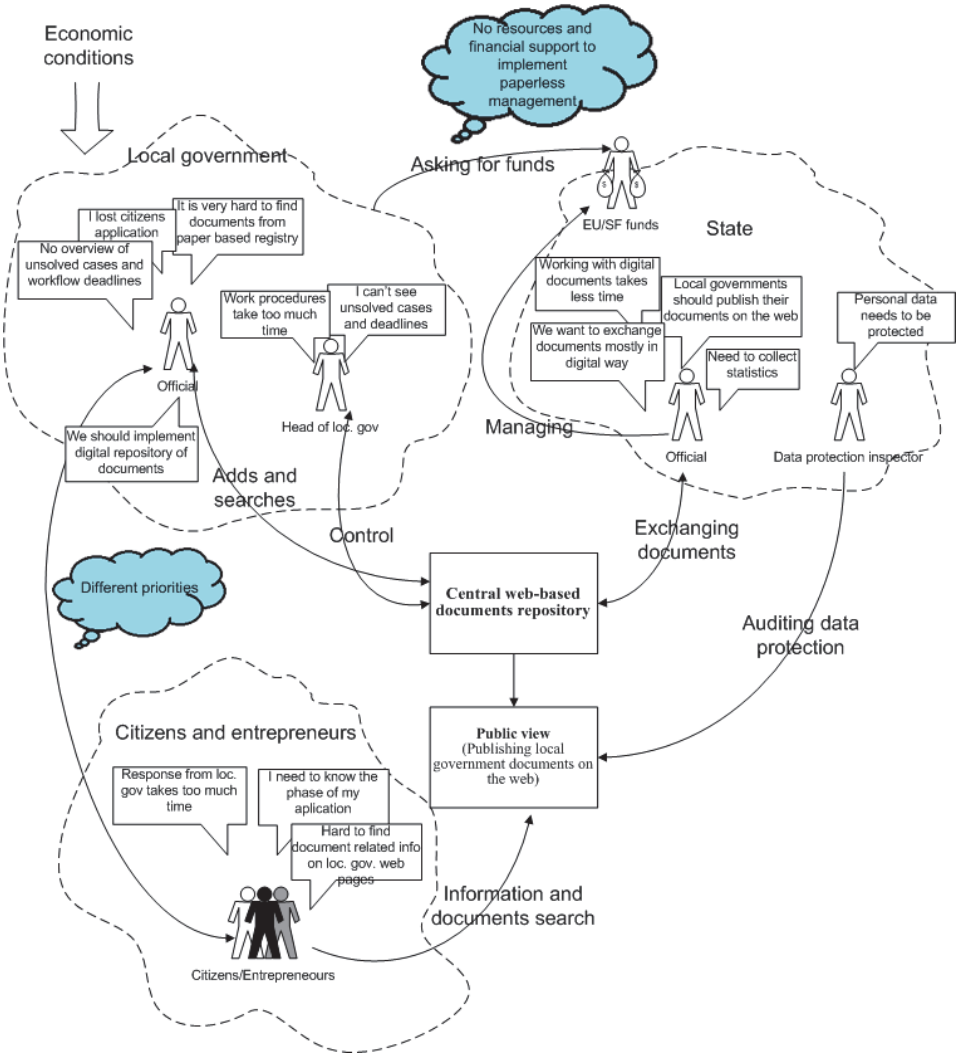

Figure 5 Using Rich Picture (SMM) to describe the main problems that serve as the starting points for this research

The input data for describing the aforementioned problems was obtained from local governments from 2003 to 2005 through the use of various methods. On-site interviews were carried out in local governments, various questionnaires were used both via the Internet and over the phone, and information days with the more active followers from local governments were organised. Examples of the methods used are provided in the following table.

Table 3 Data collection and analysis

Method	How it was carried out?	Example of a question	Data analysis
Interviews over the phone	3 to 5 questions were asked over the phone and the answers were written down in the given form	Is it necessary to preset AK restrictions upon publishing documents?	Summary in text form; the answers revealed the objective (will, desire) and the desired result (that evolves) of an official
Written questions	The questions were compiled in the form of multiple choice and yes/no questions	The system has to enable the automatic opening of an e-mail upon pushing the @ icon: yes/no	In order to manage the answers to these questions, an application was used to calculate the average statistics
On-site interviews	The interviews were carried out in local governments, during which the officials were questioned by using target groups for the questions related to their field	Do you believe that it is possible to digitally process the legislative drafts of local governments?	The method used to manage the answers given in the interviews, i.e. statistical data, was to work through the text and make conclusions
Work with state statistics	Studying the research carried out in the public sector among local governments	The number of local governments and its ratio to the number of officials working there	Various statistical indicators (frequency tables, including cross-tables, number indicators and number figures) that were analysed in the context of needs related to information technology

The obtained data have served as an important input for the specification of EDRMS Amphora developments, helping to make the needs of local governments more specific, both within the infrastructures as well as in their entirety. During the development of EDRMS, it was necessary to take into consideration the interoperability of a local government with all management-supporting systems – IT systems (including state registries and internal systems), people and knowledge. EDRMS cannot solely be an internal system. Certain social prerequisites have made the implementation of e-governance in local governments more effective:

- Local governments and local government associations were more active in specifying joint activities, role division and priorities in domain-oriented development actions. This, in turn, allowed for decentralised projects and joint activities upon the development of local governments.

- Since 2008, it has been possible to use structural fund (SF) resources to develop the information society related joint activities of the public sector and local governments (as it is shown in Figure 6). However, not all solutions that have been created using those means have promoted the local government units in becoming a consistent structure (Estonian Ministry of Economic Affairs and Communications, 2011).
- The awareness of local governments and their need for more service-oriented solutions was rising due to the implementation of improvements in several national registries in the public sector. This brought about the need to improve ICT in local governments when using new technological solutions. Several of those solutions are "forced", as local governments have to use such solutions without having the required technological platform.[10]

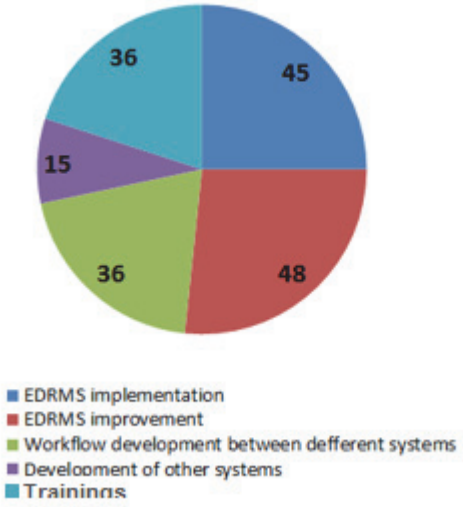

Figure 6 Usage of SF funds in development activities related to EDRMSs (% from named target groups)

This research is in support of the information technology development policy of the state for the better implementation of e-governance (see Figure 7), and proposes that the necessary environment consists of EDRMS and various IT systems with the required application methodology and feedback system.

[10] E.g. In the regulations on the common principles of administration, the requirement for the public sector was established to manage documents electronically, but no financial resources were appropriated for buying EDRMSs. SF financing mostly funded the improvement and development of the existing EDRMSs.

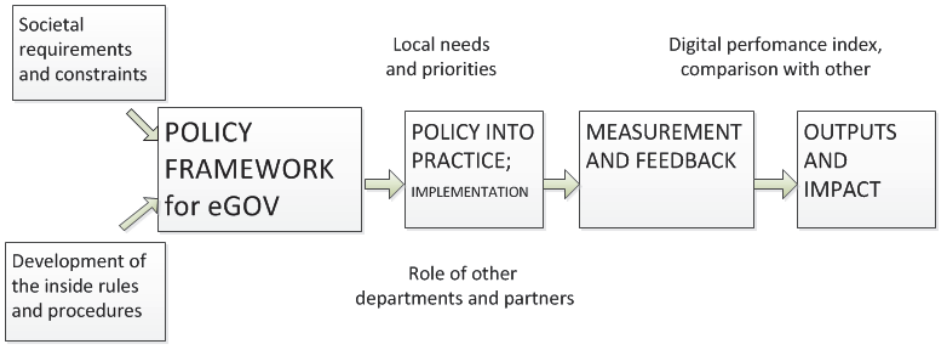

Figure 7 Dynamics of changes

3.1.1 Transition from Services to e-Services

Estonia is heading in the same direction as the European Union by adopting the strategies of information society and digital thinking (COM, 2010b; COM, 2010a). Local governments provide services for the residents: issue permits, pay benefits, monitor public maintenance and environment. Almost all cases of service provision presuppose the preparation of an administrative legislation for the specific application (Pappel & Pappel, 2011c).

In Estonia, a local government is composed of two bodies: an elected council and a government appointed by the council that is managed by a rural municipality or a city mayor. The basis of service provision is laid down by the council in legislation of general application or regulations, and the council also provides legislation of specific application or makes decisions to solve more important questions (Pappel & Pappel, 2011c). It is the responsibility of the government to make individual decisions regarding day-to-day activities, which are formalised as orders, and to provide legislation of general application and regulations for governing the work of the government (Pappel & Pappel, 2011c). Today, there is readiness on the local government level for digitalising document management systems and for using EDRMS as a central management system. Furthermore, EDRMS has become the main intermediary of services between the state and its citizens. In the early years, using EDRMS was a forced solution that enabled local governments to comply with the requirements pursuant to the Public Information Act[11], but today EDRMS has become an environment that is able to administer the work processes of local governments as a coherent entity. In the next sections the importance of EDRMSs will be explained more thoroughly.

[11] According to the Public Information Act, local governments have the obligation to maintain their document registry electronically and make it available to the citizens, including on the Internet.

The decision-making process of local governments is closely related to the provision of services to citizens as many decisions are based on the needs of the citizen. A local government may provide services to citizens in several ways:

- On the spot; this has so far been the traditional way and will also be employed in the future. A citizen can perform the necessary operations in the office of their local government.
- Through the State Portal, www.eesti.ee that allows certain target groups to consume services through authentication in a single environment, regardless of their location.
- Provision of e-services via the public interface of EDRMS that allows certain target groups to consume services through authentication on the website of a specific local government and monitor the procedural steps related to them.

Describing services and taking them to the electronic level is undoubtedly an growing trend. According to the Survey of Electronic Records Management in the Public Sector Agencies of Estonia (Estonian Ministry of Economic Affairs and Communications, 2011), the main obstacle in the way of creating and developing e-services is the lack of funds (26% from all the obstacles). This is followed by difficulties in changing habitual activities and a lack of skills and knowledge. Every tenth institution that participated in the survey did not see problems or obstacles in developing new e-services. In order to further develop paperless management and e-services, it is important for the institutions to "leave their comfort zone". For that, they need to be provided with knowledge, skills and financial support, especially as regards smaller institutions, such as local governments. In order to further develop e-services, it is clear that the main principles must be agreed upon to achieve a smoother transformation from one level to another (see Figure 8). In the process of transitioning into e-governance through various activities and the wider application of e-services, a greater conflict between technology and organisations appears. This, in turn, can affect the basic values; thus, the public sector organisations and citizens can become disgruntled.

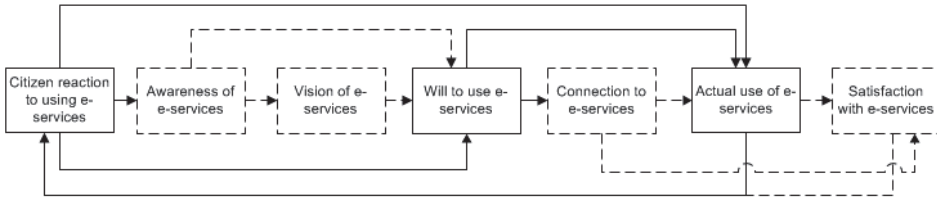

Figure 8 Service transformation and acceptance process

However, a way of thinking where the provision and consumption of services is taken to the level of e-services is becoming increasingly prevalent. A clear articulation of the concept, nature, boundaries, components, and elements of e-services is necessary in order to better understand the e-service research and to

manage e-service in the public sector (Hassan et al., 2011). The application of new methods requires the assessment of the wider impact, yet in the context of information technology, changing the form of service provision is inevitable. In Estonia, the transformation into those solutions is enabled by deep-rooted authentication systems and openness to innovative solutions. One of the key success factors could also be our small population that facilitates better central implementation. Estonia's approach and methodology might not be implemented in the same way in other countries. It could be difficult to transfer the entire technological platform in its fundamental form as the legal frameworks and traditions of the recipient countries may differ significantly.

In addition to the above, the trust of the citizens should be considered as an important key element. According to Teo et al. (2009), e-government adoption can only take place when the citizens have a high level of trust both in the government as well as the Internet. Developing and implementing new e-services should be considered only if the citizens believe these to be trustworthy (Horrigan, 2003; Van Dijk et al, 2006; Belanger & Carter, 2008). Thus, increasing trust and analysing the key factors is required in order to create the environment for developing and introducing new e-services. However, in Estonia, the Internet and various IT solutions are generally well received and, therefore, problems with trust are less prevalent.

Nevertheless, the adoption of new methods of service provision by citizens and service consumers is dependent on several factors. According to Anthopoulos (2007), the strategic plans of governments are political, directed at cost and time minimisation during the execution of public services. Such plans do not necessarily take the citizen's needs or public administration operating procedures into consideration. According to Anthopoulos, although these plans have led to the development of projects that have succeeded in cost and time savings for both citizens and public administration, surveys conducted around the world show that users evaluate digital public services and do not hesitate to return to traditional methods rather than using digital channels to transact with the public administration again. Neither would they recommend the use of digital services to others (Anthopoulos et al., 2007).

3.1.2 EDRMS as a Platform for Transparency

The governance process of local governments has to be transparent and, therefore, one of the most important functions of EDRMS is the creation of information availability. This is provided by the EDRMS public interface (EDRMS public view) that grants access to the document registry of the local government. Estonia's public sector authorities have a legally binding obligation to maintain electronic document registries and make them publicly available and accessible. Access to documents has to be ensured for all interested parties through the use of both electronic and physical channels. The choice of channel depends on the format of the data medium. This obligation makes management more transparent, which in turn creates the premise for more effective application of e-democracy, offers "good management" and better service

provision to the citizens. However, an understanding of what is meant by e-government is still emerging and complicated as the concept can have different meanings. According to Grant & Chau (2005), consequently, the conceptualisation and implementation of e-government programmes are diverse, and often difficult to assess and compare across different contexts of application.

Although the scope of e-governance may be broad and it may prove difficult to delimit it unambiguously, the primary platform in this research has been the implementation of paperless management. The digitalisation of the internal document management of institutions has to be instigated through the means of EDRMS. That is followed by addressing the external communication of institutions, which involves all the relevant parties in the decision-making processes of local governments. The proportion of different information technology solutions in the management area of e-governance is quite large (Kaurahalme, 2011). Still, the first level of the application of e-governance trough paperless management must be the implementation of EDRMS. There are high demands for the functioning of EDRMS that are governed by various national and international legal acts[12]. In the earlier years, EDRMS was used for managing the internal communication of an organisation. By now, the former internal communication tool has evolved into a system that, on the one hand, is the electronic memory and knowledge base of the organisation, and, on the other hand, is the tool for managing different processes both in and outside the organisation. This ensures the implementation of the main principles of e-governance and helps overcome the gap between the IT and management sectors. These two principles have started coming closer together in recent years and various development plans for the information society have created further possibilities for mutual cooperation.

From the perspective of the citizens, a situation has evolved where transparent management has to be in accordance with their fundamental rights, including freedom of information, openness, e-democracy and e-participation. On the EDRMS level, this is regulated by the necessary authorisation system that eliminates the transmission of the personal information of a citizen to unauthorised parties. On the software level, personal data has been handled in such a manner that the external parties can only see the minimum required part of the information. Therefore, the authorisation must be thoroughly considered. A set of rules for the internal data handling of a local government must exist. Access to documents contained in EDRMS has to be justified by the local government officials. When constructing the access hierarchy of the users, it is necessary to monitor the relation of the respective officials to specific fields, and the relation of a specific official to the field of work in question. It is possible to determine all the required accesses and authorisations in EDRMS Amphora. It is important to follow disclosure requirements pursuant to the Public Information Act. The officials responsible for disclosure have to be competent enough to know how to add the necessary access restrictions. The issues with the

[12] Requirements for EDRMS by State Chancellery 2003, ISO 15489, Moreq, etc. These documents establish requirements and standards implementing paperless management

disclosure of excess information are in some cases tied to the inexperience of an official and not due to the insufficient functioning of EDRMS. Using that functionality in a proper way should close the gap between these problems.

Additionally, in order to ensure more effective communication between local governments and citizens, it is necessary to pay attention to the issues related to the quality and usability of the websites of local governments. Recommended requirements for the quality of IT solutions, as regards the public sector websites, have been laid down to conform with the international Web Content Accessibility Guidelines (WCAG) standards. These guidelines will make the content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these. Following these guidelines will often also make the Web content more usable to users in general. Adapting these guidelines would be more effective, if these requirements were simple and understandable to everyone. As these guidelines are very detailed and technical. In addition to accessibility, user convenience is an important issue for every website and all the more in the case of public sector websites. As in many other fields, it is also possible in the case of web solutions to measure everything, including quality. Conformity with the WCAG accessibility standards is one of the cornerstones of the quality of websites, and there are various control questionnaires and other means for evaluating this. Hence, the problem here is not the lack of means but rather the prejudices and limited knowledge of the parties concerned. Opportunities have been created for participating in training sessions on accessibility and user convenience. An overview of the requirements of WCAG standards and best practices of user convenience is given, but it is necessary to have better connectivity due to the specificity of local governments.

3.1.3 Engagement of Citizens into Decision-Making Processes

The involvement of citizens in the decision-making processes of the local governments has been an important factor in the field of e-governance. Communication between local governments and the citizen has an important role in achieving the transparency of governance (Syväjärvi & Kaurahalme, 2010; Uzzaman, 2010). Interaction and communication between the state and the citizens have to be built on trust (Carter & Belanger, 2005; Grimmelikhuijsen, 2012). In order to involve citizens in the decision-making process, there has to be mutual trust between them and the government. Increasing people's awareness by providing factual knowledge about government performance outcomes is seen as an important way of increasing citizen trust in government (Grimmelikhuijsen, 2012). Furthermore, Grimmelikhuijsen has carried out many surveys where the growth in trust and governing transparency could make governing more efficient. His paper, *Developing and Testing a Theoretical Framework for Computer-Mediated Transparency of Local Governments* (2012), researches the levels of transparency more thoroughly. The mentioned framework distinguishes three dimensions of transparency: decision making

transparency, policy information transparency, and policy outcome transparency. It also hypothesises three explanations: organisational capacity, political influence, and group influence on government. According to these results each dimension of transparency is associated with different factors (Grimmelikhuijsen & Welch, 2012). The state and the citizen have to co-exist. In the current stage, the changes necessary for a transparent decision-making process have become known and the main principles have been laid down to help organise the required changes. Although work is continuous during the transition period, as far as the transparent decision-making process is concerned, the main principles have become more developed in order to involve citizens.

Years ago, citizens had no proper means of monitoring the procedural steps taken by local governments. Receiving information regarding documents, cases and problems relating to local governments and citizens, as well using the electronic request for that, was not very accessible. It was complicated to monitor the course of proceedings and workflows regarding the documents and cases of the citizens. Difficulties arose in monitoring the work of the local government council and finding the necessary specific draft acts quickly, for example the development of detailed plans was very time consuming. Citizens could not participate in the decision-making process and it was very time-consuming to receive and send information requests. The tendency over the past few years has been to develop a participatory democracy – involving citizens in the decision-making processes of local governments via public interface. From the information technology perspective, this means the publication of draft acts and application cases to grant access to the citizens in the public interface of EDRMS, as can be seen in Figure 9 below. It is shown below how citizens can be involved in the decision-making process of local governments.

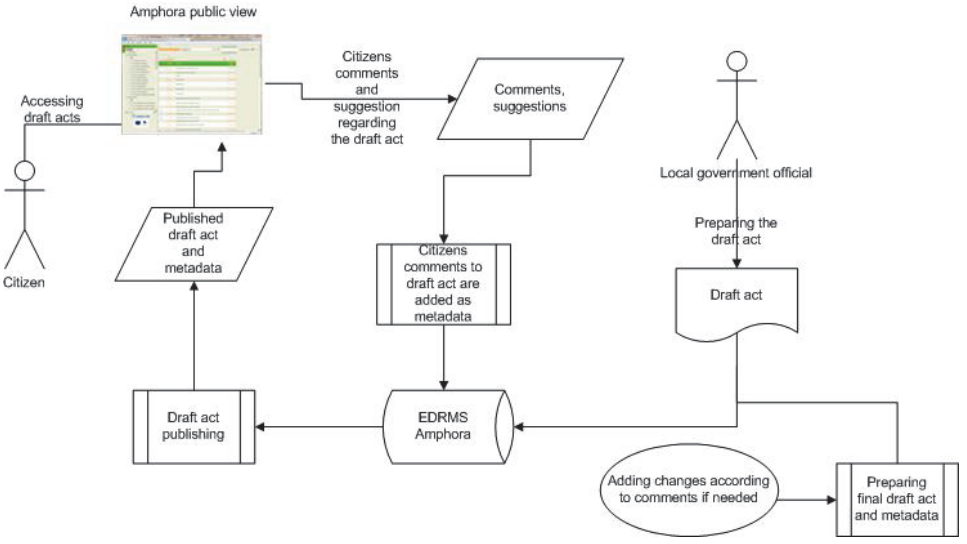

Figure 9 Communication between the citizens and EDRMS Amphora

The readiness of information technology to integrate participatory democracy into the work processes of local governments is established. How a local government takes these assessments into account in their decision-making process depends on the level of the government and their governance principles. The readiness and preconditions for the wider involvement of participatory democracy could be brought out, but in which scope it will be implemented and applied depends on the level of the governance culture. The Public Information Act establishes very strict requirements for information disclosure and search[13]. At the same time, the Personal Data Protection Act limits very strictly the public disclosure of delicate personal data. It is very time-consuming for local governments to follow the requirements of these two acts simultaneously. Technologically, this conundrum is solved within EDRMS Amphora so that officials do not have to do double the work in order to hide the information that is meant for the internal use of the institution. However, it is assumed that all documents that are added to EDRMS will be published online at once. By adding the restriction of "Internal use only", only the necessary data will be published online. When a citizen sends a document, the initials will be generated at once for such a document in the public Internet. This ensures the necessary protection of the citizen in the public Internet (publication interface). Furthermore, this document can only be associated with the specific citizen´s initials. The citizen can view the "Internal use only" notices and documents that are related to him/her upon logging in through the publication interface, where he/she can see procedural steps and send notices to the local government (see Figure 10).

[13] The disclosure is related with EU PSI Directive as well; the main objective is openness with the citizens although it is very important to follow the citizen-related privacy requirements.

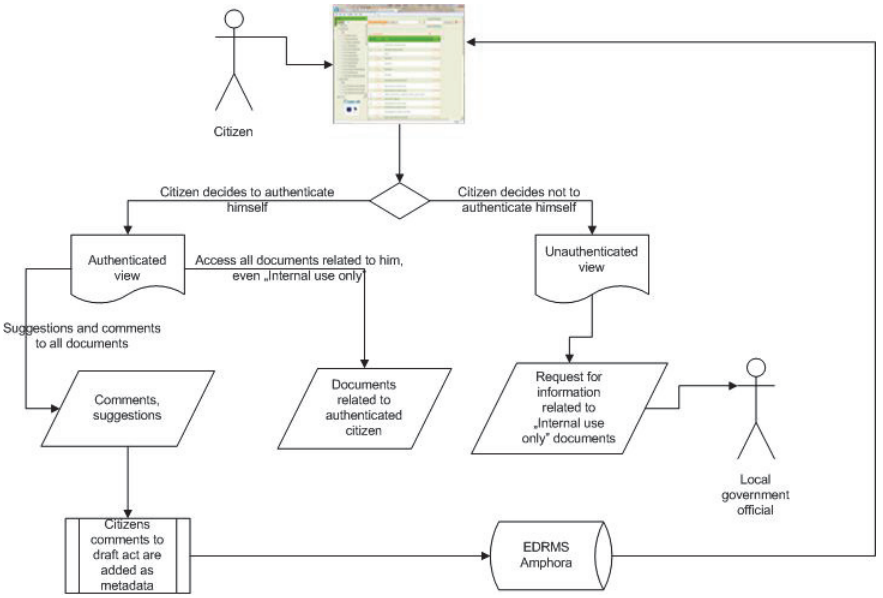

Figure 10 Access of the citizens to the public view of EDRMS Amphora

From the information technology perspective, many operations are automated, but the main problem for the officials is data disclosure. When following the requirements of the Public Information Act, it can sometimes be difficult to classify the documents based on the requirements of "Internal use only". In some cases, it is difficult to formalise the precise scope of the personal data. Due to this, the officials are following the principle of disclosing more rather than less information. If interested, the entitled citizen can make inquiries for the requested documents by issuing a request for information. Fulfilling the request for information is pursuant to legislation and an official of the local government can prepare an answer to the respective request within the stipulated period. Although personal data and its disclosure is an issue that causes a lot of discussion, in Estonia personal data is quite well protected in the governance scope of the public sector. The legal environment ensures the efficient protection of personal data where the data protection inspectorate actively monitors issues connected to their publication. The stumbling block regarding data disclosure would more likely be the competence of the officials in handling specific data. From the software perspective, this includes minor steps but the officials themselves have to be aware and responsible. Consequently, it is necessary to provide officials with more knowledge in that field.

This research has focused on EDRMS-related demands, but the context of data availability that is related to the Open Government Data should be noted. Two general types of data can be brought out: Big Data and Open Data. "Big data" refers to datasets the size of which is beyond the ability of typical database software tools to capture, store, manage, and analyse (Manyika, et al. 2011). Such a definition leaves open many interpretations of how big a dataset needs to be in order to be considered big data. Open Data is described in more specific

terms. The concept of "Open Data" describes data that is freely available and can be used as well as republished by everyone without restrictions from copyright or patents (Braunschweig, et al. 2013). Public sector information (PSI) is universally defined as “information, including information products and services, generated, created, collected, processed, preserved, maintained, disseminated, or funded by or for the government or public institution” (OECD 2008). It has to be noticed that PSI can be, but is not always Open Data, because it may be linked to private information (EDRMS public view) or may not be free or licensed for re-use. For doing so, the government needs to move towards “openness” where the wide usage of EDRMS-s can be the solid foundation for promoting e-governance innovativeness.

All relevant systems should be taken into account when developing participatory democracy. To conclude, the usage of EDRMS and its functionality makes communication between local governments and citizens more efficient, which should subsequently bring citizens and local governments closer together.

3.2 Prerequisites for the Implementation of Paperless Management

The software implementation process plays an important role in ensuring the smooth implementation of new principles and IT solutions. During the planning phase, the implementation of software solutions in day-to-day work must be properly planned. This research began analysing several areas which should be considered during the different phases of the implementation process. The following points that have been taken into account are brought out here:

- Analyse the existing processes of the organisation and describe them in order to achieve more effective operation results of local governments (e.g. provision of specific services);
- Describe the workflows in a manner that allows for establishing them in the software in an optimal way;
- Inform users of the transition into using new applications and include users in the decision-making process in order to find the best implementation method;
- Identify situations where the implementation of software does not optimise the existing work processes but rather inhibits them. Analyse what should be changed in the existing organisational work and implement only the part of the software that supports the management and processes of the organisation;
- Train users both on the functions of the software as well as the organisational process based approach; explain the advantages of including technological solutions in the transition into new governance methods;

- Find the most effective way for training officials by using various learning methods (such as e-learning possibilities which could be added to the overall training process).

The implementation process along with its activities is a lengthy one that requires vast resources and an abundance of time. It is important to include users in this process at an early stage to facilitate their acceptance of the new system and new work routines. User acceptance is a priority and must be paid attention to when implementing EDRMS Amphora as it affects the entire organisation. "Perceived usefulness, perceived ease of use, training, compatibility, external influence, interpersonal influence, self-efficacy, and facilitating conditions are significant predictors of users' intention to utilise EDRMS" (Hung et al., 2009). In addition to software development, it is necessary to think about the activities that are required for its implementation. From the local government perspective, where the functions and activities coincide, it is reasonable to think about automating the implementation activities of the EDRMS where similar functions are pre-defined.

Upon implementing EDRMS and related platforms, it is necessary to arrange the organisational structure, analyse the existing work processes and raise the competence of the officials. Incorporating information technology into the work processes requires, in addition to analysing the organisation, continuous training of the local government officials. The training expenses are divided unevenly between different fields, and often there is a dearth of training. One possible tool for minimising these expenses could be to include e-learning in the training process. Doing this during the software implementation process may significantly change the process itself as well as its outcome (Pappel & Pappel, 2011b). The inclusion of e-learning methodology could potentially allow to save time and money. Using implementation methodology not only includes local governments but also other actors partaking in this communication.

However, it should be added that software user-friendliness and usability have an important role in the implementation process as they directly affect the acquisition speed and serviceability of the information system. The intuitiveness of the information system impacts the learning capacity of the users (here: the officials of local governments). On the one hand, developers must contribute to the constant enhancement of user convenience and, on the other hand, it is possible to make the implementation of the information system more effective by including flexible learning methods. E-governance solutions are mandated to follow very strict requirements in terms of evolving regulations, the use of legacy technologies, confidentiality protection, and technical constraints tied to management. Therefore, the usability of the software should be paid attention to when developing the software because it affects the outcomes of the implementation.

3.2.1 Restructure of Organisational Documentation

In the past, the administration-related documentation and document management arrangements did not include the possibility of information technology. The administration was paper-based and the problem-solving process depended on the professional skills of an official in order to arrange his/her own structure for the paper-based approach and the traceable course of a solution. Due to this, the document list (hierarchy of how the documents are classified) of local governments was relatively complicated and capacious. Observing deadlines in the proceedings processes was challenging as it was difficult to identify the information regarding unsolved matters at the desk of an official. Work procedures and processes are not traceable in paper-based management. Furthermore, it is difficult to keep in mind the pending and unsolved matters when using paper-based cases. This excludes the possibility of entering search words in order to find the right folder on paper or to find a document by a citizen's name. However, starting to use the software does not change the existing work environment immediately. Problems emerged in connection with identically transmitting the information contained on paper to the digital environment. The usage of EDRMS also requires a critical restructuring of the existing work procedures and paper-based work. The observers of paperless management suggest that governments use the Internet to increase the effectiveness and transparency of administrative functions while engaging with citizens and transforming the nature of democracy. According to Calista et al (2010) early adopters of the digital government often found it difficult to maintain their performance, while some late adopters have experienced dramatic performance improvements.

During the transformation from paper-based to paperless management, existing work procedures change. The implementation of e-governance principles can face controversies arising from the legislation-based requirements on the one hand, and the use of progressive ICT tools on the other. The existing standard documentation of an organisation has to be adapted and linked to the work processes. This can include a lot of activities, such as reviewing and mapping the existing workflows, document management and administration procedures. Analysing and assessing standard documentation and procedures reveals where work processes should be optimised. In order to develop new administration rules, the change and optimatisation of the document lists of local governments have been included. The generally described processes for mapping these to the document list ensure the later creation of a common classification and process based document management. This field has a significant impact on the effectiveness of local governments. So far, the activities have been performed thanks to financing by local governments themselves or from a joint contribution by the partners. Due to insufficient resources, not all established objectives could be achieved.

Creating a common description format for classifying documents and common templates of the local government processes has gained initial results. In 2011, a work group was compiled on the basis of the local governments of

Rapla County, which began developing the common list of documents for local governments. The first version of the common document list has been created (shown in later section in Figure 25) but it still needs further optimisation to cover the real needs of local governments.

3.2.2 Analysing Problems of the EDRMS Implementation Process

Implementation process is the first priority during the application of EDRMS. While teaching about the EDRMS Amphora functionality, feedback has always been gathered from users to make the learning process more efficient. Simultaneously with development, steps have been taken to streamline the optimised implementation procedures. This provided a foundation for creating a methodology, which enables each joining local government to start working digitally in a relatively short period after taking EDRMS into use. Nevertheless, several factors were discovered about why the software application might not be successful. These factors are considered in the table below (see Table 4).

Table 4 Problem formulation for the implementation process

Problem	**The solution to be developed**
Training main users was not justified when only the functionality and the setting possibilities of EDRMS were taught. Practice showed that after the training, setting up the necessary environment (creating a document tree, users' rights, system's rights of use, etc.) by the main user took a lot of time – weeks or even months. Often, the main user was not able to set the work environment of the local government.	Due to this, a need has emerged for new methodology which includes the implementation principles and the need to develop a local government-specific preset model environment in ERDMS Amphora.
Not all officials were trained; this was undertaken by the main user. In practice, in these local governments EDRMS was left to only be a workspace for the office. The officials did not start using it and, therefore, the digital administration was not activated.	Due to this, it emerged that all officials must be trained together. A training methodology was beginning to be developed that also included specific work processes (e.g. proceeding of X application) that were played out during the training of the officials that was carried out in a computer class.

The instructions that describe the functioning of the system were not sufficient. It was not enough for the officials to know what a specific button does in the software, they also needed information about when and in which procedural phase they should use any of the operations.	Due to this, there evolved the need for process-based instructions and training videos.
In each local government, there emerged a question, whether and how other local governments had solved a similar problem.	As a result, an idea evolved to create a common learning environment where the users of different local governments could share their experiences.
The problem of the main users and customary users is that they are afraid of learning software in a live environment. New functions have been added; it was not possible to test them in a real work environment.	This referred to the need to be able to generate beforehand the test and the learning environment for the officials that would be generated on the basis of their own environment.

During the first years, through analysing the various needs and implementation possibilities in local governments linked with EDRMS Amphora, an understanding of the importance of software implementation was acquired. It was perceived how the low usage of the software affects the real outcomes of paperless management. This, in turn, created presumptions for developing a specific implementation method in order to integrate the EDRMS functionality more smoothly into the daily work of local governments.

In the interest of an effective final result, the development of the implementation methodology was founded both on the theoretical description of the base and on the analysis of the practical outputs. I had the opportunity to test the same problems in different local governments and sometimes achieved a different outcome with different users. Nevertheless, not all problems were due to human behaviour; many were caused by the general infrastructure and levels of preparedness. According to Phusavat & Anussornnitisarn (2007) the primary obstacles reflecting digital divide include the infrastructure barrier (e.g., speed and size of the internet network), language difficulty (i.e., increasing the content cost), and the low number of qualified developers for local-language content in the market. Content production has to be more focused on specific target groups to ensure that real learning needs are met. Local government officials gain knowledge more effectively when EDRMS user manuals are combined with real service descriptions and everyday case studies.

After analysing this topic, the tremendous role of implementation alone became evident. That was an important input for starting the development of the common implementation principles for local governments based on the platform EDRMS Amphora.

3.3 Improving Communication with Interoperability

The interoperability of the systems ensures better cooperation between various institutions, systems and citizens. Gottschalk (2009) states that improved interoperability between public organisations, as well as between public and private organisations, is of critical importance to make digital government more successful. Until mid-2000s, there was a lack of possibilities for mutual communication between inter-institutional systems. Different EDRMS solutions were used in local governments, which did not allow for the exchange of inter-institutional documents between the document management systems themselves. In order to send a document from one local government to another, traditional postal service was used instead. Only a few local governments used the possibility of a digital signature whereby a digitally signed document was sent to the other party by e-mail. The local government that received the digitally signed document had to save this document on a computer and afterwards upload to EDRMS. This was clearly time-consuming. In addition, EDRMSs did not permit mutual communication between the internal systems of the institutions, e.g. there was no direct communication between the financial softwares and EDRMSs.

The transformation of invoices into digital proceedings was hindered. The mutual proceedings of invoices between local governments and their subdivisions were ineffective. Therefore, it became necessary to pay more attention to interoperability in order to ensure the mutual integration with state registries and various IT systems in the daily work of local governments. As regards interoperability, making data available and exchanging it, a significant focus has been on the development-related needs in the following fields:

- Publication of documents (EDRMS and publication interface).
- Inclusion of citizens in the proceedings and decision-making processes by implementing participatory democracy (e.g. electronic applications and asking for opinions on drafts by using the functionality of EDRMS and relevant systems).
- Cross- and re-use of data (information exchange between various systems) in order to support automating data entry and to reduce replication upon entering data.

The issues of interoperability and cross-usage have been widely discussed in different projects and in this research field, but examples of good solutions have been delayed by various problems. Several technological solutions exist, but agreements required for their implementation, (e.g. enabling the requests made by the service provider), are hindered by bureaucracy[14]. The mature way of

[14] In the framework of Kehtna Local Government EU project (Appendix A), an interface for the mutual communication of EDRMS Amphora and the most widely used databases (MTR, Commercial Register, Population Register, and Land Register) was created. This development has been left at the prototype level, as necessary agreements between the service provider of EDRMS and the database administrators have not yet been reached.

thinking in order to see the whole picture is very often a stumbling block in the public sector as regards more closely linking the existing systems. The maturity levels of the institutions for ensuring more in-depth cooperation must be addressed more thoroughly. Gottschalk, who has studied this particular topic, has proposed his model for testing the maturity levels. He presented a model of maturity levels for interoperability in digital government, which could be the basis for e-governance in general. It transpired that the five-level model might be applied by public organisations to identify current maturity and future direction for improved interoperability (Gottschalk, 2009).

Estonia's success in launching the national digital management is based on the wide use of various information technology solutions (EDRMS, ID-card authentication, X-road, DEC, Service of Official Documents (ADIT), etc.) and on the assurance of an interoperability framework of such solutions. Among the defining purposes of e-government, highly agile, citizen-centric, accountable, transparent, effective, and efficient government operations and services rank high (Scholl & Klischewski, 2007; Ambrust et al., 2009). In order to be more interoperable, national level data handling in Estonia has been centralised and appropriate databases for data handling and storage have been created. The following schema (see Figure 11) shows Estonia's technological model of the e-state that also tightly involves the private sector.

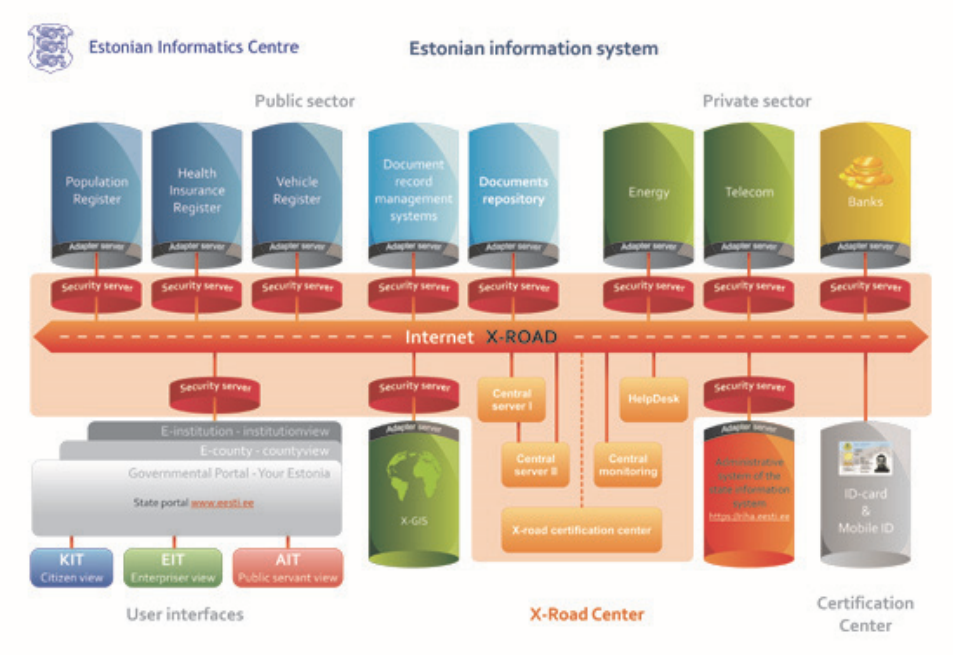

Figure 11 Estonian e-State model (from www.ria.ee)

In Estonia, there is significant focus on the interoperability of state information systems. The latest basic concept is presented in Figure 12. Based on this, each public sector institution maintains their own data repository (level

one). Data repositories are usually databases that contain different datasets within the organisation's infrastructure.

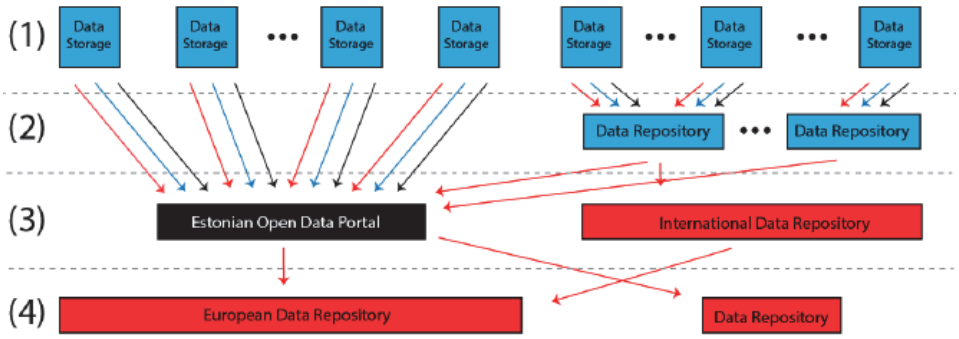

Figure 12 Conceptual interoperability between systems (Valner, 2014)

Therefore, the interoperability between different systems is a critical success factor for paperless management. Similar solutions have been applied in order to govern the mutual communication of the most widely used EDRMSs through the CMIS[15] solutions (Pappel & Pappel 2011a; Pappel, Pappel & Saarmann 2012b). It proposes a data model combined with a set of generic services and several protocol bindings for these services, including: Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) – using the Atom convention (Cover, 2008). The tendency towards the development of the information technology bridges required for linking various systems has to be consistent (Gartner, 2010; 2011). It is important to set a target in order to achieve the inter-system information exchange that must be geared towards producing fast data exchange. On the other hand, during the procedural steps more effective responses are also needed. Upon interface development, the specific chosen methodology has to be taken into account. The emphasis should be established in a way that covers both the expectations and the needs of the parties. For instance, the needs-and-wants theory can be suggested as one promising theoretical lens (Scholl & Klischewski, 2007). Integration and communication between the systems must target the operative information exchange that makes the operations of all parties more effective.

Interoperability has to be ensured with both the internal and external databases of an institution as well as in the fields of the registries used on the state level and the information systems used by local governments. According to the Survey of Electronic Records Management in the Public Sector Agencies of Estonia (Estonian Ministry of Economic Affairs and Communications, 2011), as

[15] Content Management Interoperability Services (CMIS) is a specification for improving interoperability between Enterprise Content Management systems. OASIS approved CMIS as an OASIS Specification on May 1, 2010.

shown in Figure 13 and Figure 14, integration between EDRMSs and other systems is still low.

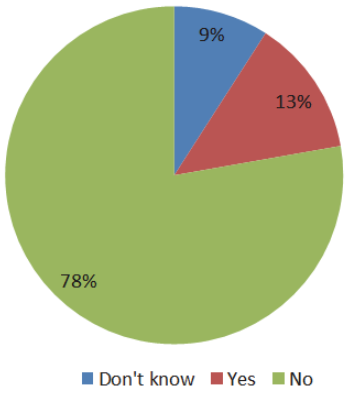

Figure 13 Interface relations between external systems and EDRMS in the public sector

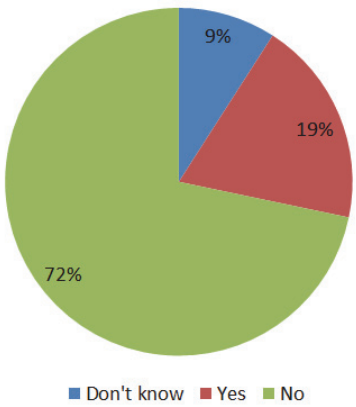

Figure 14 Interface relations between internal systems and EDRMS in the public sector

The interoperable EDRMS makes the officials' work more efficient. If a specific document is created in EDRMS that has to be coordinated with other institutions, it must be possible to send it to the appropriate database or registry directly from EDRMS with a relevant note. The information relating to the entire management is stored in one system that permits future statistical and data analysis. One important purpose of the EDRMSs is to be an electronic memory of an organisation.

In addition, it has become clear during the development of EDRMS Amphora that the most effective way for making EDRMS solutions interoperable is using the software as a service (SaaS) model. This model is the most cost-effective solution for local governments, as it does not require any additional ICT resources in the sense of hardware, software, and investments in

human resources (Pappel & Pappel, 2012a). The expediency of web-based (and SaaS) solutions lies in the fact that flexible web services or get-post requests over different systems can be used to interface with external components. This fact makes it possible to extend the service model to cloud applications that have been a growing tendency over the last several years, facilitating erasing geographical borders and creating access regardless of the destination (Pappel & Pappel 2012a). Service orientation has a positive effect on issues such as interoperability, flexibility, cost-effectiveness and innovative power. At the technology level, web services and XML-based open standards provide for true interoperability in this area.

3.4 Cross-Usage of Data to Increase Efficiency of e-Governance

EDRMS cannot be an independently existing central system that provides services to an organisation as an independent unit. In order to ensure complete paperless management, the internal and external systems of an organisation have to communicate with each other (Pappel & Pappel, 2011a). In Estonia, the integration of EDRMSs with other IT solutions has been a growing trend. The exchange of data between softwares helps to save money and time that is otherwise spent on preparing transcripts and copies. Information management in a common system and cross-usage of data allows for better monitoring of the procedural steps.

The cross-usage of data between different systems is an important future perspective that allows re-using data and optimises the time spent on data entry. EDRMS must be able to offer the intermediation of such communication because the dataset inserted there is essentially the same as the data in the main state registries. Due to the projects carried out during this research, the interoperability of the EDRMS system has been the main focus for offering an interface for intermediating communication (automatically generating the requested data into the document form) with different state databases. In order to integrate EDRMS Amphora with other systems, it is possible to use different protocols and technologies: http, https, get, post, WebDav, SOAP, XML-RPC, Twain, IMAP, POP3, SMTP, SSL, LDAP, etc.

Over several years, numerous integrations have been developed on the basis of EDRMS Amphora, e.g. interfaces with national registries, financial software and personnel software. The information moves between the systems on the basis of a set of agreed-upon rules of metadata in the XML format (see Figure 15). The first pilot was chosen to build an interface between EDRMS Amphora and financial software P-Men (among the solutions that are aimed at local governments).

P-Men is currently used by more than half of the local governments in Estonia. For verifying the data descriptions, the e-invoice standard developed by the Bank of Estonia was used, and the items of the invoices are transmitted between the systems.

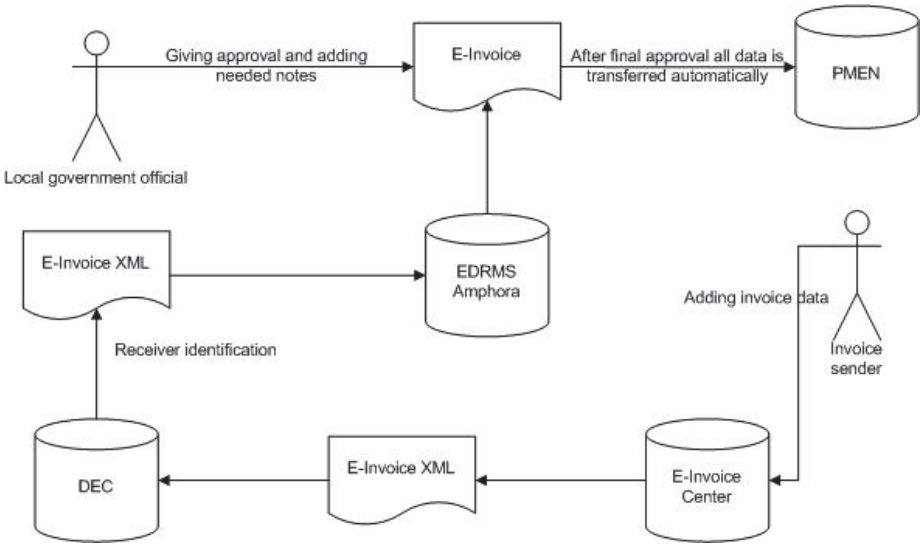

Figure 15 The invoice handling process between Pmen and EDRMS Amphora

There is also an interface with a financial software SAF, wherein the interface is still based on the XML-invoice that conforms to the Estonian e-invoice standard. It was adapted to the SAF invoice base, in order to enable exporting the XML-output that conforms to the Estonian e-invoice standard and importing it to the SAF accounting system. The communication between the systems is carried out in both directions – EDRMS is being updated with regard to the dimensions and suppliers of an invoice, and EDRMS sends the items of an invoice to P-Men. This functionality permits to digitalise all incoming invoices, and process them in the digital form. Analogous practices can be found where digital invoices are used in the public sector elsewhere in the world. For instance, in Denmark, as of January 1, 2005 the public sector accepts only e-invoices (Danish Government, 2007). Sweden and Finland are implementing transformations to this system, and since 2010, the transformation of sending e-invoices to the public sector has been a primary objective in most EU member states, including Estonia. A data exchange channel that has been developed in EDRMS Amphora is the interface for communicating with national registries where gateway functionality facilitates creating different get and post requests when using web services and linking those to other systems. Inside an institution, there are several information systems where the organisation-related information is managed. In addition, there was a need to develop an interface in EDRMS Amphora for communicating with a personnel software Persona, whereby a document that is registered in Persona is sent with its content and metadata to EDRMS Amphora. Many smaller local governments can manage the personnel-related documents directly in EDRMS Amphora and the financial software. In addition to the above-mentioned interfaces, EDRMS Amphora communicates with DEC and Service of Official Documents (SOD) that permit a fully electronic exchange of documents between local governments and citizens.

The re-use of already existing data is inevitable in order to save time when processing the information and eliminating the data entry mistakes.

3.5 Local Government Processes through Paperless Management

Paperless management lends transparency to the decision-making processes and transition into e-services. This section will briefly describe how EDRMS can improve the service provision of local governments. The consumption of services and communication should be allowed to start from the common web space (Citizen Portal, local government websites, etc.). As regards information technology, the general infrastructure enables local governments to successfully switch to e-services because the used methods of authentication include an ID card, mobile-ID and a digital signature (see Figure 16). During the digitalisation of certain services, the achievable efficiency is significant. For the provision of certain e-services, the time consumption can be measured in minutes. This fact makes the whole service process agreeable for both parties. However, upon the digitalization of certain services, the resource savings might not be large enough. It is sensible to combine the various ways of service provision so that neither a citizen nor an authority will be in a losing position.

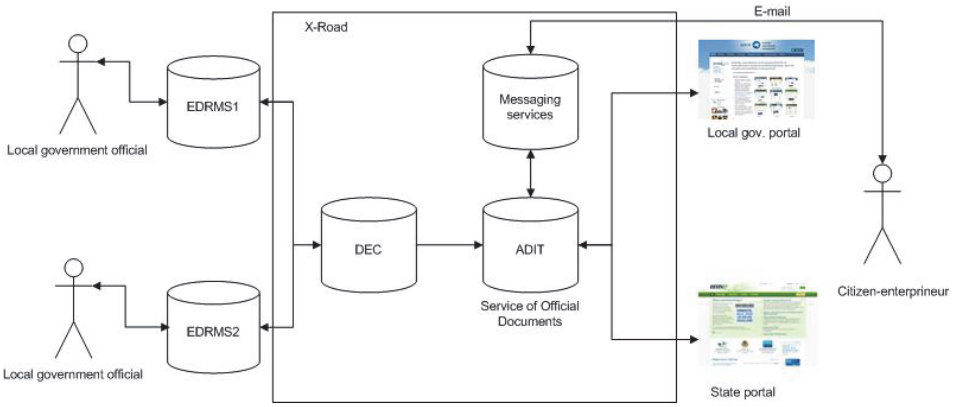

Figure 16 The communication between a citizen and the local government upon using the function of e-forms over the Internet

Linking the development of e-services with the work processes of EDRMS has been a logical step, as according to the Public Information Act all state authorities and local governments have to maintain their document registries electronically. In recent years, EDRMS has become more important as an information environment that concentrates the activities and decisions of an organisation. Service provision goes hand in hand with legal decision-making at the local government level, and requires appropriate previous agreements. In the past, the decision-making process as regards the possibility of service provision of specific application was mostly carried out outside EDRMS, which only received a confirmation of the decision – a specific legal act, e.g. a building permit. Today, the decision-making process can be initiated and completed

through EDRMS and associated channels. The application of a citizen is transmitted via a digital channel to EDRMS where it is registered and forwarded for further approval. For instance, after all the necessary legal procedural steps (e.g. approvals and decision notes) have been taken, the decision can be adopted at a meeting as a specific legal act. Legal power is given to this decision by the head of institution or a person with decision-making powers with his/her digital signature (see Figure 17).

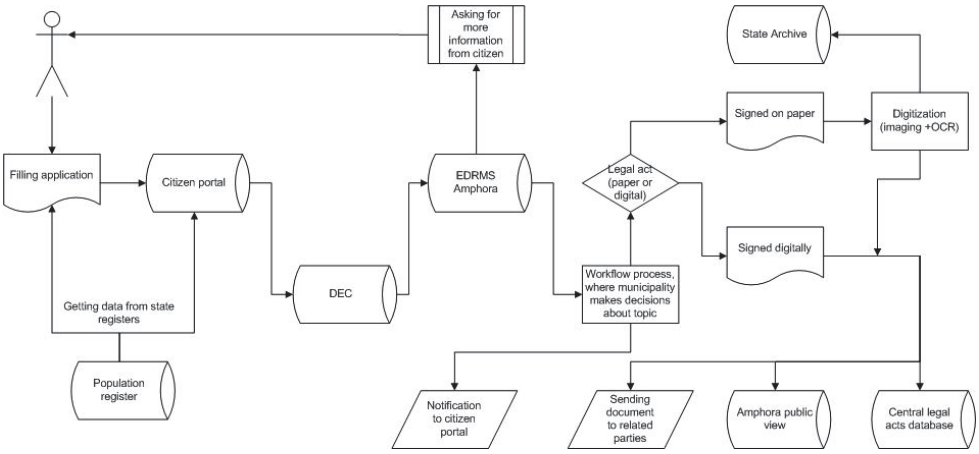

Figure 17 The decision-making process of the legal act

As regards EDRMS, it is possible to automate the various stages of all the procedural steps. In the process of registering an application, an appropriate database (e.g. the Population Register) is approached to obtain the necessary data. The information received is automatically generated in a document. Throughout the whole process, it is possible to go directly from EDRMS to the requested database that releases information to EDRMS (see Figure 18). Technologically, reciprocal communication is possible but requires specific agreements between the institution and the database owner. Furthermore, it has been very complicated to obtain such agreements between service providers, the state database owner/ administrator and local governments.

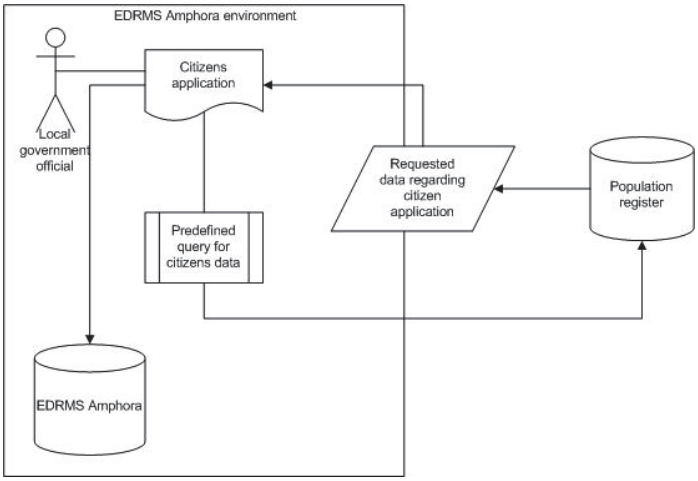

Figure 18 The communication of EDRMS with various national registries

This communication process returns the appropriate information about the decision made to the citizen via a digital channel and performs further acts, if required. Technologically, it is conceivable to perform several services simply within the electronic environment, but in practice, various obstacles hinder this possibility. The main obstacle so far has been the insufficient readiness of both the organisation and the citizen due to a lack of technological knowledge and legal restrictions. The different options for citizens of using services must be taken into account, as many target groups are unable to only use the services electronically. Not all target groups are able to communicate with local governments through an electronic channel. For them, the communication, information transmission and service provision have to be ensured in the traditional way. Additionally, the ability of local governments to transform their services into e-services can also be delayed due to a lack of competence on the part of the officials.

The examples described above make up a small part of the work procedures presented in digital form. One of the main problems that could hinder their broader implementation is the low level of acceptance by users. In the current research, low acceptance can be measured by the application of Local Government Systems (described in section 4.3). The level of use of Local Government Systems varies in organisations. The application of new governing methods (including information technology) encourages officials to use software systems in their day-to-day work. Therefore, user acceptance has a significant role in the implementation of IT systems, but often far too little attention is paid to it. The emphasis is put on the development of technological solutions but the factors that ensure the smooth implementation of these systems are still undervalued and considered unimportant. The traditional focus of inter-governmental services research has been on technological development, not on user acceptance. However, user acceptance of intergovernmental services in each e-governance implementation attempt affects the ultimate success of these projects. According to Hung et al., “in the e-government implementation

context, many governments have invested huge amounts of money and manpower to make inter-governmental services both available and accepted by users, although some individuals have no intention of using those" (Hung et al., 2009). Therefore, resourcefulness must be emphasised as far as the implementation of IT systems is concerned: making the users accept the IT systems in the name of improved implementation and getting them to use more of these systems in their day-to-day work.

Duplicating governing methods (the possibility of providing a specific service both electronically and on paper) are here to stay for many years to come. Local governments must be able to offer solutions to matters in both aspects. On the one hand, state IT components support digital communication between the state and its citizens but, on the other hand, it must be admitted that not all citizens have the ability to consume services in an interactive format. Therefore, the current fully digital proceedings layer is included in the governing model as a supporting function. It is important to follow the principles of the information society, where the consumption of services should be offered in an electronic manner, and more services should be transformed from one level to another. It must be noted that during the acceptance and implementation procedure of new principles, the citizen should not be the losing party and the relationship between the state and its citizens should be satisfactory for both.

3.6 Summary

This section provided an overview of the research and development activities that aimed to define the development needs of local governments. These activities were carried out in order to analyse and design the necessary work environment for implementing the paperless management framework based on EDRMS Amphora. Furthermore, various factors and their impact were discussed in order to grasp how the innovative technological improvements, which offer methods of transformation into e-governance, could advance the workflows of local governments. Although the possibility of innovation using ICT tools varies largely in different regions, the Internet is still sufficiently accessible in every part of Estonia. Thus, the conclusions drawn from the movement from As-Is to To-Be situation are as follows:

- It is necessary to implement paperless management in local governments using EDRMS as a foundation for e-governance in order to move further towards e-governance;
- Innovative solutions are required in order to make the established requirements and legislative rules suitable;
- There is a need to make certain rules obligatory for the entire public sector so they would cross-organisationally[16] organise their electronic document management, with the use of the digital document exchange.

[16] Existing legislation has established the obligation to use DEC for the ministries and their offices; this was a voluntary provision for local governments.

The latter is necessary for implementing e-governance applications with a view to transparency and efficiency;

- The work processes and organisational activities of local governments must be analysed and adapted in a way that would produce results as optimal as possible after implementing the information technology and EDRMS;
- Although it is widely acknowledged that e-services could provide efficient ways for managing the services required for different counterparts, further critical assessment and analysis is needed in order to implement e-services in local governments;
- It is necessary to focus on the implementation and utilization of the information systems in local governments – taking software into use does not only entail creating access for officials.

In order to implement paperless management more efficiently, the EDRMS systems must comply with certain prerequisites:

- Create the opportunity of cross-usage of data between EDRMS and different information systems; documents should be exchanged between the systems and created automatically on the basis of existing data;
- The link between citizens and local governments should be more digitalised and supported by public interfaces (document registry) that are integrated with the state portal;
- Agreements between database administrators and service providers should be centralized for effective and efficient management. The Estonian Information System's Authority (EISA) could be such an institution;
- The central financing of EDRMS-related developments (integration with other systems, learning environments, etc.) would increase the implementation and assimilation of paperless management.

To conclude, firstly it should be admitted that the traditional form of government is no longer always sufficient for affording efficient means of service provision to entrepreneurs and citizens. Often, the administration and management of the organizations must be dynamic and adaptable to changes in the ecosystem requirements. The transition to e-governance can be affected by many different factors, which were described by Moon (2002) more thoroughly. Moon's study found that the orientation of managerial innovativeness and the size of the city are the most compelling determinants of municipal e-government adoption. Furthermore, different levels of e-government adoption may yield different outcomes (Moon, 2002). These circumstances are also relevant today where the expansion of ICT possibilities has given rise to new issues related to the Internet and security in a wider sense. Nevertheless, the ability and need to digitalise the processes has increased tremendously.

4 RE-ENGINEERING LOCAL GOVERNMENTS PROCESSES

This section explains the results stemming from the question of how the implementation process can bring about organisational changes. The principles of the e-LocGov model composition will be explained. Furthermore, the parts of the model will be described and the required components based on EDRMS Amphora will be considered. Various parts of the model are tied to the implementation of paperless management. Local Government Systems provide rules and common ground for paperless management and Public Services System aims to gather all service descriptions of local governments into a common space. The EDRMS implementation methodology that provides more efficient outcomes in different application stages will also be reviewed. The creation of the necessary cooperation opportunities as a result of my work will be presented, wherein a direct positive effect can be seen that helps local governments to achieve the readiness required for implementing new principles on a wider scale as well as enhancing research in this field. Constant training and learning should raise the awareness of the officials in that field.

4.1 Development of the e-LocGov Model

The development of the e-LocGov model has taken several years. Different methodological approaches have been considered in this research process. EDRMS as a platform has been the main guide in the development process during which we have used several techniques to achieve positive results. The identification of what local governments need has been carried out in different ways (data collection, interviews, analyses of legal acts and standards etc.) and in order to describe them, we have used various approaches and tools for defining the processes. The software implementation stages have given us valuable feedback about improving and extending the functionality of the work. Our development and research have been very agile which, in turn, in the light of the rapidly changing environment, has fortunately given us swift results and relevant feedback (see Figure 19).

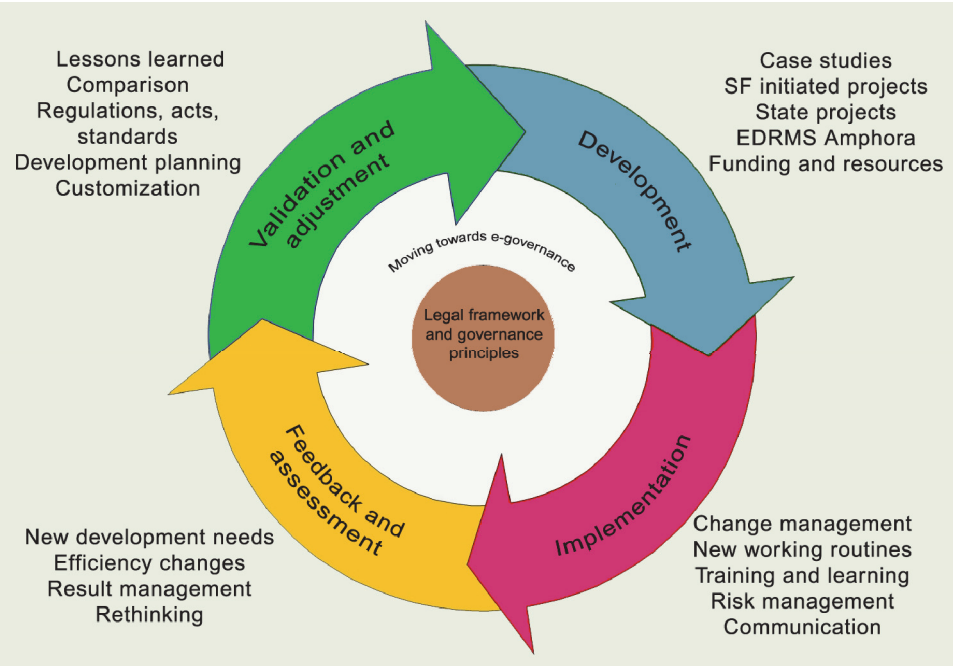

Figure 19 e-LocGov model engineering process

The research, involving nearly 100 local governments in Estonia, has proved that EDRMS as platform for e-governance has shown considerable results. The constant process of implementing, validating and improving the work processes and the platform itself have been challenging and it is fairly difficult to achieve the right approach at once. At the beginning of the research, we found that there is a copious amount of approaches that have been built for the application of e-governance, but none of them provided a concrete technological platform for concentrating on implementation. Usually, the models specify the various stages of the process and the order in which they are carried out. Here, the technological platform plays an important role. The development of the e-LocGov model has been influenced by many dimensions and corresponding real inputs:

- Development of the EDRMS Amphora, which has its own intervals for updating the new features and functionality (typically every 3 months);
- Development projects, which are initiated at the state level and financed by it (EU structural funds);
- Already developed features, which bring a new level of the desired functionality in the future;
- Independent development projects such as DEC or Citizen Portal, which are creating the necessary updates for interoperability.

Many countries are putting innovative e-governance models into practice. These may be technologically simple but they are also changing the way information is

distributed in the society. Based on the example of Estonia, it can be said that the technological approach to e-governance founded on the identification system (ID card and associated solutions) permits to reach a sufficient level of e-governance whereby the technological platform brings the government and its citizens closer together in a virtual space. Similarities and connected factors have influenced the implementation of e-governance both in Estonia and elsewhere.

An important goal of e-governance models in addition to service provision is moving towards a more efficient, inclusive and participative government through the adoption of a set of new trends in their business, operational, financial, and technological models. This research concentrates first and foremost on the implementation of technological solutions in the local government environment and describes the relevant presumptions that make it possible to implement this model. In order to identify the scope of the e-LocGov model development process, a set of problems was compiled that evolved during the implementation of the technological solutions for e-governance. In Figure 20, the areas of activity, criteria and set of problems that are connected to this have been pointed out. These activities were defined in close cooperation with local government workgroups. Adjustments to these areas were made over time according to the feedback received from the application process. The main goal has been to find a means of including these areas in the EDRMS procedures.

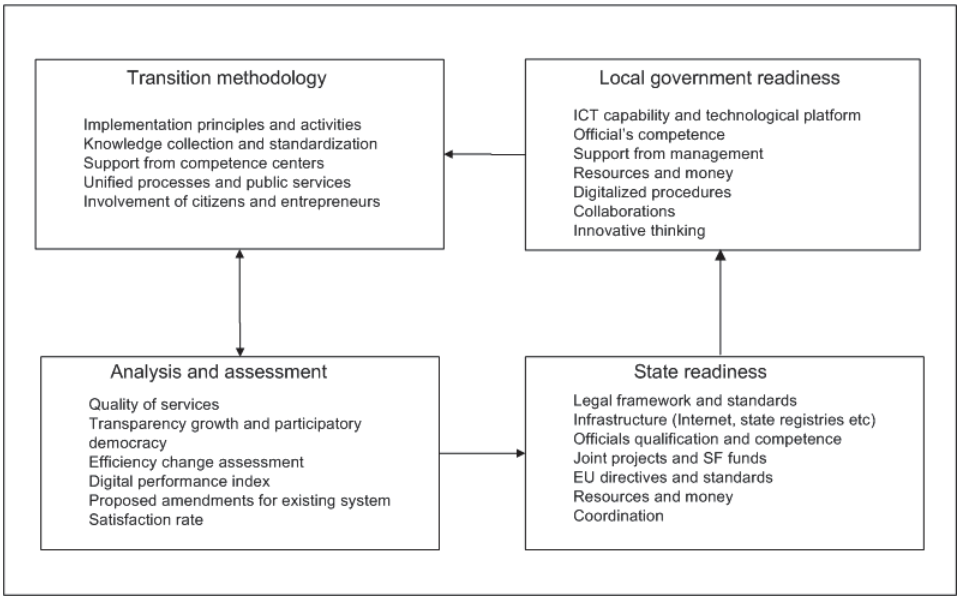

Figure 20 The presumptions for local governments to transfer to e-governance

The proposed model is created on the basis of Estonian local governments and, therefore, contains solutions that are specific to Estonia. However, the Baskerville and Wood-Harper validation criteria (1998) have been used for the improvement and verification of the e-LocGov model design process. This is more thoroughly described in Appendix B.

At the same time, it is possible to improve and adapt the e-LocGov model to the context and practice of other states. The main function of local governments among various states is relatively similar – they are the major service providers between the citizens and the state. The expansion of service space into the Internet and the involvement of technological devices is a prevailing trend everywhere and, therefore, the problems can also be quite analogous. These may include 1) the adaptation of the legal space and the social environment; 2) the implementation of ICT and adaptation of the structures; 3) the change of existing habits and the increase of competence; 4) the effectiveness of economic cost-efficiency; 5) the implementation of new service models.

The e-LocGov model is constantly changing and improving. The inputs for improving the model assist local governments and external influencers. Several components of the model are still in the research and development phase, as various facets need constant development and verification. The components of the model have evolved over various repetitions and developments, and the existing model can be treated relatively empirically. The results so far also provide a specific form for further development activity; several task settings relating to the research and development activity of the e-LocGov model are planned to be incorporated into e-State Technologies Laboratory (e-State Technologies Laboratory will be discussed in section 4.7.1) as future work.

To illustrate the work done during the development of the e-LocGov model, two case studies that were carried out in Rapla County will be presented in the next sections. These case studies present 1) the application of e-services where the chosen applications were described, optimised and developed, and linked to the EDRMS Amphora and Citizen Portal, and 2) the development of assessment criteria for measuring the digital performance of local governments.

4.2 Description of the e-LocGov Model

In general, the models are understood as an abstract representation of an object. They mimic the structure and the analysis of the object in the real world and are constructed to reflect certain parts that are essential for a specific purpose. The need to describe the e-LocGov model arose from the implementation activities EDRMS in local governments (Pappel, Pappel & Saarmann, 2012b). The application of paperless management caused the need to describe the problems relating to the organisation of work in local governments and simultaneously made describing possible. A wide range of institutions with similar functions and objectives were in need of a new specific model with a set framework. The activities and problems of local governments do not differ fundamentally. It is possible to unify the transition strategy of many similar organisations into a common model. The model must give a clear understanding of the planning and performance of the objectives of local governments.

Important input for describing the e-LocGov model (Pappel, Pappel & Saarmann, 2012a) was given by a Structural Funds project "Paperless records management and development of participatory democracy in local governments" (which is described in Appendix A), however, it is the result of the work done

over many years, every part of which can be treated, studied and improved separately. Constant improvements are necessary as these are linked with the developments in the society on the whole. The e-LocGov model (see Figure 21) involves the following areas, which are an imperative part of the framework for the transition of local governments into e-governance:

- State-level readiness – the readiness of the state must ensure coordinated activity when developing local governments and must also provide specific legal space standards. In addition to the requirement to implement obligatory standards, the state should also ensure certain co-financing that assists in applying new IT solutions in local governments more effectively. More resources need to be allocated for the integration of systems.
- Organisational readiness – the readiness of local governments must be connected with the existence of paperless management to enable monitoring how the work is organised, creating more transparency in the decision-making processes and organising digital communication with other parties – the state, citizens and entrepreneurs. Open communication must be ensured: various digital channels in the form of Internet publications, digital data transmissions and the inclusion of citizens in the decision-making processes. Moreover, raising the qualification of the officials should be considered.
- Transition methodology (including implementation methodology) – this gives local governments the rules and standards that include the implementation methodology of the software solutions (implementation methodology of developed EDRMS Amphora). Furthermore, the sector-specific research activity is regulated in order to support the development of new principles and solutions.
- Assessment of feedback, statistics and impact – a feedback system should be developed to enable monitoring the changes in local governments and assess the satisfaction of the citizens.

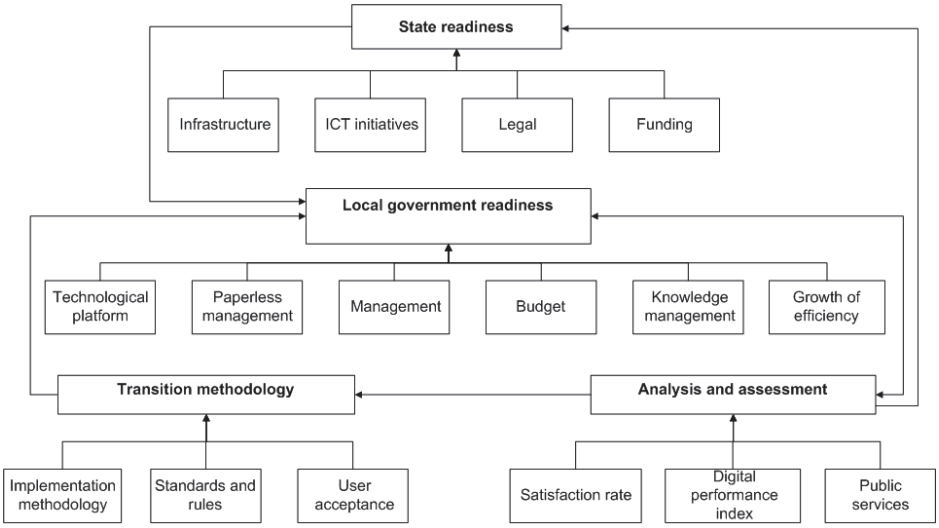

Figure 21 The e-LocGov model

The model consists of a technological and a so-called soft part. Based on this research, the technological part includes EDRMS Amphora with the required integration for implementing Local Government Systems. The 'soft part' includes a methodology of how to carry out the transformation into a new platform. In addition to the established requirements, there is a need for resources and coordinated activity that would help local governments to apply the principles necessary for following legislation through common activities.

In addition to the technological platform of the model, the implementation methodology of paperless management plays an important part and also includes the application, training, aggregation and implementation of the feedback from users, development, and adjustment to new rules. This permits the digitalisation of the information level of local governments as a whole. By raising the awareness of the officials, the ICT capacity of the institutions can also be increased. The application does not only entail learning the software components; it is also necessary to change one's way of thinking through the use of renewed work routines. In cooperation with various counterparts, an action plan was developed during 2011-2012 to allow for the harmonisation of principles and planned joint activities.

During the development and verification of the model, the prototyping and testing has been conducted through the implementation of specific parts in local governments. The model has been improved and developed further via feedback and research (see Figure 22). This enables the Estonian local governments to transform into paperless management and create the preconditions for the construction of a service centre together with participatory democracy between the citizen and local government, all the while moving towards e-governance.

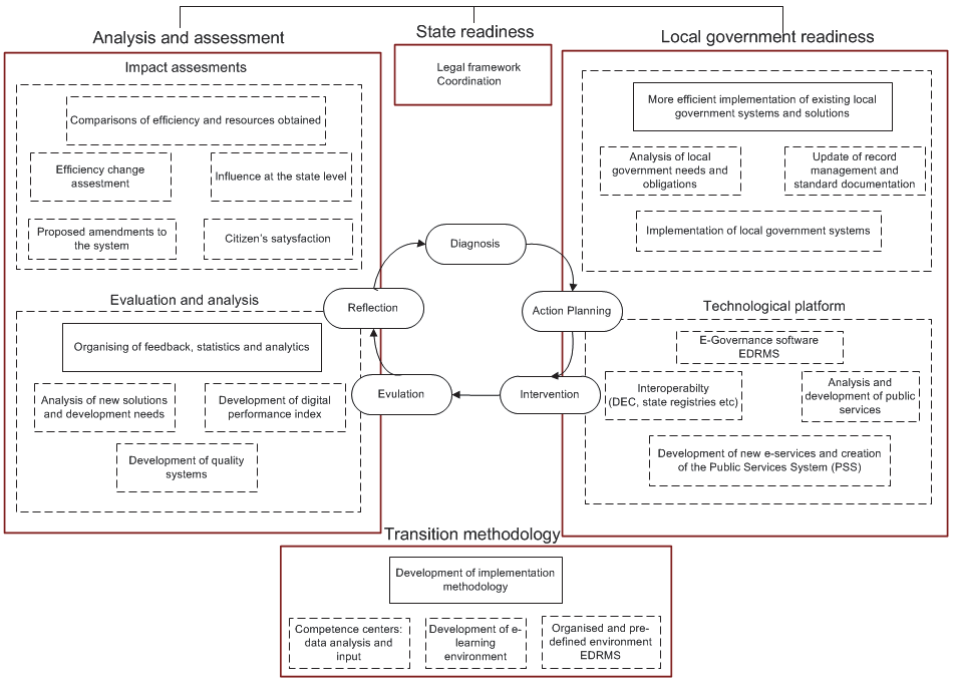

Figure 22 The development and implementation process of the e-LocGov model

The subsequent sections will describe the different parts of the model such as Local Government Systems along with the necessary functionality. An overview of the Public Service System (PSS) will be provided that has been developed on the prototype level and plays an important role in the further unification of the public services of local governments. The implementation methodology of EDRMS Amphora, which has been developed and deployed, is discussed. This proposed methodology allows for a smooth and quick implementation of technology in the day-to-day work of local governments.

4.3 Description of Local Government Systems

During the analysis of local governments (their requirements, standard documentation, processes), Local Government Systems were described at first (Pappel, Pappel & Saarman, 2012b) as an operating platform for local governments. Initially, Local Government Systems were defined empirically in order to establish the needs of specific parts. Afterwards, we started building the necessary integration and functionality for supporting the described requirements. The Local Government Systems consist of an IT platform that has been adapted on the basis of the EDRMS, and a set of rules that combines the legal framework and the daily responsibilities as the agreed-upon rules of local governments. The functions of all local governments are the same, thus, due to

the obligations established by various legislations[17], the IT systems (in particular EDRMS) can be successfully built up and implemented as the Local Government Systems. Table 5 describes Local Government Systems along with the necessary components that have been developed over the past decade. The main focus of developing the Local Government Systems was making EDRMS a central internal process engine wherein the Local Government Systems was created inside of EDRMS or by using an independent platform, which can be attached to EDRMS. The elements of the Local Government Systems are presented in the following table.

Table 5 Local Government Systems describing their purpose and functionality

Part of Local Government Systems	**Description, components and functions of the system**
Legal draft acts preparation system of local governments (digitalisation of decision-making process) – contained in EDRMS	**Objective:** the digitalisation and transparency of the decision-making processes of local governments that enables monitoring the course of problem-solving at any time. Implementation of the case management[18] principles ensures the smoothness of the whole decision-making process from beginning to end. **Result:** ✓ Digital preparation of draft acts and digital proceedings in EDRMS; ✓ Automatic preparation of an agenda and its use at meetings [19]; ✓ Automatic generation of protocols; ✓ Digitally signing the legislation;

[17] These legislations include the PSI Directive, regulations on the common principles of administration, the Personal Data Protection Act and the Databases Act.

[18] So far, the tendency of implementing document management in Estonia has been registry-driven – the main administration criterion is the type of the document. The current Moreq deals more with the management of processes and information, which, from the perspective of effective administration, ensures the successful implementation of case management.

[19] Estonia's practice assumes that local governments adopt their legislation in the format of a sitting where participants vote by being physically present. The implementation of IT systems gives an opportunity to give up this format by using person authentication, as the note on the approval of a participant is left on every draft act.

	✓ Registration according to the rules of administration and archiving.
E-forms system (query of public services as an e-service in the www.eesti.ee **environment) – an independent system that attaches to EDRMS and PSS**	**Objective:** To enable using services (e.g. query) either electronically or in any other form that does not require direct contact between the official and the citizen. **Result:** ✓ The state portal eesti.ee[20] uses e-forms that are created in this environment, and the filled e-forms are transmitted to EDRMS; ✓ Digital proceeding of received e-forms is functioning; ✓ Digital answers to e-forms is functioning; ✓ On the website of a local government, the subpage of e-services is located on the first level of menu; ✓ On the website of a local government, there are links and references at the public services to the respective e-service;
Digital archive system – contained in EDRMS	**Objective:** Digital storage of the documentation of local governments according to the storage deadlines and destruction requirements[21]. **Result:** ✓ Proper archiving of the documents, letters and case files that are in a half-active or an inactive phase;

[20] In the www.eesti.ee environment (Government Portal) it is possible to use (both in the case of developers and institutions) the general XML-format editor that can be used to create required e-forms.

[21] In Estonia, requirements have been established for digital storage that follow the good practices from the rest of the world. The developed universal archiving interface (UAM) allows transmitting the records (files) from EDRMSs to the State Archives.

	✓ Storage of the records; ✓ Transmission of the records to the State Archives; ✓ Destruction of the records;
Public Services System – an independent system that will attach to EDRMS	**Objective:** To establish common agreements for describing public services, on the basis of which it is possible to describe the services available for the wider range of users in the form of the Public Services System (PSS). **Result:** ✓ Description of public services and re-usage of created data structures; ✓ Identification of the legislation that forms the basis for service provision and associating it with a public service; ✓ Determination of the officials responsible for the service provision and who provide services; ✓ Compilation of the contact information of the officials and linking them to a public service; ✓ Publication of the public services on the website of a local government;
Legislation management system – contained in EDRMS	**Objective:** To provide a fully complete base for the legislation of an institution where all the legal acts are linked to each other and managed on the basis of their versions. **Result:** ✓ A digitalised legislation base that includes all (100%) valid versions of the legal acts of a local government (including council);

	✓ The versions are linked to each other by links such as "amends", "repeals", etc.; ✓ Legislation base has been made public for the citizens on the website of a local government through the public view of EDRMS and it is also accessible through the state portal environment;
E-invoices system – contained in EDRMS and attaches to financial software and other interested parties	**Objective:** To enable fully digital processing of invoices, involving the customary work environment of the users for that purpose (usually only financial analysts work with the financial software). **Result:** ✓ EDRMS is interfaced with a financial software, Invoice senders have been notified of that; ✓ Local governments only accept e-invoices; ✓ Invoices are approved digitally in EDRMS; ✓ Items are transmitted to the accounting software in XML-format; ✓ Invoices are stored and archived in EDRMS; ✓ Received invoices are not to be printed out in any case;
Digital correspondence system (management of inter-institutional messages) – contained in EDRMS, attaches to the Document Exchange Centre (DEC) and various e-mail customers	**Objective:** Digitalisation of the documents received on paper, and fully digital proceedings, which creates a common environment for solving matters and monitoring the solution procedure. Permits the centralisation of all information that is required for the reorganisation of processes. **Result:**

	✓ All paper documents and letters are digitalised; ✓ Letters received in digital form are not to be printed out in any case; ✓ Letters are processed and forwarded to be executed only digitally; ✓ The officials responsible for solving specific cases are published and could be found in the public view of EDRMS ✓ The primary sending mode in the case of outgoing letters is digital, only digital signatures are used.

The Local Government Systems, presented in the table, must be interoperable with other systems and registries. It would be reasonable to centrally create universal interfaces that are necessary for EDRMS along with the requested queries (e.g., local governments need a query from the Land Register for preparing a document in EDRMS). An engine for integration with all state registries within EDRMS Amphora has been developed, but agreements have not been reached between the service provider of EDRMS Amphora and administrators of state registries. Such agreements on the usage of databases for performing queries should be taken to the state level. The central concluder of the agreements could be the Estonian Information System Authority (EISA). EISA concludes agreements with necessary databases on behalf of local governments in order to perform the required queries in EDRMS. Thereafter, an agreement should be concluded between the EDRMS service provider and EISA.

4.4 Transition and Necessity of the Implementation

Over the years, the implementation of the EDRMS Amphora in local governments has provided useful feedback about the implementation process for future optimisation and unification of the process. This should be considered in conjunction with other sources. All implementation activities have been carried out with my direct involvement: I have trained government officials and gathered feedback for further development and improvement of the software. The development of the software implementation methodology has been an important focus of the e-LocGov model in order to provide more efficient implementation of the developed technologies and new principles. However, the

transition methodology is not only connected to the implementation of software solutions but also includes cooperation with various parties, users (both officials and citizens), awareness-raising, and conducting sector-specific research for the necessary further developments. As mentioned above and stated by Davison et al. (2004) both the practical progress and the advancement of knowledge result from deep reflection and learning. Experience has taught that there is a need for a variety of co-operative support systems but the focus has mainly been on the implementation process of EDRMS Amphora, in the course of which factors influencing the success of the transition into e-governance have been identified. The results reached during the development of the transition methodology of the e-LocGov model are as follows:

- An EDRMS implementation methodology has been developed that includes both the specific software for local governments and the necessary learning methods.
- Cooperation between parties responsible for sector-specific developments and research has been established, and competence centres have been created to facilitate sector-specific research and further comparisons with other states.

However, it should be pointed out here that for further and continuous research, an important achievement connected to further work on the transition methodology is the emergence of a competence centre linked with the field of e-governance: the e-State Technologies Laboratory and the TUT's International Master's programme: e-Governance Technologies and Services (which will be discussed in sections 5.8.1 and 5.8.2). This allows to improve the association of the practical activities in this field with the theory in order to engage students and scientists in the research. Apart from the technological aspects of the e-LocGov model, principles for implementing paperless management are necessary, including the introduction of a specific work environment, training sessions, collecting user feedback, and the development and adoption of new rules.

The EDRMS Amphora implementation methodology, especially the factors relating to cooperation, will now be explored further. The development of the components of the implementation methodology has evolved over the course of various projects, the analysis and the generalisation of which have greatly contributed to this research. Whenever local governments have been interested in the as-quick-as-possible application of the systems, it has always been essential to find out if and how improving the application process would be possible. Although, as noted before, clients will focus on practical outcomes while the research community is more interested in the discovery of new knowledge (Davison et al., 2004), we wanted to achieve both goals. The derivation of new ideas (on the basis of the results from finished projects and experiments, the formulation of problem definitions and the generalisation of the data/results obtained from the experiments) has been a chief interest of the author for several years. A local government specific environment has been

developed along with the necessary learning methods which allows for efficient implementation of new solutions. The results have been summarised in the form of the implementation methodology of EDRMS Amphora (see Figure 26).

During the development of EDRMS implementation methodology, several existing methodologies were considered, such as SAP (SAP R/3) ARIS; ERP systems using Dynamic Enterprise Modeling (DEM); Oracle e-Business Suite, using Oracle Application Implementation Method (AIM) and Microsoft Dynamics Sure Step methodology. Initial projects for developing EDRMS and the implementation methodology were the most similar to the Sure Step methodology (see Figure 23) as the principles used there have coincided with the development logic of this methodology:

- Agile project type;
- Organisational Change management Discipline;
- Collaboration and project tracking capabilities;
- Enhancements to the Diagnostic Phase;
- Enhancements to the Optimisation Offerings.

Although, it was possible to draw parallels with the Sure Step methodology in the initial implementation methodology, over time the implementation methodology of the e-LocGov model became more distinctive and was optimised over various phases. The usage of the Sure Step methodology during the development process of software gives a good opportunity to obtain the necessary feedback during the project. It also provides a chance to document the course of the activities. In organisations where mapping the requirements is an important part of the initial phase of the project, the use of this methodology can be a potential success factor.

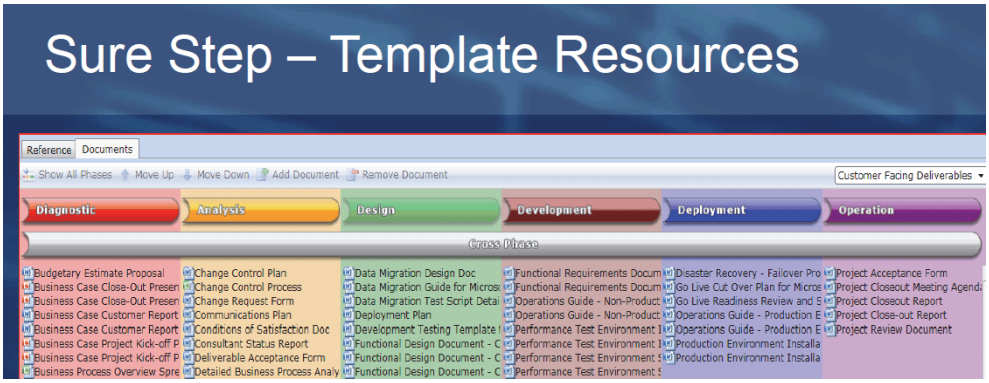

Figure 23 Example of the Sure Step documentation plan

Objectifying and optimising the EDRMS implementation methodology and comparing it with others (see Table 6) was possible due to the similar functions of local governments and the services provided.

Table 6 Comparison of methodologies

Phase Sure Step	**Phase e-LocGov EDRMS**	**Sure Step**	**e-LocGov EDRMS**
Diagnostic	Organisation and analysis	Mapping the needs and conclusion of agreements	Conclusion of an agreement and generation of a model environment
Analysis	Organisation and analysis	Analysis – business processes, architecture, etc.	Adaptation of the preset environment (if necessary)
Design	Preparations	Data migration and implementation plan	Data migration and an implementation plan
Development	Implementation	Functionality requirements and testing	Training days and adaptation of the environment after the training feedback (if necessary)
Deployment	Implementation	Go live (plan)	Go live
Operation	Post-implementation and feedback	Project feedback	Feedback and further plans (new e-services, addition of business processes, etc.)

By 2012, the software platform of local governments and the necessary functionality for launching paperless management had been developed. The implementation of the necessary functionality was formalised as an implementation methodology in the form of the e-LocGov model (see Figure 24), involving four phases. The harmonisation of the EDRMS implementation methodology and transition methodology has been possible due to the fact that:

- Required software functions among local governments are the same;
- Services used and provided by local governments are similar;
- Business logics and processes of local governments are similar;
- Requirements provided in the legislation are the same;
- The number of users in local governments is similar: around 15-20 officials (excluding larger local government units, such as the City of Pärnu, etc.);
- Behaviour of users (officials) is similar.

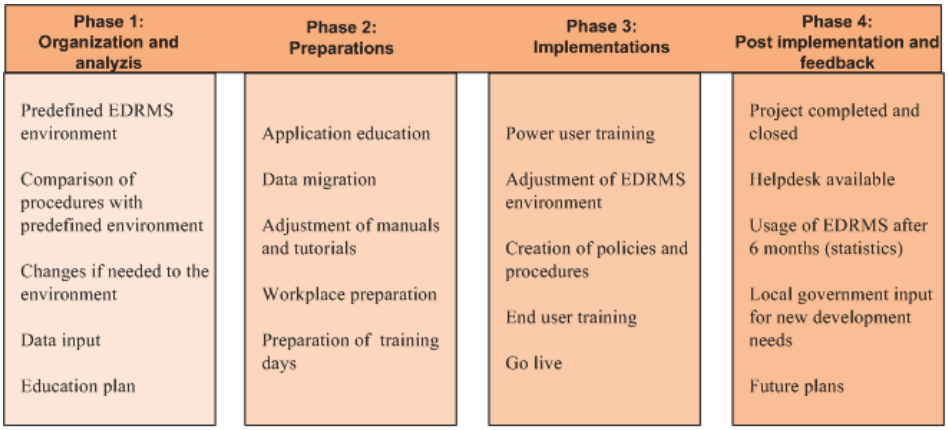

Figure 24 EDRMS Amphora implementation methodology

The proposed implementation methodology includes the implementation of EDRMS Amphora and the necessary interfaces. Additionally, a lot of focus is on raising general awareness and teaching the officials. Improving the ability of the officials to see the e-governance as a whole is vital. As mentioned above, the main obstacle has been their low awareness of the information society and e-governance principles in general. Solving this particular problem must be a continuous development trend of the transition methodology; the implementation methodology of the developed EDRMS is not enough. This methodology gives an opportunity to develop the technology, but increasing competence is an ongoing process and should be considered as constant. Local government-specific implementation methods have been developed in order to enable them to quickly, easily and cheaply implement the possibilities of EDRMS and to improve their work processes. The e-LocGov model gives instructions and guidelines for the implementation of local government-specific systems.

4.5 Implementation Principles of EDRMS

As regards increasing the capacity of EDRMS, a pre-generated work environment with preset parameters and functions is required. Pre-determined process-based functions and roles need to be described in the software and implemented by specific target groups. The functions of the institutions may vary and, therefore, the ways of using the same software can also differ. A sample model of EDRMS environment has been developed over several years among local governments and this can be employed by every new joining local government. The preset work environment of local governments includes the following:

- List of documents of local governments that was unified and optimised in the local governments of Rapla County in 2011 (see Figure 25);

- EDRMS views adapted to the roles of the users (the roles are, for example: the secretary of local government, official, council chairman);
- Preset document forms and applications;
- Operation rights determined by policies depending on the role (for example, whether or not a person can further delegate a document, i.e. does the user have such authorisation according to standard documentation);
- Pre-filled fields depending of the role of an official.

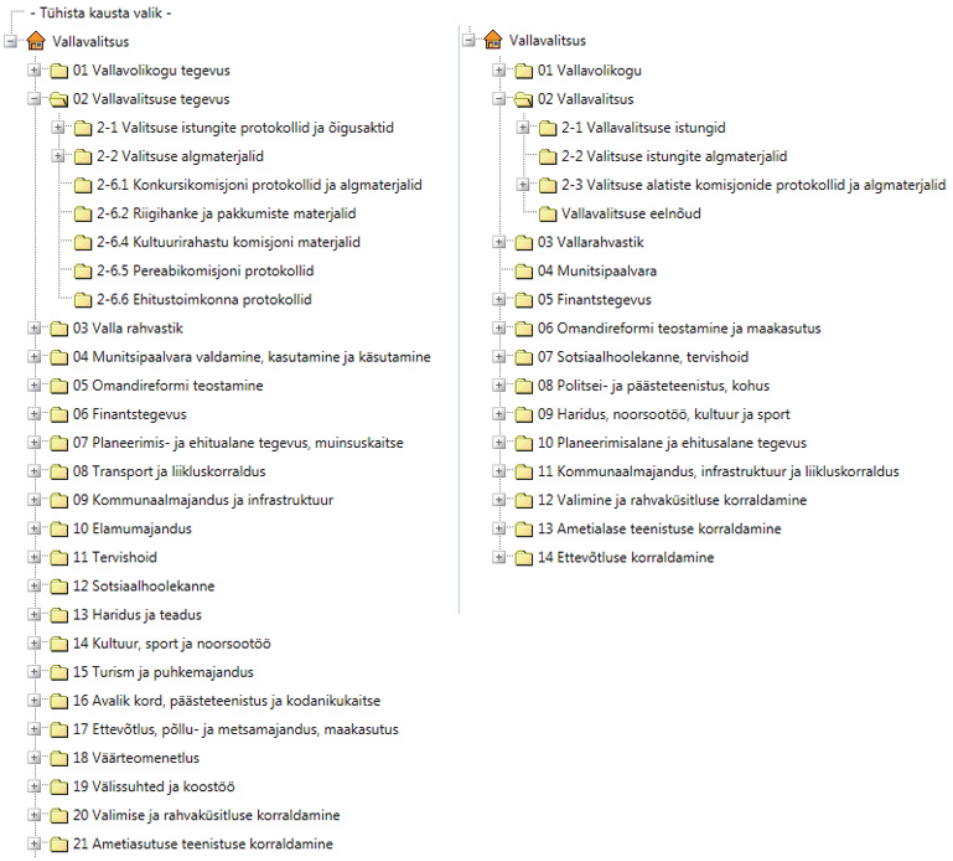

Figure 25 A hierarchy of the document list of a local government that demonstrates the results of optimisation from left (the number of functions before) to right (the number of functions after). A screenshot from EDRMS Amphora.

From Estonia's perspective, the governance of local governments has been changing over the past decade, especially by function[22]. Local governments used

[22] In 2010, Ministry of the Interior developed a new document list of functions but it was not implemented as expected. The usage of it is minimal.

to perform tasks that today are practically non-existent, e.g. issues relating to the ownership reform. Meanwhile, the descriptions of their functions have not always adapted to the changes. Hence, information system should allow for flexible adaptation. Therefore, from the software development aspect, an organisational model should be described in several dimensions. The software must not strictly dictate the course of solutions for different processes. Accomplishing such a dynamic, especially bearing in mind its complexity, leaves the software development in an open-ended state. As the governing of local governments can be dynamic and the services provided can change over time, updating the model environment must be as simple as possible.

In addition to the fact that the determination of processes is imperative during the development of the model environment, it is also an important information source for describing process-based instructions (Pappel & Pappel 2011b). User instructions about the software can be divided into two groups:

- Instructions that describe the system of EDRMS, which give an overview of its functionality and functions (buttons, operations, form elements);
- Process-based instructions of local governments that describe the operations for performing a specific process step-by-step (e.g. processing X application of a citizen). Here, the inclination must be towards wizard-based learning materials that, in turn, should be linked with the provisions of the law that regulate the specific course of proceedings. For instance, the issuing of a building permit is described step-by-step with the specific processes and deadlines.

Alanko-Turunen (2005) noted that the success of the training results has been significantly bigger in institutions where, during the application and training phase, process-based instructions were used. In the light of this, it must be conceded that a web-based e-learning environment provides extraordinary tools for the creation of a competence base that is required for using EDRMS and paperless management in general. It establishes new kinds of possibilities for communication between users (Goodman, 2002). The environment of EDRMS Amphora offers a minimum set of web-based learning materials. In the implementation stages, a separate learning environment is created that is a clone of the functioning work environment. This permits using real work procedures in a game environment as a simulation. The development phases of web-based e-learning environments are in constant change, as each new user may bring along new skills. There are several dimensions to developing e-learning environments that can be highlighted separately:

- E-learning environment contains information (instructions, training videos, etc.) about software, implementation, and managing various functions;
- E-learning environment enables users to measure the level of their knowledge, skills and user experience;
- Users can exchange their experiences in e-learning environments.

In addition, the usage of EDRMS Amphora (its rights and functionality) can be linked with the lessons covered. After concluding each lesson, the specific user is given the right to use that particular EDRMS function. The tutorials are divided into topics, each of which deals with a maximum of 10 functionalities. A further objective (Pappel & Pappel, 2011b) is to include references to specific business processes with which the functionality is connected. The structure of the theoretical part includes 10 to 15 slides of functionality-specific processes, followed by one or two multiple-choice questions about each slide. Each completed tutorial awards the user with a certain level. In order to achieve a level, the participant has to complete all obligatory (O) modules and 50% of the recommended (R) modules on EDRMS. A module is completed when the participant has covered at least 80% of the theoretical and practical parts.

In the further development of this environment, an assessment system can be built (Pappel & Pappel, 2011b), the results of which could be stated on a CV as a separate competence level. In order to facilitate the management of a web-based learning environment, in future research, it should be linked to a Public Services System (PSS, see next section), where service descriptions are transformed into specific forms and wizards upon producing process-based training videos. It is important to create an infrastructure that would permit downloading the service forms described in PSS to the e-learning environment. The given form, i.e. service, is divided into important stages and, thus, it is possible to add to each phase a description that is important for an official – which fields to fill, how to fill them and what kind of legislation must be followed. By now, solutions have been offered which employed the wizard-principle[23] for describing the services of local governments, yet as independent solutions, these would entail additional work for local governments. Central coordination, which requires further development, yields better results, as the common space of local governments communicates using various technological components (see Figure 26 below).

[23] The international project EGOPRISE organised in the Tallinn University of Technology, the Centre for Business Research and Development of Tallinn University of Technology, the Institute of Baltic Studies and Narva BAS Foundation have studied the e-government services for enterprises in 2012.

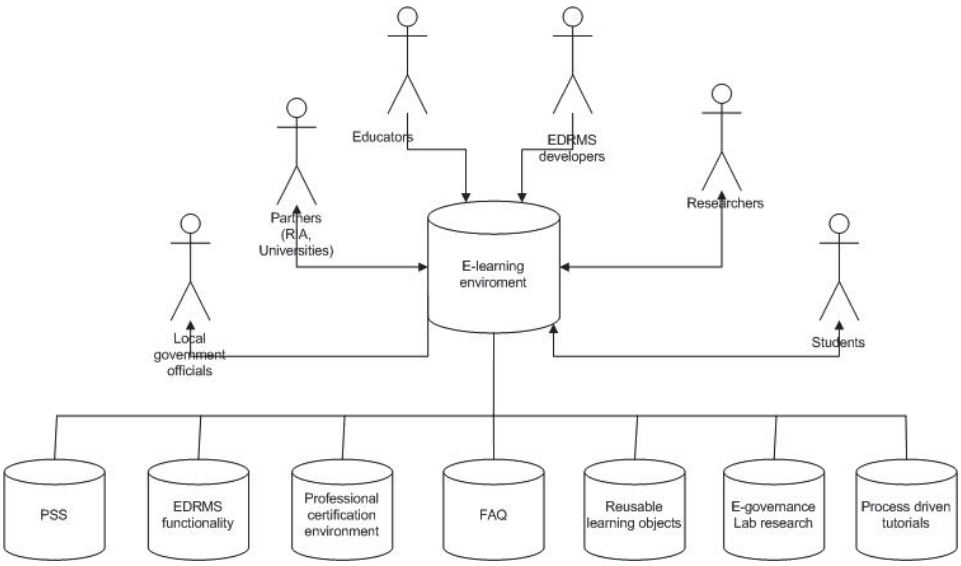

Figure 26 A possible learning environment which is a work in progress

A common web-based learning environment enables the executive officer of an institution or the main user of the system to establish an obligatory procedure for users new to the work environment. Thus far, it has been apparent that web-based learning environments in combination with computer class based training increase the efficiency of software implementation. During my work on the implementation of EDRMS Amphora over several years, it was evident that after carrying out combined training (traditional learning and e-learning), the scope of software usage increased. In order to transform the application into e-learning, changes both in the information technology and the social aspect are necessary. Allen (2003) claims that the adoption of e-learning will radically influence how the training is organized and its overall relationship with the institution. The issue of whether or not e-learning is cheaper than face-to-face instruction is still rather unclear. It has been admitted that e-learning can reduce training delivery costs in some circumstances but the costs associated with developing and delivering effective e-learning will be substantial (Langford & Seaborne, 2003).

Potential further research could include the principles of the Intelligent Reusable Learning Components Object Oriented (IRLCOO) approach that produces learning materials with a standardised interface and functionality, and in the words of Valderrama et al. (2005) that are rich in multimedia, interactivity and feedback which in turn can raise the efficiency of learning. Furthermore, according to Canales et al. (2007) adaptive and intelligent Web-based Education Systems (WBES) take into account the learning requirements of individual students by means of a holistic architecture and framework and has noted by Valderrama et al. (2005) is centered in reusability, accessibility, durability and interoperability of didactic materials and environments of virtual education. Solutions covering matters relating to e-learning must be universally applicable.

This presupposes mapping the main processes in the organisation (local government) and their thorough unification before creating the learning materials.

The learning methods evolve along with the users: every new user can bring along new knowledge to be shared with others. Using e-learning opportunities for that purpose is definitely a good option and should be considered in further research. E-learning is presented as a cheap and effective way of providing public servants and public sector organisations with continuous learning opportunities required for recruiting and retaining valuable employees and improving organisational outcomes (Langford & Seaborne, 2005). This is an effective tool and should be integrated into the transition methodology and also further explored. All these considerations are going to be more thoroughly researched and adapted according to the application aspect of the e-LocGov model over the coming years.

4.6 Classification of Public Services

An overview of the proposed system for describing the public services of local governments will be presented here. Mapping the needs of local governments in order to find a solution for describing the services offered by them has been an important goal in this research (Pappel & Pappel, 2012b). There are many connection points directly linked with EDRMS Amphora and the Local Governments System. Many parts of the e-LocGov model must be involved in order use the framework as a whole. The developed prototype has been tested on the basis of EDRMS Amphora and the future plan is to connect it with other necessary systems, which need to be interoperable when offering specific services.

A research ordered by the Government Office (Government Office, 2014) notes the necessity for creating common principles for describing public services and analysing the possibility of a common repository for these services. In the research conducted by Ministry of Economic Affairs and Communications (Estonian Ministry of Economic Affairs and Communications, 2013a), currently prevalent problems of local governments are illustrated and, thus, have contributed to the creation of the Public Services System. In order to describe the public services at local governments, common agreements should be more precisely confirmed. This would facilitate publishing the descriptions of the public services to the wider range of users. The usage of confirmed services is possible both on the website of the state portal and on the websites of the respective institutions. The common repository for describing services ensures the re-usage of existing descriptions and establishes rules for describing missing services. It enables local governments to access information and the services that have been successfully employed by others. Furthermore, it increases cooperation with the various units of local governments.

The proposed common repository of the Public Services System (PSS), referred to as Public services registry in an earlier work (Pappel & Pappel, 2012b), permits to develop simple national thematic service fields that are easily

comprehensible to citizens, and can be found in state portals and also via the websites of local governments by using the EDRMS public view (see Figure 27). The websites of the organisations could be linked to the state portal where a citizen can move from one administrative unit to another through specific topic fields.

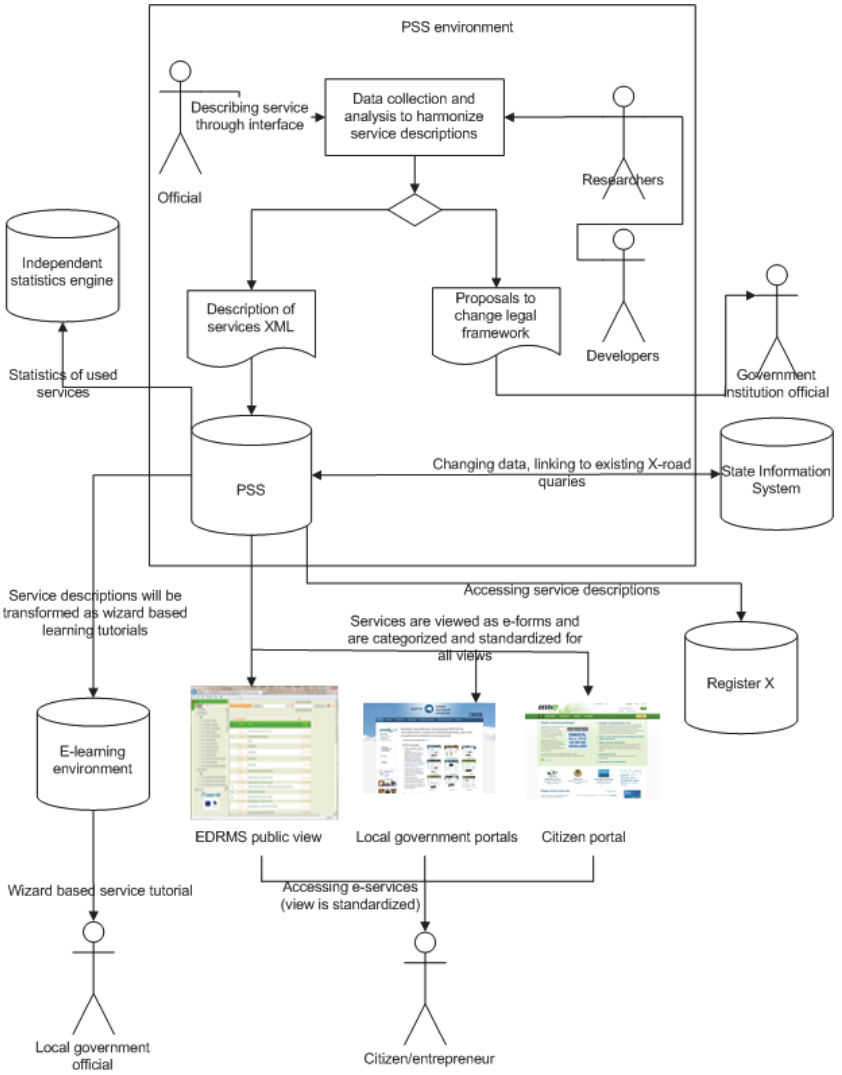

Figure 27 The functionality of PSS

This approach improves the accessibility and comprehensibility of the services by using a harmonised limited amount of topic categories, as it has been successfully employed in banks for structuring a diversified service environment. PSS data usage should be the common part of the state portal. The service descriptions are only entered once, after which other information systems

and databases could also use this information. A common repository and unified service descriptions will facilitate the growth of efficiency on many levels; certain points have been listed as follows:

- Replication is avoided, i.e. the descriptions of specific services are located in one environment and are reusable;
- Data is kept dynamic. Changes have to be reflected only in one environment and are automatically renewed in all the cross-used systems;
- Service descriptions, which are the same in local governments, are unified;
- Creation of common classifications, which can be easily re-used;
- Common cross-border classifications permit the shared use of certain services in EU Member States which could be built on this platform;
- The universality of the interface and the technical platform allows for open communication with all IS-s.

Moreover, it gives the citizens an opportunity to use a single environment that contains all the information about the public services provided by local governments. It should make no difference to the citizens in which environment they wish to start consuming the specific service by sending out an application. An important functionality, which is planned to be added to PSS during further development, aims to involve citizens in the service design process. It could provide valuable knowledge for making e-services more customer-friendly and usable from the point of view of the citizen. It permits reflecting the public services in the state portal, and these can also be found through county portals and on the websites of the local governments. Both a thematic and an alphabetic catalogue of public services should be used. Today, this system is used by some local governments, but wider application would give nearly half of the local governments the opportunity to improve their communication through the following points:

- Citizens use the same kind of structures when they search for services, which would facilitate navigating all websites;
- User-friendly topic service catalogues will be created for citizens;
- Information movement and application process is quick and operative;
- Standardised services enable citizens to understand the bureaucratic division and responsibilities of the organisations more easily.

As regards the wider application of PSS, it must be admitted that some necessary integration is still missing but a database had been created, in which the data objects of the services in their initial form can be determined. In further research, the dynamic data model should be used more in depth. Furthermore, data sets should be relatively small. Research needs to involve issuing data through Internet services. As a further development, it would be appropriate to add an

e-service design engineering to PSS for quick and easy prototyping of new e-services (currently, there are forms and data fields, but the design process itself should be more interactive, e.g. Mindmap techniques visualise the design process more efficiently).

4.7 Support Systems for the Application of the e-LocGov Model

The transformation into e-governance requires close cooperation between all parties (COM, 2005a; 2010a; 2010b). The Ministry of the Interior should centrally coordinate the activities of local governments, but this is not always done very systematically and consistently. In addition to the Ministry of the Interior, local governments have umbrella organisations, the Association of Municipalities of Estonia (AME) and the Association of Estonian Cities (AEC) that coordinate the activities of local governments of the basis of common principles. From the financial perspective, local governments are relatively independent within their own independent budget. They can receive financing from the state on a project-basis. Furthermore, the AME and AEC do not have financial resources for the continuous development of local governments, and therefore, their contribution to increasing ICT awareness in local governments has been insufficient.

The long-term research and development activities have been of great personal interest to us. Consequently, some forms of cooperation with different parties have started to take shape more clearly in recent years. A need for a competence centre has arisen (discussed in sections 4.7.1, 4.7.2) in order to conduct more thorough research and problem-solving actions (Pappel, Pappel & Saarmann, 2011). This idea primarily evolved due to the problems that emerged in the course of developing local governments.

As regards different cooperation forms, the principles of the Public-Private Partnership (PPP) could be brought forth as a suitable methodology for local government developments. At first, PPP was mostly used for implementing physical infrastructures, but the tendency over the past few years has been to link it to the development of e-governance. Typically, PPP agreements are the mutual agreements between the public and private sector in order to support products and services that, in general, are provided by the public sector. From a risk management perspective, many risks have been mitigated that, without a preceding cooperation agreement, would have produced related elements. The responsibility of the private sector could be subject to negotiation, but in the future, the tendency is towards the notion that the interest of the private sector is not merely profit-oriented. Instead, responsibility sharing is about to become a standard. This ensures a higher proportion of success for projects that, in turn, bring well-earned remuneration for the private sector producer. Under ordinary procurement contracts, the private sector vendor is likely to be paid whether the project is successful or not. E-government projects are often planned on a large scale; the magnitude of the operations requires substantial financial resources and interdisciplinary skills in order to plan, install, and operate such systems and services effectively. The possibility of using PPP should be carefully considered,

as it might not give the expected return in every implemented project. To some extent, the Structural Funds project (Appendix A) of Kehtna can be regarded as an example of PPP where the state and private sector achieved a result that could serve as a good example for all local governments.

The success of implementing e-governance rests on cooperation. Cooperation within the organisation, and with other organisations, citizens, entrepreneurs and business partners insures better acceptance of new principles. Policies and strategies have to support this (Doornbos, 2003). Cooperation must focus on achieving a better result. Unfortunately, people tend to excessively categorise delegation as cooperation. According to Lundin (2007) complex policies are more effectively put into practice if agencies cooperate a lot, but also if cooperation does not improve the implementation of less complex task. Cooperation must be directed at the overall minimisation of resources and optimisation; cooperation itself cannot be too expensive. Different risks have to be evaluated if cooperation might not give the expected positive long-term effect to the parties involved. It is necessary to evaluate cooperation costs that highlight the importance of joint task complexity, inter-partner diversity, equity and strategic implications on the perception of the value of alliances and the formation and evolution of hybrid governance structures (White, 2005). Through this research, great emphasis has been put on the development of cooperation between different parties. We have realised that a separate centre of competence which regulates the roles and activities of the involved parties is the best form of cooperation.

4.7.1 Research at the e-State Technologies Laboratory

An overview will be given of developing the e-State Technologies Laboratory to ensure constant research in e-governance field. After the activities were performed, the vision of the structure related to the information society and e-governance developments of local governments became more precise by also considering the vision of e-state charter (National Audit Office, 2008). Many good ideas and thoughts were unfinished due to a lack of resources. Thus, it became clear that for more comprehensive research and knowledge partnerships and networks involving many different parties were required. This created the need for a laboratory because more efficient e-governance from competent officials to a well-arranged information technology platform demands an infrastructure (Pappel, Pappel & Saarmann, 2011). In autumn 2011, the e-State Technologies Laboratory was formalised under the Institute of Informatics and the main spheres of research were defined as follows (Pappel, Pappel & Saarmann, 2011): 1) application and implementation of the functionalities of existing information management solutions as the use of existing systems still remains insufficient; 2) elaboration and application of e-implementation methodology; 3) description and elaboration of services and development of a quality management system for the feedback; 4) analysis of new development needs as transition into e-governance presupposes continuous development; 5) feedback, statistics, analysis and different (applied) research in order to

examine the possibilities of applying the existing methods and models and to determine the bottlenecks in the application of specific methods.

The first outcome of the e-State Technologies Laboratory was a prototype of the Public Services System. A further call of action is to conduct citizen surveys and satisfaction studies, and analyse the measured results of Public Services System. The action plan for 2011-2015 describes the main research and development goals related to local governments by formulating the primary terms, partners, fields and spheres of responsibility. First, an e-local government contract was signed by Jõgeva City Government in 2012. The objective of this contract is to improve the implementation and application of the functionalities of the existing information management solutions (incl. EDRMS Amphora) in local governments. Additionally, in order to analyse the transformation to paperless management, it enables the laboratory to make statistical queries in the EDRMS Amphora databases of local governments, and use the information received for the development of local governments, the improvement of the e-LocGov model, and for learning and research work. This contract appears on three different levels (A, B and C) where the maximum level is "A" which requires the use of all Local Governments Systems (presented in previous section) as well as fully paperless management. "B" and "C" levels set fewer obligations relating to paperless management which also enables local governments with lower ICT capacity to join this contract. Contractual relations are necessary. An important agreement that had to be negotiated was on the usage of local government data in our research.

Increasing student participation in various survey related projects (e.g. preparation of questionnaires, statistical analysis, etc.) is planned with a view to linking the activities to their courses. However, further research on the e-LocGov model is one of the more important activity spheres of the laboratory, where different parties, including the state, local governments, the private sector and scientific research establishments, are working together. Currently, discussions are underway for local governments to make their data available to the developer and the university for statistical and scientific purposes. However, these agreements must certainly be regulated in accordance with the copyright and other principles. Furthermore, the State Information System and Ministry of Economic Affairs and Communication have already agreed to being involved in many research projects and have ordered and specified desired e-governance development outcomes. Many project ideas and research areas requested by these institutions are becoming a part of the study courses or student projects, with the laboratory providing the required support and infrastructure.

In addition, foreign experts are planned to be engaged in research projects, thus importing methodologies from other countries and gathering information about their practices. This would provide a valuable input into current research outcomes. Moreover, employing our solutions abroad would give feedback on the adaptations required for a large-scale deployment of the e-LocGov model. Initial cooperation discussions are under way with universities that have shown interest in, among other things, our structure of closely linking the Master's

programme with lab activities. This allows students to continuously gain practical experience by researching e-governance systems. Furthermore, availing of local government cooperation partners in foreign countries aids comparing the e-governance abilities of different countries. Thus, through researching the local governments abroad and generalising the gained knowledge, common principles can be formulated. For example, Public Services System approach could be used in foreign countries for cross-border service provision.

4.7.2 E-Governance Technologies and Services Curriculum

The activities carried out from 2010 to 2012 in regard to the development of the international Master's programme "e-Government Technologies and Services" will be presented here. I am responsible for the creation of this concept for the curriculum and lead the development of the programme structure and courses in cooperation with experts as well researcher in this field. There were many factors that supported the development of the Master's programme. For instance, the
e-State Charter was prepared in 2008 to provide principles and criteria for assessing the relevance of the work done by the institutions upon using the possibilities of information technology pursuant to the interests and needs of the people. Furthermore, information technology students who are going to work in the public sector should have the capacity to create and apply the solutions that respond to these criteria ((Pappel, Pappel & Saarmann, 2011). In 2011, activities were initiated for the creation of a field of study that would merge science and the practice of e-governance (Pappel, Pappel & Saarmann, 2011). This curriculum enables public sector institutions in Estonia and abroad to send their officials to acquire further education and field-specific knowledge. The program gives students a broad knowledge about the makings of a modern state: the transition into e-governance, its management and development. Studies include a wider overview of administrative and legal aspects of e-governance and cover the following dimensions:

- Focus on designing, developing and improving governmental systems and implementing e-government components on every level of the state
- Specialisation on IT technologies, innovation/services in the public and private sector or the adoption and marketing of e-governance
- User-oriented services offered by the government that are based on information and communication technologies
- Experience in the industry, practical research and project work during studies

Additionally, the e-State Technologies Laboratory is planned to facilitate conducting practical training and workshops, and to enable students to participate in practical experiments related to e-governance and the improvement of local government processes. The purpose of this is to export models, prototypes and know-how produced by the students and the laboratory to foreign

countries through public sector institutions and the research of the academic field. The curriculum allows for the involvement of students from other countries and, thus, makes this module more attractive with the help of a practical implementation platform and the presence of practicians and lecturers.

4.8 Summary

The previous section gave an overview of the main results of the development, implementation and research results of the e-LocGov model. On the whole, a lot of restrictions and limitations have been removed thanks to new technology and software, and a significant amount of new opportunities have emerged. It is important to keep an open mind for innovations and to encourage local governments and their counterparts, thus making e-services more efficient and user-friendly and in line with the principles of good governance. Therefore, one important objective in this research has been the improvement of the work environment of local governments by moving into e-governance in order to provide better services for citizens. The solutions developed for local governments facilitate the adaptation of e-governance principles and make their everyday work more efficient by using the interoperable EDRMS along with other technological tools. Additionally, they provide answers about the changes in the efficiency growth. The implementation principles have evolved during the involvement of interested parties. In the e-LocGov framework, the following outcomes for local governments have been achieved:

- A technological platform based on EDRMS Amphora and its interoperability with different systems;
- The description of Local Government Systems and their organisational processes have been described, developed and tested;
- A transition methodology containing EDRMS-specific implementation procedures and common repository requirements for public services has been developed;
- Different training opportunities and the use of predefined EDRMS environment have been put into practice as supporting components.

For the time being, the activity of implementing paperless management has largely been focused on formalising the concept in order to simplify the implementation of the e-LocGov model for local governments. Currently, the research and development agreements have allowed for conducting the prototyping of certain parts of the e-LocGov framework in the local governments. The framework of the e-LocGov model, its obstacles and requirements were discussed in this section. Although the prerequisites for the implementation of e-governance principles have been created, the factors which could affect the implementation and uptake results still exists. Despite the latter issues, the development of the e-LocGov model is an evolving process. Nevertheless, the existing framework allows local governments interested in implementing the framework to increase their efficiency by using these principles. In addition, the creation of the competence centre in the form of the

e-State Technologies Laboratory, and the international Master´s program e-Governance Technologies and Services facilitates promoting the development of the local government sector through various research and development projects.

5 EVALUATION OF INTERVENTION CONSEQUENCES

The following sections will give an overview of the evaluation of the e-LocGov model that has been implemented to date and the assessment needs for measuring efficiency change in local governments (Pappel & Pappel, 2011c; Pappel, Pappel & Saarmann, 2012b). The assessment criteria for local governments will be presented. Therein a feedback system has an important role to play – nowadays it provides the opportunity to assess the digital performance of local governments by using both qualitative and quantitative methods and gives valuable information about changes in local governments. The application of the e-LocGov model will be examined by considering the different factors which can influence the results of paperless management implementation. Two case studies will be presented that were conducted in order to develop and assess that approach. The results of the case studies provided an opportunity to evaluate progress by assessing the digital capability and the developed e-services. My role in the process was to develop, in cooperation with local governments, a set of characteristics to measure the efficiency of the local governments (Pappel, Pappel & Saarmann, 2012b) as well as to describe the measurement sets for evaluating the e-LocGov model as a result of the work so far.

5.1 Evaluation of the e-LocGov Model

Measuring and analysing the results is important because of the feedback for planning further research and development activities. The evaluation of the results has to be connected to several objectives: firstly, obtaining feedback on ongoing changes in the e-LocGov model; secondly, assessing changes in local governments; and thirdly, obtaining feedback on new necessary developments. To date, the focus has been more on the assessment of post-implementation changes in local governments. In future research, the impact of the e-LocGov model as a whole should be assessed and analysed in more detail. This work describes my own evaluation of the e-LocGov model in which the primary characteristics are developed. The efficiency and readiness of local governments in the e-governance field can be assessed in several ways. It is possible to assess general readiness upon the implementation of e-governance, and to assess changes that the implemented functions bring along.

For instance, the e-Government Readiness Assessment (ERA) analysis in the ICT spectrum (Alghamdi et al., 2011) could be usable and applicable for specific local governments with its own unique e-government priorities and goals. As a result, a set of specific readiness assessment indicators can be derived for carrying out organisational change. The principles of e-Government Readiness Assessment (ERA) approach have been taken into account in this research but several of these activities have also been based on the information technology view in order to assess the possibility of implementing the ICT in local governments more efficiently. However, according to Shareef et al, the e-Government Readiness Assessment (ERA) can be an effective tool for

carrying out the planning and evaluation of the initiatives toward achieving an information society in general (Shareef et al., 2008). “Through ERA a government can assess its level of readiness, identify its gaps, and then re-design their strategy” (Shareef et al., 2008).

Also, the e-Government Adoption Model (GAM) should be considered as allowing the citizens to adopt the e-Government (e-Gov) at different stages of service maturity (Shareef et al., 2011). The elements of this method have been used and should be implemented more in depth for further development and verification of the e-LocGov model. However, Kitsing argued that the indexes give an imperfect picture of the state of the e-government. He noted that indexes use different conceptualizations of e-government (Kitsing 2010). He exposed many shortcomings associated with the index approach. Also, different studies on e-government framework assessment point out that some e-readiness tools do not include e-government (government itself) in their assessments (Azab et al., 2009). These tools mainly evaluate e-services, accessibility, support, and the usage of ICT (Azab et al., 2009). This, in turn, can give an imperfect overview of the situation. Different approaches have been proposed for the provision of services (Gouscos et al., 2007), analysis methods of service quality (Halaris et al., 2007), and risk management in the light of E-GOVSQUAL-RISK model (Rotschanakitumnuai, 2008). Here, the research has focused on the fact that paperless management is key to employing e-governance where the measurement sets developed in this research consider internationally known approaches.

In addition to assessing the changes in local governments, the validity of the e-LocGov model must also be assessed and analysed. E-Government Readiness Assessment Model offered by Al-Omari & Al-Omari (2006) met the expectations of this research in many ways. They described different stages for achieving a more efficient e-government. The organisation building blocks that need to be assessed are Organisational Readiness, Governance and Leadership Readiness, Customer Readiness, Competency Readiness, Technology Readiness, and Legal Readiness. The approach used in this research for developing the e-LocGov model and its evaluation criteria has many similarities to the aforementioned work. However, the main evaluation in this work has concentrated on the EDRMS feedback from users that could, in turn, assess to what extent a local government has implemented the functionalities in their day-to-day work. Notably, characteristics have been developed for the evaluation that gives important feedback about the application of and changes to the e-LocGov. The changes in the dimensions of the model have been depicted in the charts below (see Figure 28-31). The following representation is the empirical, qualitative and, to some extent, subjective view of mine. From the development point of view, changes that have occurred over time upon using different criteria have been taken into consideration. For instance, in order to measure the ”budget” criteria in local government readiness, developments or training days ordered by local governments (income from local governments) were considered. By measuring the “legal framework” changes in law (legal

acts), changes related to paperless management were mapped. Many legal acts have been changed (e.g. DEC usage has been written into law). The readiness of local governments to compare such criteria by using a technological platform is connected to specific development projects and its outcomes over the years. In addition, paperless management does not always follow this path. The platform could be ready, but its application and user acceptance take more time. Satisfaction rate is related to visits by the citizens to local government webpages and to the usage of the EDRMS public view. Some of these metrics are already measurable by concrete queries based on webpages and information systems, but this research is ongoing in order to build a specific index for measuring all aspects of the e-LocGov model. The criteria use the following scales:

- 0 – none
- 5 – very low
- 10 – low
- 15 – medium
- 20 – good
- 25 – high

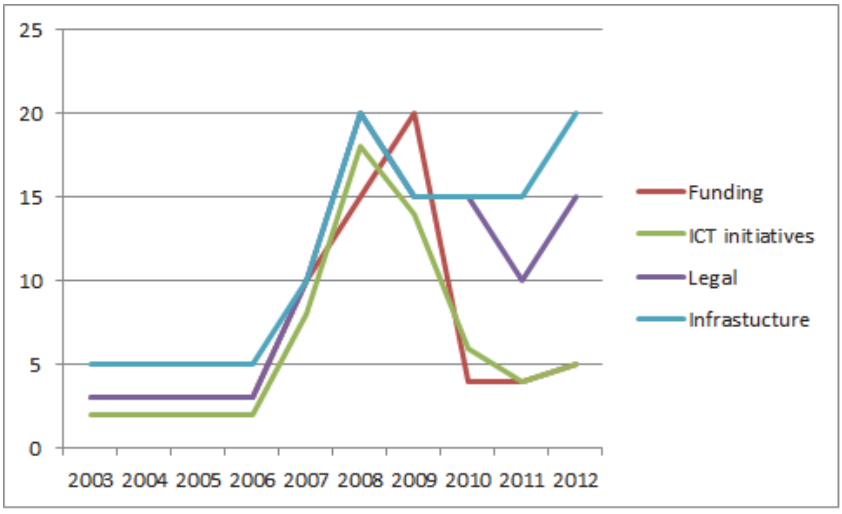

Figure 28 Change in the state's readiness (e-LocGov model)

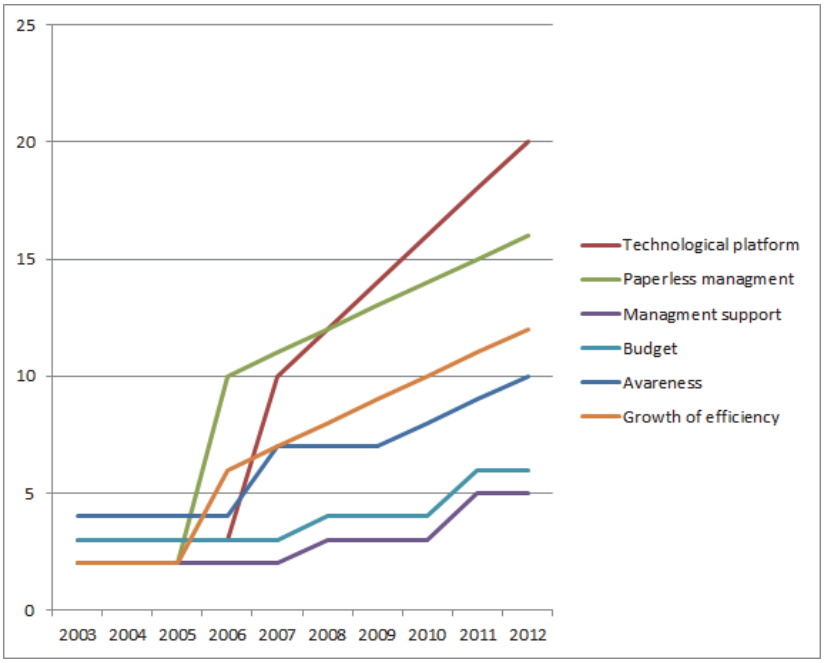

Figure 29 Change in the local governments' readiness (e-LocGov model)

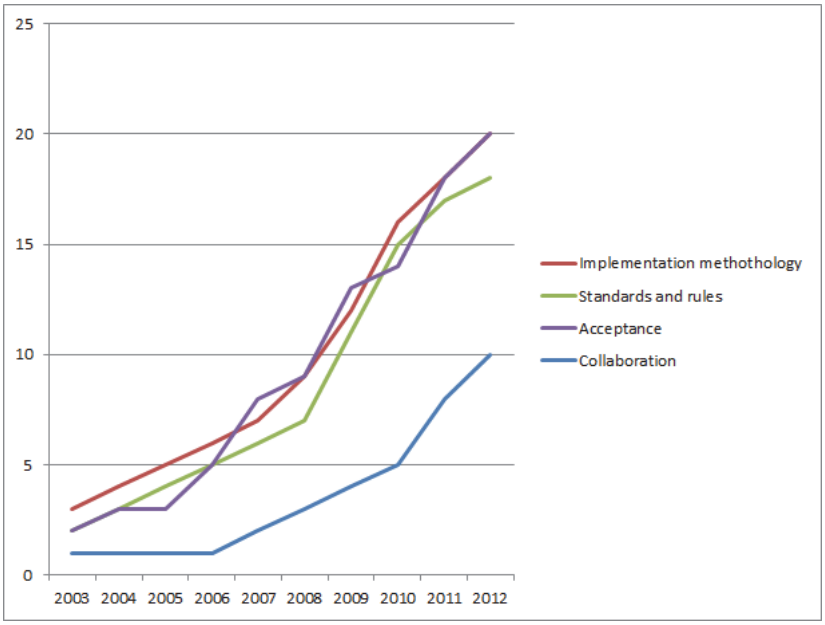

Figure 30 Change in the transition methodology (e-LocGov model)

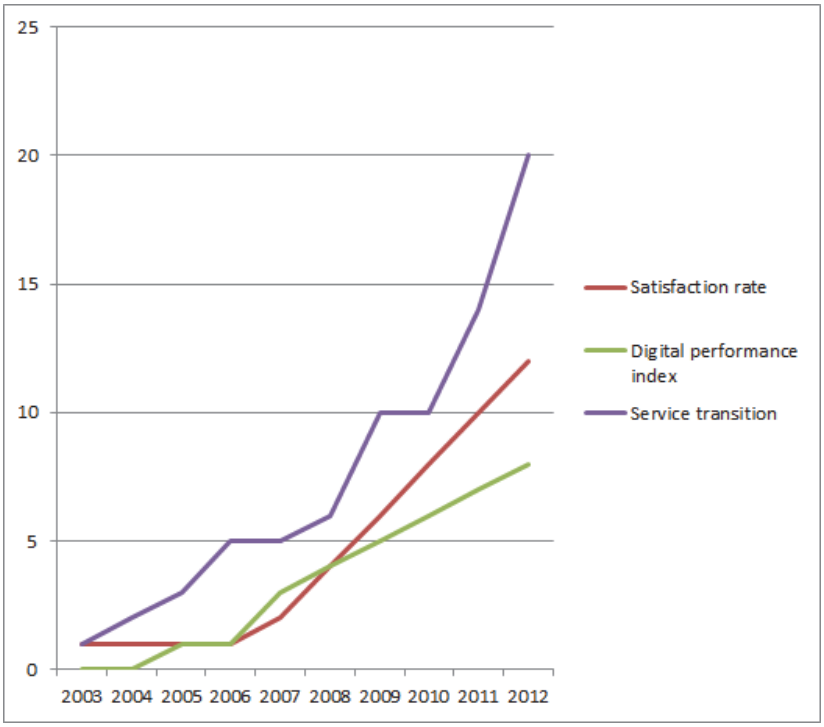

Figure 31 Change in feedback (e-LocGov model)

5.2 Measuring Digital Capability of Local Governments

Developing an appropriate measurement methodology for assessing the readiness of local governments for e-governance (and measuring the implemented results) has been an important goal for this research. There are some regionally provided surveys that have assessed the e-government, e.g. the Brown University e-Government ranking (Brown University, 2004), United Nations Department of Economic and Social Affairs (UN-DESA), e-Readiness Index (UNDESA, 2004), UN e-Government Readiness Index (UN, 2012) and E-Government Readiness Index (EGDI) measure the capacity and willingness of countries to use the e-government for ICT development (United Nations Public Administration Programme (UNPAP) since 2003). These studies employ different techniques and varying sets of indicators for evaluating the readiness for e-government. Some of them focus on evaluating e-government maturity instead of e-government readiness, with the focus on developing the features of public sector websites and e-services. While the aforementioned examples are targeted to assessing e-government readiness on a larger scale and in a broader sense, this research focuses on creating a feedback system that would, firstly, give an assessment of the existing application results, secondly, provide a necessary feedback system for further development, and thirdly, would allow for measuring the changes in a local government, including the increase in efficiency among the implemented functions.

In order to ensure sustainability and constant development, it is necessary to assess the results achieved by the implemented solutions. However, it is difficult to assess the entire performance merely from using EDRMS. Nevertheless, it provides useful feedback on the activities of the institution. It is possible to assess the scope of EDRMS usage in local governments on the basis of several criteria, e.g. by the relation between the number of EDRMS users (proportionally from the employees who use computers) and the number of business processes inserted in the software. It is difficult to assess EDRMS application performance and its profitability for the organisation because there are no agreed upon measurable indicators yet. The main practice for creating an overview has been using the users' surveys on the frequency, convenience, learning needs, and the usage of the information system (some examples are discussed in Case Study 2). It is possible to implement such data by using the qualitative analysis method during the development of the software, but these do not always permit quantitatively measuring the profitability of the information system in the organisation's work.

In further research, more thorough consideration should be given to the use of statistical measurements and sharing the results with the associated instances, including legislation-related issues, in order to make the necessary changes to the legislation. Several solutions cannot be adapted because of the law. Giving updated statistics to policy makers should facilitate changing legal acts. For instance, the development of the DEC resulted from the need to change documents digitally, while back then statistics clearly showed that paper-based document changes were more reliable as compared to e-mails.

It is relatively difficult to formulate unambiguous evaluation criteria for assessing e-governance. However, current research established the basic stages for assessing the service provision and digital performance of local governments (Pappel & Pappel, 2011c). Evaluating the quality of the provided services should be taken into account as well. However, when some parts of work processes are performed outside of EDRMS, the emitted query information will not be identical to the amount of work processes performed by local governments. Data analysis then considers only the data that is inbound and outbound from EDRMS. Reducing this gap is an important key element for implementing paperless management. Although quantitative measurements have been conducted on the basis of the databases of EDRMS Amphora, the objective is to prepare standardised query descriptions. Then, it would be possible to also conduct studies using other EDRMS systems. In addition to EDRMSs, the development of an independent statistics query engine could also provide opportunities for measuring the usage of other information systems in the public sector. Semantic models and common data descriptions have created wide opportunities in this particular field.

An important objective here has been to contribute to the research that can be conducted by using numeric values of specific databases in order to specify the metrics for Digital Performance Index (see next section). The development of common measurable characteristics and criteria for all EDRMSs used in Estonia

would make it possible to assess the digital performance of all Estonian local governments.

The obtained measurement results must form a base that could be used to conduct surveys, identify factors that affect the efficiency of local governments, and compare these on the county and the national level. Furthermore, the publication of the results puts pressure on less capable local governments to develop and achieve more successful governance. In order to publish the results in accordance with the data protection requirements, use them in study and research work, and create a digital performance index, a cooperation contract, the e-local government contract, has been created (referred in section E-Governance Research at the e-State Technologies Laboratory). First pilot contracts have been entered into; a more widespread joining is planned for 2014-2015.

5.3 Digital Performance Index

The Digital Performance Index should enable to measure the participation (and willingness) of local governments, and their internal capability after implementing paperless management. The objective is to design methods and criteria for assessing the percentage of digital records management and changes in efficiency in local governments (Pappel, Pappel & Saarmann, 2012b). An important input for describing the index was obtained based on Rapla County (see Case Study 2) in order to get feedback on the implemented solutions. The index calculates the participation level of local governments through EDRMS functionality. The index includes the identification of different processes and operations that are still carried out on paper as well.

The criteria developed so far have provided an initial assessment of the digital performance of local governments (Pappel, Pappel & Saarmann, 2012b). The implemented quantitative measurement methodology (Pappel & Pappel, 2011c) has been built using the statistical data of EDRMS databases of the institutions. The queries are performed in the EDRMS database, using only numeric data and data received as a result of actuating database queries. The results are saved at certain agreed upon intervals (once a week, once a quarter), and they are interpreted in the form of a time row and analysed by respective characteristics and criteria. The queries and descriptions, necessary for using this index, will be employed in the next phase to develop an independent platform. This permits to evaluate how local governments have changed over time, both before and after the implementation of the necessary systems. The first metrics in the Digital Performance Index have given some important feedback and input for commencing the creation of an independent engine platform and a corresponding engine. EDRMSs have many common functions and data structures, which make that possible. Furthermore, specific database (SQL) queries can vary but the functionality requirements are the same in the case of all EDRMSs.

With some adaptations by the developers of EDRMS, it is possible to create a universal statistics engine. The measurable characteristics are dynamic and relate

to the changes and developments in the society. The indicators and features that are currently agreed upon may not be usable in the future, therefore, the set of criteria should occasionally be amended and the suitability of features should be assessed. In the context of the project e-Raplamaa, different criteria have been developed and some of them tested (see Case Study 2). A separate analysis engine enables to manage data descriptions and create queries to EDRMS-s data flow in specified format more easily. This engine platform should be suitable for receiving the necessary analytics from all interested EDRMSs. So far, the measurement and statistic results have been tested on the basis of an EDRMS Amphora. The software platform is a secondary outcome: the primary focus lies in data, which needs to be retrieved from the systems used by local governments. Some criteria, data and workflow descriptions have been agreed upon between different EDRMS-s.

However, further discussion with all the interested parties is needed. With the help of a developed index it would be possible to assess the progress of local governments towards e-governance because it consists of software components (databases, statistics engine, etc.), assessable criteria, and more widely used analysis tools. First surveys have been conducted to formalise the Digital Performance Index, but the complexity level of the index lies in what and how to measure, taking into account the requirements arising from good practice and legislation. Developing the evaluation criteria for the Digital Perfomance Index is a continuous process because the requirements of local governments are in constant change. Thus, the fixed measurements of the evaluation require future research.

5.4 Case study 1: Application of e-Services in Rapla County

In 2006, the Estonian Information Society Strategy 2013 acknowledged, "Estonia has been successful upon applying the e-services of the public sector, being among the leading countries of the EU in this field" (YIA 2006). Furthermore, in 2006, according to the Capgemini study (2006) Estonia came second in the EU (after Austria) in developing fully digital services. Therefore, this section gives an overview of the creation and implementation of e-services in Rapla County that were made possible after the development of the Structural Funds project.

By spring 2011, 24 e-forms had been developed and implemented in Rapla County that were selected on the basis of the most important services on the local level**.** This selection was made in cooperation with the workgroup of the local governments of Rapla County. In cooperation with the workgroup, the necessary data descriptions were prepared and created as e-forms on the basis of the Citizen Portal and EDRMS Amphora. In order to find the most widely used forms in Rapla County, all local government websites of Rapla County were analysed, and the document forms identified. The respective datasets were gathered and the 24 more widely used forms (see Table 7) identified. The most widely used metadata of all the forms were described and unified. This process was coordinated with the representatives of local governments who approved the

final dataset. However, this approach included analysing the existing forms and conducting interviews, yet linking these results with legislation and other regulating standard documents was insufficient. Moreover, the whole process was relatively time-consuming. The main shortcoming was the lack of a common repository for describing the services.

Table 7 List of developed e-forms

Name of the application	**Fields before**	**Fields after**	**Integration with state registries**
Application for childbirth	21	19	yes
Application for the admission to 1st grade	16	16	partial
Application for the kindergarten	25	23	partial
Application for freeing of property tax	21	19	partial
Application for property excavation	18	17	partial
Approval for positioning drill hole location	27	27	partial
Application for guardianship	32	32	partial
Application for placement in nursing home	24	22	yes
Application for detail planning of property	31	29	partial
Application for public event organisation	22	20	partial
Withdrawal of organised waste transportation	16	16	partial
Application for funeral benefit-support	15	12	yes
Application for compensation of travel expenses	24	23	partial
Application for building planning	29	24	partial
Application for registering a pet	25	22	partial
Application for nursing compensation	23	23	partial
Application for school attendance	20	16	partial
Request for information	11	11	partial
Application for project initiation	21	21	partial
Application for land/property division	24	21	partial
Application for social benefits	18	17	partial
Application for property tax exemption	19	19	partial
Application for advertising space	17	15	yes
Application for compensations of recreational activities	18	16	partial

After the project, the citizens had the opportunity to obtain the necessary applications (see an example on Figure 32) from the www.eesti.ee environment or through the website of the local government. After entering the application, the digital application was received in EDRMS Amphora where further procedural processes were initiated. The results of the conducted project were:

- E-forms created in the www.eesti.ee environment of the Citizen Portal are used;
- The transmission of filled e-forms to EDRMS is functioning;
- Digital processing of the received e-forms is functioning;

- Digital answering to e-forms is functioning;
- The subpage of e-services is located on the first level of the menu on the website of the local government;
- The website of the local government includes links and references to the respective e-service under public services.

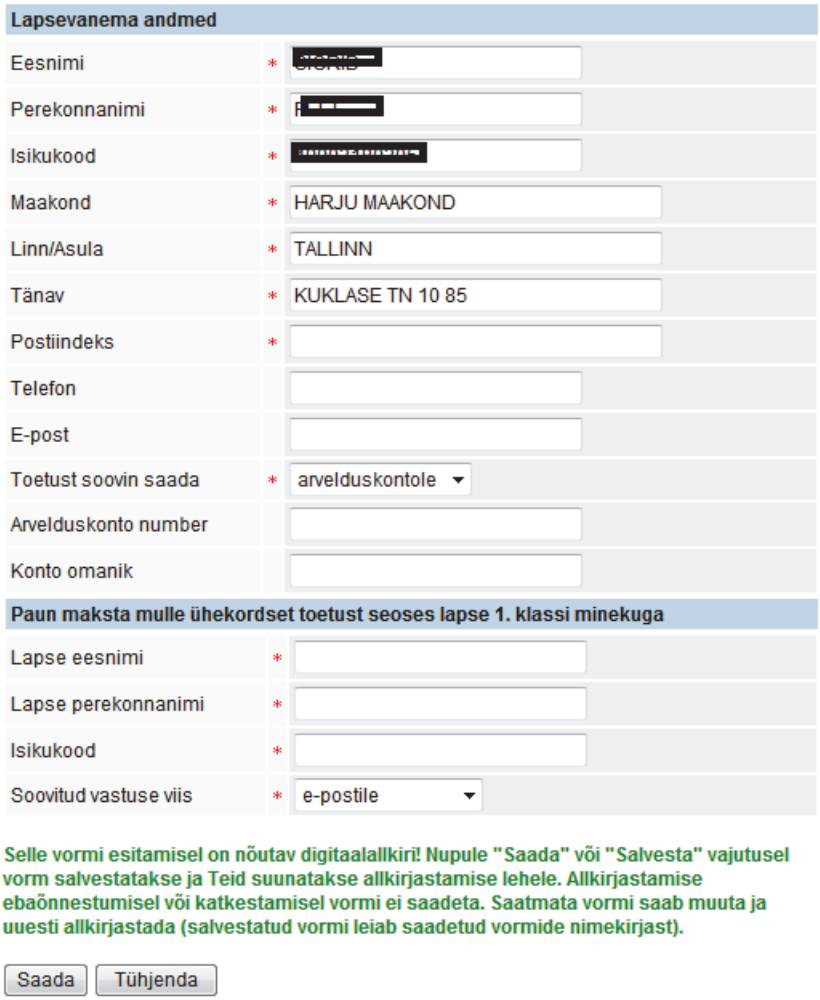

Figure 32 Application for admission into 1st grade with prefilled fields after authentication; screenshot from Governmental portal www.eesti.ee

Today, it is possible to take e-services into use in all interested local governments (many of them have started to use the existing developed datasets). However, this is still a relatively static system of e-services. Further tendency must be towards the development of the common repository for describing public services, linking it to EDRMS and the public view of EDRMS. Although

technical tools have been created for describing services in the environment of the Citizen Portal, this is just one part of an extensive system. Hence, it is rather difficult to achieve the specific development needs without developing the entire system, which in turn may be very expensive. In order to ensure a more mobile and flexible solution, it is necessary to have an independent system for describing public services in the common repository. In this research, that is presented as the Public Services System (PSS) which has been developed in this research and will be discussed below.

The study conducted in Rapla County showed that local governments need a solution that would unify their services. After taking e-forms into use, an increase by leaps and bounds in digital signing was also evident (see Figure 33 and 34) as the procedural steps of the respective applications were performed digitally and the answers to citizens were also transmitted digitally (Pappel, Pappel & Saarmann, 2012b).

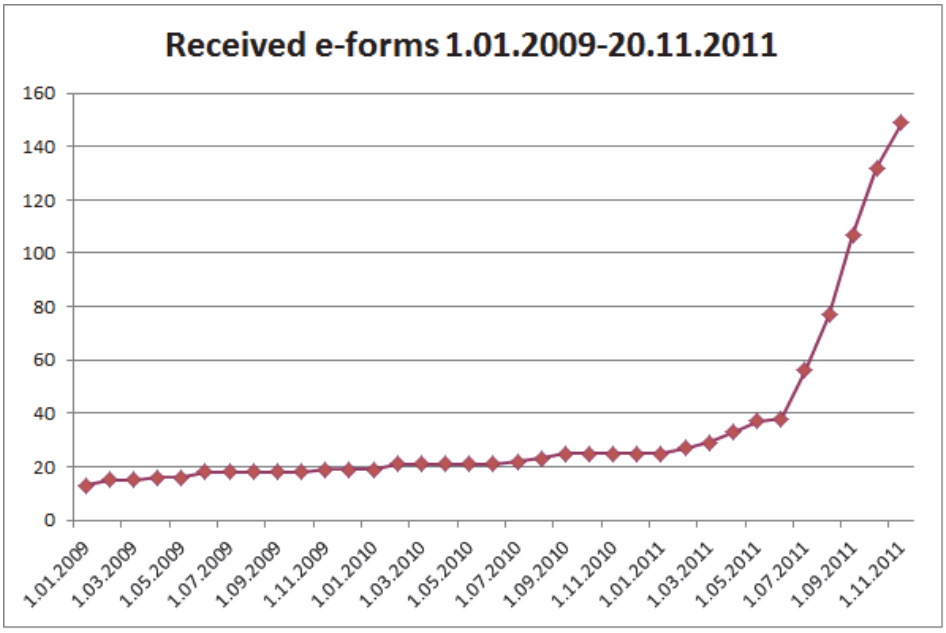

Figure 33 The growth of e-forms received in EDRMS Amphora

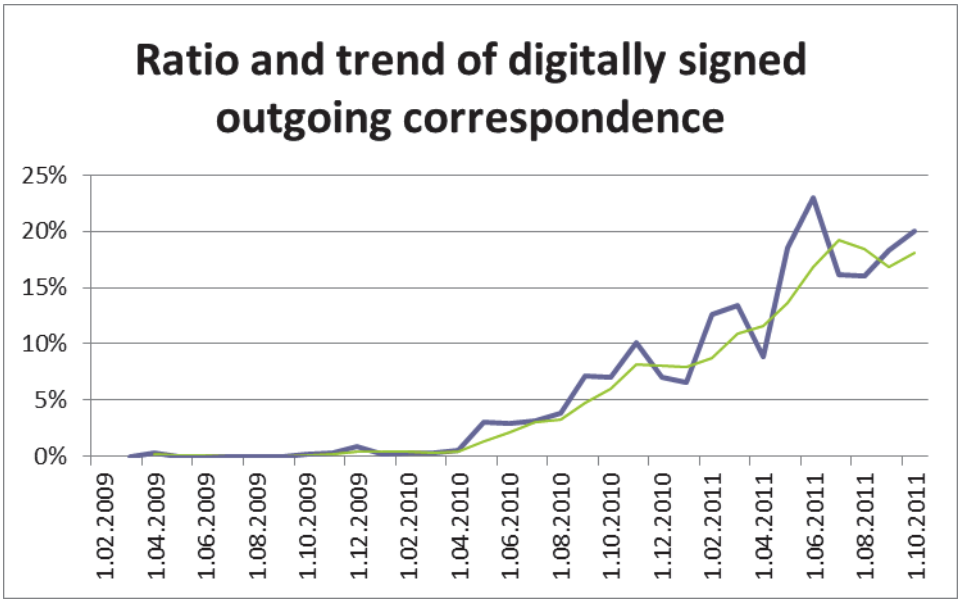

Figure 34 The increase in digitally transmitted correspondence

It can be noted that the implementation of e-services in the governing arrangement of local governments had a positive impact, because it facilitated solving the issues of the citizens more operatively and permitted the better monitoring of the whole course of proceedings. In 2012, initial steps were taken to develop a more efficient methodology for the transformation into e-services.

Further transformation of the services must include the assessment of the wider impact from the perspective of the local government officials and citizens. In addition, it is necessary to link the transformation process with the legislation and databases by employing the required descriptions of queries. Furthermore, thorough research in this field is essential. The transformation into e-services and the issues relating to this are also a priority elsewhere in the world. For instance, a study carried out in England in 2011 by Cranfield University has clearly stated the issues relevant to the field of e-services. The research attempted to identify the key characteristics of e-service, and to gather conceptual perspectives on the nature, scope, and transformation into e-service. These findings develop a clear articulation of the concept, nature, boundaries, components, and elements of e-service, which are significant for better understanding e-services, and for managing e-services in the public sector (Hassan et al., 2011). Risk management is also an important aspect for assessing the trust relationship between the state and its citizens. An individual citizen will have to decide to adopt the new electronic government services by weighing its benefits and risks (Horst et al., 2007). The transition of local governments into e-services is inevitable. As the population in Estonia is very Internet-centric, further research in this field is well justified. Initial steps have been made, and now, additional resources are required for further research and development.

5.5 Case Study 2: Assessment of Feedback, Statistics and Impact

In the beginning of 2011, the objective was to partially develop the methodology for increasing and measuring the digital performance of local governments on the basis of nine local governments of Rapla County – the project was called "e-Raplamaa" and some results were presented at an e-Governance conference in Tallinn (Pappel & Pappel, 2011c). Activities were commenced in January 2011, and first feedback and results were received in May 2011. In this trial base, an important objective was to develop the methodology and the important criteria for measuring the changes in proportion and effectiveness of digital administration in local governments. One of the aims was to give an answer to whether and how much the training and application of EDRMS increases the proportion of digital administration in local governments. The statement was that the effectiveness increases at least 20 percent in a three-month period after the application and, thereafter, there will be no increase, i.e. the growth stops[24]. So far, the results have not given sufficiently adequate feedback to support this, and research in this field is still in progress.

A good result was given by the qualitative study geared towards receiving feedback on the existing digital capabilities of local governments. In order to conduct qualitative measuring (Pappel, Pappel & Saarmann 2012b), various questionnaires were compiled that were coordinated with the local governments of Rapla County. The conducted survey for targeting the assessment criteria was set up on a 5-point-system. All 19 criteria were described to the workgroup of local governments, each of which was assessed by the responsible person appointed by the local government (see Table 8). With each criterion, the levels of compliance by a local government were described in five stages. The local government gave its assessment itself. The assessment was reviewed and analysed with us.

Table 8 List of the measurement criteria

Criteria	Measurement
The correctness of the publication of government legal acts	The publications of the legal acts, where by law legal acts have to be published
The publication of legal act drafts of the elected council	The publications of legal act drafts, where by law legal draft acts have to be published
Menu dividedness (subdivision)	How easily (how many clicks) a citizen finds the needed information
The visibility of public view on local government homepage	How easily (how many clicks) a citizen finds it from the website
Informativeness of public view	How correctly the document registry is presented
In-house circulation of correspondence (correspondence search by official)	How easily officials find the needed information

[24] Based on the initial study project that was conducted in the framework of e-Raplamaa in spring 2011, when two application days were organised in each local government.

The administration of incoming correspondence	Registration time and adherence of deadlines
The administration of outgoing (initiative letter) correspondence	Answering time and admission of deadlines
The compilation of answer letters	Activities and time for compiling the answer
The administration and usage of e-mails	E-mails and EDRMS cooperation, registration of necessary emails
DEC usage and correspondence forwarding	The usage of the exchange of digital documents
Digital approval process in legal drafts	The usage of digitally approved legal act drafts
Digitally signed legal acts	The proportion of digitally signed legal acts
The involvement of elected council in everyday work	How much the council is involved as well as their access to document registry
The usage of digital archiving	The usage of archiving module
The usage of e-services	Offered e-services and access to them
The number of e-forms and their accessibility	The usage of different e-forms and access to them
The usage of e-invoices	The usage of e-invoice module in EDRMS
Workflows connected to paper-based invoices	The usage of workflows in EDRMS related to invoices

On the basis of this scale, the level of each local government was determined in spring 2011, using the chosen criteria. The feedback (see Figure 35 and Figure 36) illustrates the e-governance capacity of local governments upon the implementation of the systems according to each criteria. However, it should be mentioned that not all of the aspects of the measurement criteria from Table 6 were assessed. The criteria were chosen in discussion with the local governments of Rapla County.

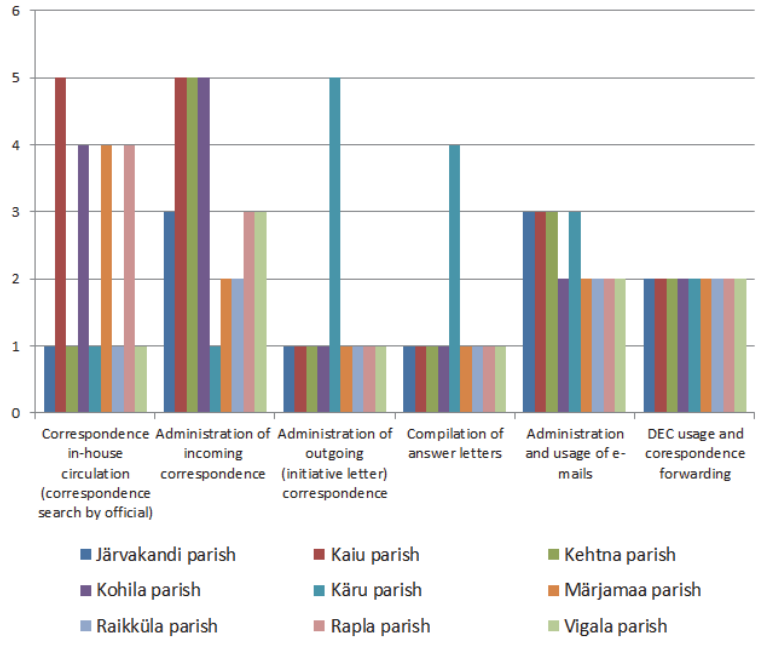

Figure 35 The results of e-Raplamaa in the first half of 2011

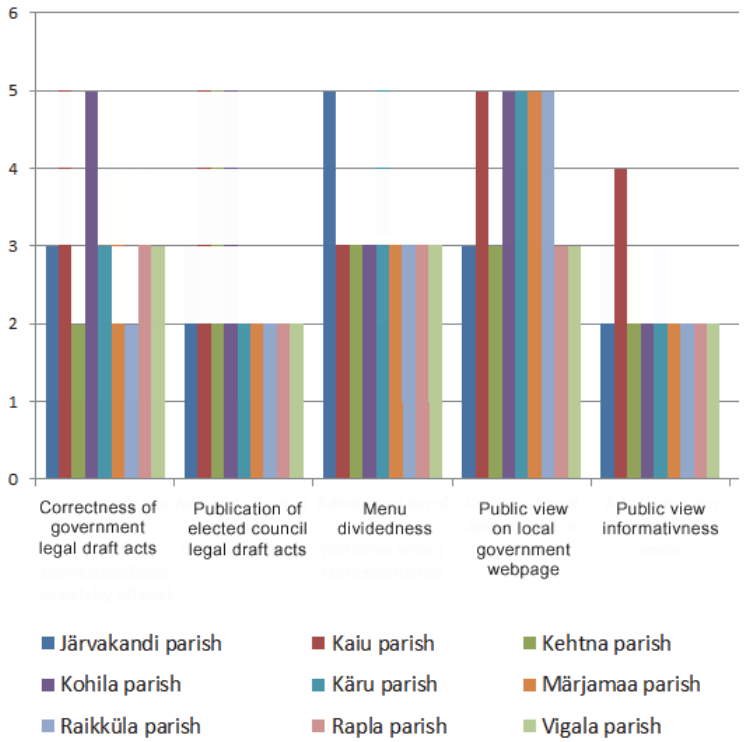

Figure 36 The results of e-Raplamaa in the first half of 2011

During this project, we sought to conduct studies where in some cases the combination of both qualitative and quantitative methodology was used in order to assess the usage of Local Government Systems through EDRMS. The qualitative study that was conducted as a trial in the Rapla County (e-Raplamaa) project in spring 2011; it was time-consuming and received quite subjective results (Pappel & Pappel, 2011c). This caused the need for quantitative research. The following table (see Table 9 with some of the criteria) was the first input for describing the necessary assessment criteria by using the EDRMS database to obtain the statistics required for a quantitative study. Developing the criteria for quantitative measurement was connected to studying specific functions, which were based on the operations performed in software and specific functions (that an official has to perform in his/her day-to-day work).

Table 9 Table of some of the assessment criteria for quantitative measurement

Function	**User profile**	**How to measure**
Digital signing in correspondence management	Executive official, specialist	The number of digitally signed letters in EDRMS Amphora in the last 6 months is to be measured (to make queries on the letters sent in the last 6 months, their amount and relation to .ddoc)
Number of active users	All profiles	Determine the number of unique users in a day which shows the actual usage for everyday work
Digital signing in standard documentation management	Executive official, council chairman	Digitally signing legislation (orders, regulations, protocols) in the last 6 months. Take specific legislation of various types (or by folders) by queries and view how large the proportion of .ddoc files is in the total amount
The usage of the Council system	Council chairman, council members	Find out the number of logins to EDRMS in the last 6 months: • Council chairman (when it has not been brought out as a separate group, then the name of the council chairman could be found from the website) • Council members – the number of members and how many of them have logged in

The usage of the Council system and the publication of draft acts in the public view	Council chairman, council members	Find out whether the draft acts of the council are published (generally under Function 1 "Initial materials of the council") and find out if these can be seen in public view and under which topic
The usage of the government's legal acts system	Local government mayor, local government officials	Find out whether the draft acts of the government are added (generally under Function 2 "Initial materials of the government") and coordinated in EDRMS

The quantitative measuring approach conducted in Rapla County was built on the statistical data of the EDRMS Amphora database. 27 measurement criteria were developed and described, and some of them where employed (see Figure 37 and 38), including the total number of digitally signed documents; the growth of EDRMS use in local governments; changes in the average period of workflows and deadlines; the number of proceedings solved on time; and the number of proceedings solved after the deadline. So far, the quantitative measurements have provided more objective information. Results have been treated in different numeric values and it was possible to present them in a diverse set of time rows and other dimensions. Nevertheless, this kind of research depends heavily on the functionality of the EDRMS.

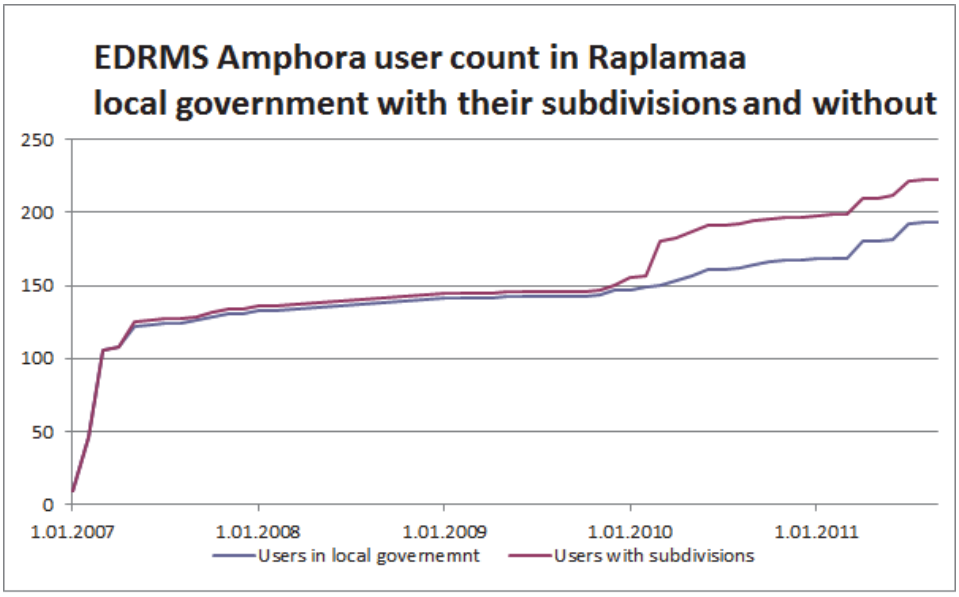

Figure 37 The growth of the users (Pappel, Pappel & Saarmann 2012b).

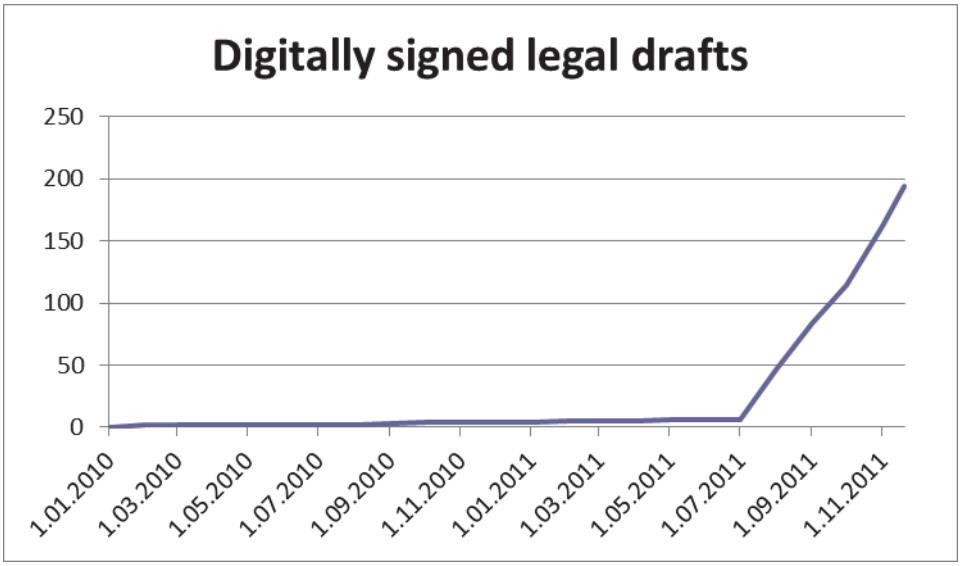

Figure 38 Changes in digital signing among legal acts

The final report of this study was submitted to the Raplamaa Local Governments Association and presented to the local governments of Rapla County. The information, gathered when the conducted research was validated during the aforementioned surveys, meets its goal and is akin to the results of similar qualitative surveys, e.g. a Survey of Electronic Records Management in the Public Sector Agencies of Estonia (Estonian Ministry of Economic Affairs and Communications, 2011). The aim of the study was to establish the current status of electronic records management in Estonia's public sector. Study results showed that all ministries, administrations and boards are using EDRMSs, but the results regarding local governments and smaller institutions indicate lower usage. The survey was conducted using qualitative methods. The most important piece of information received was the general applicability of EDRMSs. During 2011, practical studies were used to test whether or not the implementation of laboratory principles involving various forms of cooperation is possible. In order to get the statistical dataset required for the research, an agreement with Rapla local governments was developed.

These criteria should be implemented on a wider scale by adding other databases and registries to the algorithms of the quantitative method. In Estonia, this possibility is provided by using the X-Road and SOA models. This could be achieved with adjustments to data and queries because the workflow descriptions and statistics of local governments that EDRMSs can offer are quite similar.

5.6 Application of the e-LocGov Model

The feasibility of e-governance in local governments was already discussed by Moon more than a decade ago. He explored the effect of managerial innovativeness in municipal governments on the adoption of e-government, and

examined the association between the adoption of e-government and its outcome (Moon, 2002). During the application of paperless management, there are several factors that determine its success. Significant attention has been paid to smoothing the implementation process of EDRMS Amphora and its related systems but as an inevitable precondition, creating the necessary infrastructure requires more effort. Although the implementation of the e-LocGov model has given us initial results, the application of e-governance depends, in addition to the implementation methodology, on several other factors as well. The more frequent obstacles in the implementation of the e-LocGov model are quite similar to the common problems that occur when implementing new solutions on a wider scale:

- The awareness and willingness of people;
- Low motivation of managers for developing new solutions;
- Money and other resources related to EDRMS;
- Lack of common work and coordinated activities.

The most productive outcomes in relation to these issues have been achieved through common projects that involve a large number of local governments which provides the opportunity to test the solutions on a big target group. A great contribution to the research activities was the funding of the development of EDRMS Amphora by Structural Funds in 2009-2010 (see Appendix A). The best example would be Rapla County where several joint research projects and experiments have been carried out as collective activities since 2006.

It could be claimed that the implementation process of EDRMS is the most honest and direct feedback about the software usage convenience, which is in itself an important factor for success. From the point of view of the local governments, it is extremely important that the software, which is used for organising the service provision and managing workflows, can be conveniently used by its officials. The development process of EDRMS Amphora has been in constant change and evolution with the assistance of feedback from users in order to try and reach the maximum level of usability. We have tried to comply with the ever-changing needs and requirements. The changes in the usage trends and the development of implementation tools have changed the logic of the software itself.

In the course of this research it has become evident that it is possible to increase the success of the implementation results by using e-learning methods that help increase the user-friendliness of EDRMS. EDRMSs and other analogous applications are complicated systems. The more intuitive the software is, the smaller the amount of resources that needs to be spent on the application – learning the functionality is possible through the use of interactive learning tools. Using e-learning methods lends learning freedom to the user and ensures the possibility both during the application period and later on of using EDRMS for exchanging their experiences and good practices (Pappel & Pappel, 2011b). Continuous follow-up training sessions have been organised in local governments for applying the EDRMS Amphora. During the training day,

changes in the previous implementation results as regards the growth in effectiveness are taken into account as well.

During past projects, there have been some local governments with more than four training days. This, in turn, has provided a basis for comparing the growth in effectiveness of every subsequent implementation. The indicators can vary from the growth in the number of users to the growth in the volume of the inserted business processes (the number of local government workflows) in the software. However, it is difficult to objectively measure the effectiveness of the implementation results. Moreover, it can be complicated to determine the indicators that precisely assess the effectiveness of the situations. Nevertheless, a certain quantifiability dimension is given in relation to the number of users from year to year, and also by the comparative number of applied business processes in and outside of EDRMS. These assessments have been used to constantly develop the infrastructure of EDRMS Amphora. Taking into account the aforementioned, it must be conceded that:

- Technological readiness alone is insufficient for the principles of transformation into e-governance;
- During the application of EDRMS and concurrent systems, the implementation had an important role that presupposed the existence of the methodology needed for that purpose and also common service descriptions and processes;
- Concrete and agreed upon criteria for measuring the growth of efficiency after implementation are essential, because that provides valuable feedback on changes and outcomes of the new implemented governing methods;
- The creation of a common competence base and a (e-)learning environment provides an important impulse for improving the knowledge management of the officials of local governments;
- In addition to software related problems, lack of skills and technological literacy of officials is still also an issue.

These research activities have been a significant stimulant for creating the e-State Technologies Laboratory, and for developing a new international Master's programme at the Tallinn University of Technology. Clearly, cooperation between connected parties is promoting the sectoral development. Although only initial steps have been taken towards the development of e-governance in local governments, there is plenty of room for more efficient developments in this field.

To conclude, the correct application of the developed systems should be valued more. If an infrastructure is in place, the usage of technological solutions depends on the efficiency of their implementation. The presented framework permits involving local governments in the information society by implementing the possibilities of e-governance principles with the use of technological solutions. Nevertheless, many possibilities offered here are underexploited.

However, thanks to years of activity as regards implementing a more service-oriented approach, the preconditions have been created for increasing the efficiency of the work of local governments and involving citizens and entrepreneurs in their decision-making processes. It is clear that the results proposed here require further resources for their large-scale implementation and further study. The parallel activities have been initiated through the establishment of the aforementioned curriculum and the e-State Technologies lab which should allow for the further validation and development of the e-LocGov model in order to enable all local governments to achieve an equal standard of using this platform.

5.6.1 Paperless Management in Local Governments Today

The outcomes of paperless management comprise of different components: EDRMS Amphora and its interoperability with other systems, its application and implementation, and connecting the processes of an institution with ICT possibilities. The developments of the information society over the past decade have resulted in inevitable changes. The decision-making processes that have often been static and unwavering have had to evolve and adapt in the light of new principles. Expanded social networks have reformed the interaction between local governments and citizens which are now infinitely more interactive. Digital channels are open for interaction, which could not have been foreseen years ago. The administration of a local government or the use of services by citizens from any corner of the world is becoming a reality. Along with ICT, the tendency in the last few years has been to develop and apply a competence-based governance model. The most widespread approach is the creation of the ICT capacity and competence base, employing people and their knowledge as software.

As mentioned above, in the past there were no appropriate IT solutions for launching paperless management. Today, however, major parts of IT systems for supporting transition into e-governance have been developed. Now, it is possible to transmit documents from one EDRMS to another EDRMS by using the Document Exchange Centre (DEC) functionality of a document. If in the earlier years it was not possible to transmit legal acts in electronic form, then in 2012, the e-State Gazette environment was completed which permits the transmission of legal acts from EDRMS to e-State Gazette by using the DEC functionality. However, there is still no interface that would enable to transmit a legal act from EDRMS directly to e-State Gazette without the DEC functionality, but development plans for that have also been described.

Citizens can use different e-services and participate in the decision-making processes of local governments. They are more aware of the possibilities of how to monitor the work procedures of local governments. Conditions have been and are being created for citizens to use services and obtain information from local governments by using different channels. Extensive use of EDRMS gives the opportunity to move communication to a faster level of consuming services and information. Nevertheless, the extent of that use is left to be decided by the local

governments: whether to follow the legislation with its minimum requirements, or to create opportunities for implementing the participatory democracy on a larger scale.

Although various technological solutions have been developed, several shortcomings still hinder their wider use. One of the main shortcomings is implementing the new solutions as their application requires a lot of financial and human resources. It has become evident that all technological solutions (not just EDRMSs) targeted for local governments should be described on the basis of a harmonised format and methodology. The solutions applied in local governments need to be described by employing consistent principles. It is important to consider communication and interoperability with other systems. This would ensure cooperation between the various local government and state systems. The integration of government information resources and processes, and ultimately, the interoperation of an independent government information system appear essential (Scholl & Klischewski, 2007).

In addition, developing new duplicating systems should be avoided. More efficient integration of existing solutions would entail resource savings for all parties. This creates an increased necessity for integrating the various IT solutions employed in the work of the institutions upon the transformation from one governance model to another. That in turn changes the existing work processes from the perspective of handling surrounding information and knowledge, amongst others. Given that e-government services extend across different organisational boundaries and heterogeneous infrastructures, there is a dire need to manage the knowledge and information resources stored in these disparate systems (Iyer et al., 2006). The application of new systems and governing methods is an important part of the e-LocGov model, the inseparable part from which a common knowledge base could emerge.

5.6.2 Increasing Efficiency and Satisfaction

Changes in the ways of thinking are slower than the development of the possibilities created by information systems. The concept of the e-governance framework includes research and development upon modelling the information level of local governments. The development of e-governance principles includes both research and development work that should be available for and reusable by all local governments (and all other interested parties). Nevertheless, transforming local governments can be unpredictable. Local governments can raise ICT capacity by raising the awareness of their officials, and the success of implementing the Local Government Systems is ensured through a smooth application process and the human factor.

The growth of citizen satisfaction is tied to the growth of the digital performance of local governments. The higher the digital performance of a local government, the more possibilities the citizen has to take advantage of the services. According to Accenture eGovernment Report, the goal for e-government now is to tailor service delivery to meet the needs of the citizens, as opposed to approaching it from the government side (Accenture, 2003).

During the application of e-governance possibilities, there are contradictions between requirements arising from rules and standardised work routines, and from using progressive ICT tools. The implementation of paperless management and digital document work proceedings is facilitated by the rules and instructions described on the state level wherein several problems still require solutions in order to reach a wider assessment of the synergies and cooperation between local governments and the state.

The application itself does not only entail learning the software components. It is also necessary to change one's thinking by implementing renewed work routines. User acceptance of intergovernmental services is an important factor (Hung et al., 2009). People are afraid of changes and becoming replaceable. They are not confident about the accessibility of the technology. There have been numerous situations where if the Internet is down, there is no access to EDRMS and other databases. The service provider, however, in large part manages the risks. As a part of this, the question of what precisely is, or could be, transformed, should be examined. Finally, according to Bannister & Connoly (2011), the expectation that technology-enabled change has the ability to increase the trust of the citizens, thereby transforming government, may be too high. However, having a solid foundation provides a good start for bridging that trust gap.

5.7 Summary

This section provided an overview of the assessment requirements for evaluating the digital capability of local governments and the e-LocGov model implemented so far. The uptake and efficiency of the e-LocGov model can be assessed by the post-implementation assessment of its various parts. It allows for mapping the information necessary for further verification and improvement of the existing results and gives feedback for the evaluation of organisational change. Initial criteria have been developed to assess the digital capability of local governments, which enable to assess the change in the workflows of local governments before and after the implementation. The first metrics in the Digital Performance Index have given important feedback for further research projects. The following results were achieved:

- The components of the e-LocGov model has been evaluated and analysed;
- The primary criteria for evaluating the digital performance of local governments are developed;
- The concept of a Digital Performance Index has been formalised.

Additionally, two case studies on the utilisation of e-services and the development of assessment criteria for local governments in order to measure their digital capability performance were described. The outcomes of these case studies were as follows:

- Twenty four (24) e-services were described, unified and applied in the local governments of Rapla County, giving an opportunity to implement them in almost in half of the Estonian local governments;
- The assessment criteria for evaluating the digital capability performance of local governments were developed (with the local governments of Rapla County).

The aforementioned case studies were chosen due to their delivery of practical outcomes and direct involvement in research for showing the necessity of the paperless management implementation as regard EDRMS Amphora.

6 CONCLUSIONS

The main contributions of the work as well as a discussion of the research strategies, questions and problems, and perspectives for future research are outlined in this section.

6.1 Discussion of Used Research Approaches and Methods

Assessing the research approaches and methods is necessary for understanding the link between the research focus and how well the chosen research methods have met the research objectives. Analysing the employed research approaches and methods gives a valuable insight into understanding how different approaches and methods could be used in future works. The research spans over several years and its various cycles have involved a combination of research approaches. In different development cycles, action research and action research design have been the best way of achieving the desired outcomes because these principles are iterative in nature (repeated cycles); first comes problem formulation, then the action itself with its evaluation, and in the end, reflection. Each outcome has contributed to the next step of the research. Even though this research was conducted using different approaches, the combination of them led to achieving results that facilitated utilising the research in all aspects of real life. Hence, it should be acknowledged here that only employing a single approach could potentially limit the research. Therefore, instead of rigorously applying one method without alterations, a suitable selection of the principles from different approaches was used.

However, this research has also observed the problems concomitant with the use of varied research strategies (including design and creation, surveys and case studies) for different research activities. For instance, case studies use a wide range of data collection methods – both quantitative and qualitative – which has given the opportunity to gain multiple perspectives. Thus, the valuable information for software development is gained and results for further study are also obtained. However, many obstacles are caused by a lack of financing which slows down some development activities. Admittedly, this fact is not related to the research approaches in general; however, the approaches employed here have been useful for collecting input for the research content and activities, solving problems and finding solutions for conducting other projects.

Various surveys have provided some valuable data – data collection, questionnaires and round-table discussions have been essential for the research. Many projects have been carried out in close cooperation with the workgroups of local governments wherein subsets of officials have been part of diverse project activities. The first-hand involvement of officials in the research activities has provided the most direct feedback. However, it should be emphasised that a questionnaire might not always be the best solution for gathering information, because the questions asked or statements given might be unfamiliar to the respondents. Concerns can be voiced about the complexity of the questions, or the unfamiliarity of the field, which might be hard to

understand without explanations (potential for information bias). The awareness of the local government officials can vary and, hence, the goal of the researcher has been to simplify the structure and content of the questions for the necessary data. Nevertheless, the advantage of the questionnaire is that it can reach a large amount of end-users, thus providing feedback more efficiently and giving an overview of the results or the raised questions. This is rather efficient both in terms of time and finances. Hence, the hands-on developments, constant feedback and tests validating the solutions were highly helpful for understanding possible mismatches or similarities between the officials and the researcher. Focus groups wherein the project is discussed with representatives of local government officials provide the best results.

Satisfying outcomes in this research were gained from case studies which provided direct results and feedback from research activities. This approach presented the opportunity to act within a real-life context. By having several case studies, it was possible to focus on all the factors relating to local government issues, processes and relationships in order to explore them and gain knowledge and results for improving the work environment of local governments. The best outputs in these case studies were achieved where state support was granted. As financial issues have been widely connected with many research activities, case studies provided the opportunity to gain more resources (including people and money) by using various forms of cooperation. It should be stressed that great results were achieved in a case study supported by a Structural Funds project "Paperless records management and development of participatory democracy in local governments" where state support helped achieve effective research outcomes. This study gave a technological platform and knowledge of general applicability for further activities in defining the e-LocGov model, and verified the assumptions of a need for competence units.

To conclude, it should be noted that if this research was to be done again, chiefly the same approaches and methods would be used. The main problems that arose during the research were related to low resources and low motivation, while the research approaches had far less of a limiting influence on the development activities. Nonetheless, more attention should be paid to cooperation and support from the state in order to find resources for the application of the developed solutions by raising the awareness of the local governments and motivating state institutions. In short, several obstacles were due to low motivation caused by ignorance (and lack of knowledge) on both side. However, building cooperation between different counterparts helps close this gap. Consequently, if conducting this research again, more attention is needed on cooperation in order to ensure smoother activities for achieving goals and research results.

6.2 Answering the Research Questions

The problems detected and solutions provided according to the research questions are presented as follows. In the current section, the outcomes will be discussed in a more general way and the next section presents the practical

outputs which are applicable to information systems for implementing new ways of governing. As described by Oates (2006), there are a number of different types of results that can be expected from a research project on information systems and computing. The main categories, which can be pointed out in this research, are: 1) knowledge and (to some extent generalizable) experiences, as well as insights into or confirmation or falsification of earlier research results; 2) artefacts which could be software, methods, frameworks, etc. In this research, both types of research outcomes were achieved. New knowledge has given valuable input into ongoing and further projects and the artefacts have provided a platform for testing many outcomes in real life situations. Although the main objective of the current research was focusing on implementing paperless management based on EDRMS Amphora, the overall research question was to understand:

- How to enrol e-governance in local governments?

The research suggested that paperless management should be the foundation for the application of e-governance. However, the main focus when moving towards e-governance should be on raising the awareness of local governments of how ICT can improve their everyday work. Well-functioning infrastructures should be provided, including hard and soft infrastructures in order to organise and manage registers, databases, and information systems. Thus, this research provides a clear understanding of the IT-systems that improve the digital nature of the information flow and permit the cross-usage of data. Therefore, it is necessary to broaden the IT-knowledge of local governments in order to help them understand what tools, techniques and devices could improve their ability to perform tasks more efficiently. The need to increase the IT-awareness of officials or other counterparts could also improve future e-governance solution studies and research - the more they are aware of how and why their contribution influences the developments of the e-governance system, the more they are willing to participate to improve their abilities in a computerised world and to apply paperless management. In this research, the latter goal was set as the baseline for enabling local governments to digitalise their internal workflows as regards incoming and outgoing information. Although the interoperability between different systems (state registries, DEC, Citizen Portal and financial systems) was established, the application of complete integration has still remained insufficient. In fact, integration between different systems remains inadequate due to the insufficient resources and lack of agreements between the state and service providers. Poorly implemented EDRMS in local governments cannot provide the expected outcomes and could cause inefficiency issues.

- RQ 1 How does paperless management increase the efficiency in local governments?

The main factors required for developing the framework for paperless management, as well as the various aspects and their impact, were analysed and

new knowledge was gained in order to understand how information technology could improve the work of local governments. The implementation of software functions and new work-routines has proven to facilitate the efficiency and transparency of administrative functions while engaging citizens and transforming the nature of democracy. As the primary evaluation criteria have been developed and surveys conducted (some of them presented in case studies), the results have shown growth in the exchange of digital information, documents, digital signing and workflows. All of this has helped to save time and money in addition to savings on the cost of paper, printing and postal services simply by using technology. Moreover, there is a need to increase the efficiency of service provision. Local governments all offer the same services and therefore, describing, creating, and spreading e-services at a central level requires less time and money than separate development. Although the necessity of using paperless management and a common service repository has proven itself in this research, the mapping and realisation of local government public services with a thorough process description require further activities and resources. Thus, in order to improve the implementation of e-services in an organisational setup, the IT-literacy of local government officials must be increased. This will lead to the better management of organisational change.

- RQ 2 How can the implementation process bring about organisational changes?

Organisational change depends heavily on the human factor. The different implementation steps of are strongly associated with various factors such as the software, the partner chosen, the culture of the local government, the financial situation. In order to facilitate and encourage innovative development, education and research should be considered an important part. Often the reasons for inefficient application of the new systems and failures relate to decentralised and not commonly fixed implementation rules. The work done so far has involved many aspects such as the unified descriptions of optimised services and document lists. Innovation in the form of further development of paperless management is therefore considered to decrease the burden of a wide range of stakeholders by providing accurate, timely and reliable information. Thus, it is necessary to understand that the information systems developed for that purpose have to be designed according to the abilities and experiences of the end-users in order to achieve the overall goal. That will in turn help raise the awareness of the officials in many aspects. Hence, one of the main focuses of this research was to develop an implementation methodology of EDRMS for effortless organisational change. This provided an efficient learning environment for the users for understanding the functions of local governments. That should consequently allow for the transition of local governments into e-governance and a wider application of e-governance. As the results showed, the unified implementation methodology increases the awareness of the users by providing a common ground for understanding the benefits. However, organisational

change should be manageable as well as measurable in order to enable to further predict organisational growth.

- RQ 3 How to measure organisational change?

Evaluating organisational performance is one of the most important concepts in management where feedback on organisational abilities plays a huge role in making further decisions. Generally, the evolutionary process and growing competencies themselves can be monitored, but in the scope of this research, the main focus remained on evaluating the local government processes related to service provision, which provided feedback on change. Organisational change in the process of developing and implementing new solutions for increasing the digital ability of local governments must be measurable. Accordingly, a set of different criteria and evaluation methods is required to measure organisational change upon using paperless management. In this research, the characteristics of change were generalised as primarily agreed upon measurement sets which can be taken into account when implementing new work routines. Until such a measure is developed and applied, we cannot advance scientific knowledge about the readiness, the growth of digital ability or provide evidence-based guidance to local governments about how to increase their readiness. The research carried out in Rapla County showed that the amount of digital documents has increased over time. Moreover, it is possible to change the speed of the processes and monitor the data flow using EDRMS.

6.3 Applicable Outputs and Contribution of the Thesis

This thesis covered a wide spectrum of topics and issues about bringing local governments closer to e-governance by making their work more efficient with the use of ICT tools. The research covered the technology, implementation methodology and evaluation of results in order to measure the efficiency of the digital capability of local governments and the ability to involve citizens in the decision-making process. The importance of the thesis lies in the development of the local government-specific EDRMS Amphora with its interoperability and implementation methods in the form of the e-LocGov model. Notably, in addition to the developed technological platform, valuable insight has been gained in how to implement e-governance in local governments, which has been applied in practice. To an extent, this knowledge can be employed abroad with adjustments as well as by sharing experiences with the applicable tools and mechanisms. As EDRMS Amphora is implemented in half of the local governments of Estonia, the impact made by this research is considerable. The outcome proves that EDRMS can be employed as a foundation for implementing e-governance in local governments as it provides the necessary tools. In conclusion, the following actions and results of the thesis need to be emphasised:

- **The framework presented as the e-LocGov model** has been developed: technical solutions based on EDRMS Amphora and its

integration were developed to achieve paperless management. Different parts of the model function on different levels depending on the resources available for the local governments. The model also gives a basic platform for digital interaction between the state, local governments, and citizens;

- **Local Government Systems,** which are aimed at conducting fully digital interactions based on paperless management, have been developed and described; interoperability for using these systems and including the necessary parties has been developed, facilitating the connection of EDRMS with state registries and the internal systems of local governments;
- **Transition methodology with developed implementation principles** (instructions, learning videos and procedure standards with optimised workflows) have been described and developed. Therefore, the proposed approach focuses largely on the pre-generated environment and process-based tutorials in an e-learning environment in order to train users on EDRMS Amphora. With some minor adjustments, the same methodology could be implemented on other EDRMSs as well;
- **A set of unified e-services that allow for fully digital interactions** between citizens and local government officials (between EDRMS and Citizen Portal) and Public Services Systems permitting to describe the services in a common way;
- **A basic foundation for the Digital Performance Index is developed,** the primary criteria for evaluating the digital efficiency of local governments on the basis EDMRS Amphora has been described. On the basis of the approved characteristics and criteria, the data and documents which are processed and approved electronically could be measured using the EDRMS Amphora statistic engine and the approved criteria for evaluating the change in efficiency. The whole workflow process has been monitored in a digital environment and could be used for further analysis.

To conclude, the chief contribution of this research is related to the activities for improving the technological and organisational performance of local governments which in turn facilitates better service provision to the citizens as well as entails certain proposals for the amendment of standard documentation and the adoption of legislative drafting. Upon its implementation and further development, the developed framework leads to a more effective local government and increases the efficiency of cooperating with citizens and enterprises. However, further sector-specific research is required in order to cover all the necessary facets: firstly, an economic (and financial) evaluation of the transition process; secondly, the broader impact on the public as regards the increase of citizen satisfaction; thirdly, the adoption of legislative drafting in order to allow for the wider implementation of information technology.

6.4 Directions for the Future Research

This research resulted in a developed e-LocGov model that includes the interoperable EDRMS platform for local governments along with its implementation methodology and evaluation principles to ensure an efficiently working local government in the provision of e-services to the citizens. The following specific subjects can be brought out as fields for future research:

- Further research of Public Services System. Public Services System has to be interfaced with the systems used in local governments. Furthermore, integration with EDRMSs and the Citizen Portal in all local governments is essential. E-service design engineering (currently, there are forms and data fields but the design process itself should be more interactive, e.g. Mindmap techniques visualise the design process more efficiently) should be added to the repository for quick and easy prototyping of new e-services.
- Further development of the transition methodology. An assessment and certification system is required for the officials to assess the level of the information society and e-governance functions (including awareness about rendering services and the rights of citizens). In addition, observing organisational changes and diversifying change management requires more attention and further exploring in order to make the implementation process more efficient. Factors which influence organisational change need more thorough analysis in order to improve the current environment.
- Further development of the Digital Performance Index. It is necessary to build a statistics engine that provides feedback on existing and future systems. Thus, it is important to advance the criteria and metrics in order to evaluate the requirements.
- Future research also needs to focus on the possibility of extending this framework to local governments abroad. Preliminary connections have been made with the universities of neighbouring countries to assess the prospect of implementing the existing local government model in the local governments of those countries. It would enable to export the output, and the methodology in particular, to other countries.
- Research-related involvement of citizens in the decision-making processes of local governments and in better service provision. Exploring the options for increasing the involvement of citizens in the decision-making processes of local governments will improve their service provision and facilitate improved cooperation between various counterparts for more efficient e-service development.

A powerful component of future research is the e-State Laboratory and International Masters Programme “e-Governance Technologies and Services” at Tallinn University of Technology as a centre of expertise that cooperates with field experts and public sector facilities to ensure continuous

research and development in the field of e-governance. Under the e-State Technologies Laboratory, first projects on this topic have been launched, but further cooperation with state-level partners is in progress. To conclude, these competence centres provide vital research exhibits.

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APPENDIX A: CASE STUDY OF E-LOCAL GOVERNMENTS

This section gives an overview of the Structural Funds project "Paperless records management and development of participatory democracy in local governments" that included almost 100 local governments and was presented in Berlin (Pappel, Pappel & Saarmann, 2011b). Project created the assumptions for the transformation to the digital administration on the basis of the development and application of the existing EDRMS platform (Pappel, Pappel & Saarmann, 2011b). More than 70 local governments used the results of the project after its completion. Pre-application was submitted in the autumn of 2009, and in January 2009, the financial means were allocated for the submission of the main application. By June 2009, the necessary formalities for the development were carried out and the development activities were initiated in the summer of 2009. One year later, the results of the project were already implemented. The more important aspects of the results of the project are, as follows:

- Wide development and implementation of the EDRMS. The digital administration effectiveness of local governments has been taken to a new quality level – opportunities have been created in almost half of the Estonian local governments;
- Extension of the possibilities of e-democracy on the level of local governments and citizens;
- EDRMS Amphora functionality in the form of LocGov for local governments was created. It can be used without a license fee as the fees were removed from the existing usage policy. This agreement does not apply to other institutions, including private sector.

The cooperation partners included local governments, EDRMS developer and state in the form of a leadership group that was compiled for that purpose. The objective of the Structural Funds project was to qualitatively create a new level for the functioning of the local government unit by using ICT tools and linking the development activity to the cooperation between the public and private sector. Assumptions were created for a modern local government that is efficient, transparent and live up to the expectations of residents and enterprises.

The structure of the project was, as follows:

- Initial task, analysis and understanding of what is needed for the development inputs of local governments;
- Developments divided into five phases;
- Application activities of the developments;
- Training of the users;
- Assessment of impacts and compliance analysis.

With the results of the project, direct assumptions were created for the transformation to e-governance. The following was developed: the digitalisation

system of the decision-making process of the legislation, information publication and sharing system and a system for the communication with out-of-system users (incl. cross-usage of data with national registries). These, in turn, became the fundamental pillars of the technological platform of the e-LocGov model. Consequently, EDRMS and related information systems were modernised in nearly 100 local governments and their subdivisions pursuant to the priority of information policy. The activities of the project also enabled to bring the publication of documents into accordance with the requirements of the Public Information Act and EU tendencies, taking into account the PSI standards and OpenData tendencies. During the activities of the project, the following were developed:

- The integration with EDRMS and the main systems of the state via X-Road in order to enable automated information exchange and to reduce duplicating information entry;
- The creation of e-inclusion solutions and integration of participatory democracy on the basis of EDRMS;
- The basis for implementing e-forms and e-services and monitoring the course of proceedings of the documents related to the citizen via ID-authentication was created;
- The EDRMS digital archive module was developed as the solution for digital archiving that would enable to store (digital) documents;
- One of the greatest achievements of this project was the development of the e-LocGov model.

Major Achievements of the Structural Funds Development Project

Assumptions for the transformation to the paperless management were created simultaneously in more than 100 local governments of Estonia. Appropriate trainings, in order to introduce the principles of information society, were organised in more than 70 local governments. The principles of paperless management were harmonised and the basis for common knowledge was created. Deep-laid institutional structure of the project (developers of EDRMS with high competence knowledge in this field, competent leadership and project group[25]) ensured both the success of development results and the successful implementation of these results. Similar widespread implementation of centralised development solution in connection with EDRMS project has not been carried out in Estonia before. The most important components that were developed in the course of the project are as follows:

1. Better development of participatory democracy. An important priority was the inclusion of local governments and citizens/enterprises to a better mutual communication. For instance, the issues related to the publication of information were analysed from the perspective that it has to be ensured that the

[25] The authors of this article play a role as EDRMS developers and members of the leadership group.

citizens have convenient access to the document registries of local governments in accordance with the requirements established by the Public Information Act. As the officials make up one party in the publication of documents, instructions had to be prepared during the first phases of the project that would provide guidelines and advice for local governments to comply with the Public Information Act. As the development activities were carried out on the basis of existing EDRMS platform, an audit was carried out on the existing publication (public document registries). This audit was composed by using both qualitative and quantitative methods and was coordinated with project organisation. As a result, the public document registries of the partners of local governments were properly arranged. Consequently, local governments had convenient possibilities to comply with the Public Information Act and to ensure better information flow for the citizens upon following the processes of local governments. Technologically, the citizens now had an opportunity to follow via authentication (ID-card and mobile-ID) in the public view of EDRMS the course of proceedings of the documents that are related to them.

2. Automation of work processes. For the automation of the operations of EDRMS it was important to create the integration processes with different office software and other external systems. The wizards for the creation of documents related to work processes and improvement of work processes administration were created in a way where it was possible to predescribe the customary procedural flows for the roles and where upon the entering of an application to the system, it started to operate in its customary way. The whole course of proceedings can be monitored electronically and it is possible to take out of the system different reports concerning ongoing proceedings, priority proceedings and also completed proceedings. Also, there were created convenient possibilities for the officials to enter received applications. Upon registering a document, the personal data of an applicant is generated automatically as it is received from the Population Register. This functionality requires wider agreements between the registries administrators, local governments and service provider. Hopefully these agreements will be reached in 2013-2014.

3. The archiving of the documents. An important development need has to include all that is related to the maintenance and storage of the institution's document repository. Bringing together in parallel the paper and digital world has been a real challenge in the recent years as the information that is necessary for storage might be in two formats: both on paper and electronic. Thus, the task was to create the digital archive module within EDRMS. This created a possibility to perform by using EDRMS platform all archiving operations in the information system that had so far been carried out only on paper. Taking into account the needs of the users, the first objective was to create a two-level archiving functionality – part of the document system for the documents that are out of active use (so-called interim archive) and full archive for the storage of documents that are not to be transmitted to the National Archives. For the transmission of archive-worthy documents to the National Archives, it is possible to use the Document Exchange Centre (DEC). Similarly to the archive,

there has to evolve a possibility to transmit documents and their sets to other locations or systems in the EDRMS (e.g. usage of external services for the long-term storage of the documents, etc.). Given development was an important impulse also for the digitalisation of paper archives in the future. This would enable local governments to digitalise and describe legislation that only exists on paper.

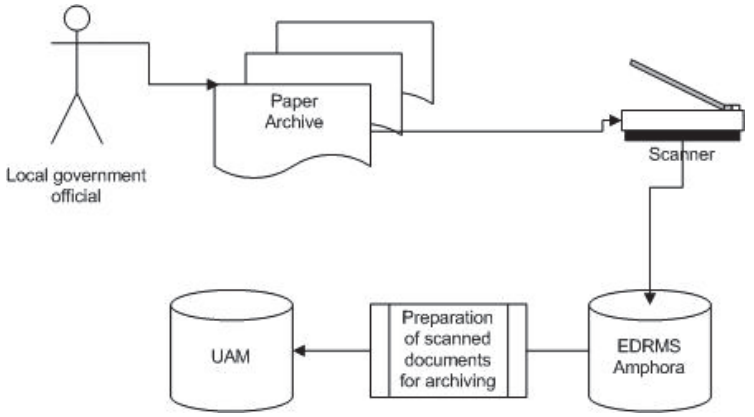

Figure 39 The digitalisation process of the paper legal acts

4. The training and implementation of development results. The training of users and application of EDRMS functionality among the officials of local governments is an important benefit achieved in the project. The trainings enabled to raise the awareness of the officials about the information society and related developments, because it was important to communicate the positioning of local governments in the state's general information model. Trainings were carried out in two parts:

- General management functionality for acquiring EDRMS functions – almost 100 local governments and subdivisions were trained in the computer classes at the county level.
- Paperless archiving functionality – almost 100 local governments and subdivisions were trained in the computer classes at the county level.

It was made possible to get trainings for all local governments that use EDRMS, not only for those who had confirmed their participation in the project by a letter of guarantee. Such widespread training among local governments has not been carried out before in the course of this research. During the trainings, it became clear that in addition to insufficient knowledge about information technology, the level of general knowledge of information society was also low. Furthermore, this acknowledgement gave a great impulse towards the creation of the necessary competence centre. It is clear that the information society issues concerning local governments are important for all parties. Therefore, it is necessary to find an efficient method to increase ICT competence of local governments.

APPENDIX B: E-LOCGOV VALIDATION CRITERIA

In the following table (see Table 10), the e-LocGov model research activity is assessed by the following criteria. As the development of the model is evolving, the focuses of the criteria have been different at different times.

Table 10 E-LocGov validation based on the Baskerville and Wood-Harper validation criteria (1998)

Validation criteria	**The e-LocGov model**
Situation of the study in a multi-variate social setting	The development of the e-LocGov model has been related to the development activity of the past ten years. The objective of the e-LocGov model is to simplify the transition of local governments to e-governance.
The use of an interpretive frame for recording and analysing empirical data	The interpretation and formulation of descriptions of actions for the participants was crucial in determining the e-LocGov model progress and the underlying reasons for change or resistance to change.
Clear identification and description of the research action or intervention	The objective has been to make the activities of local governments upon the transition to paperless management more concrete. This has enabled to study, create and develop in the course of several years various solutions for the organisation of local governments' decision-making processes that are located as specific parts of the e-LocGov model. Feedback and recurrent input from different project participants allowed the research and development team to motivate, direct, and promote improvement throughout the life cycle of a 10-year study. Semi-structured interviews were conducted and the interviewees were asked open-ended questions that allowed them to provide their own assessment and interpretations of the events, which were then feedback to them.
Data collection that includes participant observation	The lead researcher has worked closely with local governments before, during, and after this study. The author participated in the early meetings of the research and set up all interactions (interviews, forums, focus groups). The selection of documentary sources (standards, legal acts, etc.) to complement different surveys, transcripts of the interviews, focus group, and forum were also collected and used in the analysis. Author drew upon her background and experience with implementation of the paperless management in the selection of presented material and identification of sources.

Description of changes in the social setting of the organisation to be studied	The neo-institutional theory was used as a means of understanding the societal needs, learning outcomes and contribution to knowledge of the action research by interpreting our survey data, feedback from the forum, focus groups, and different interview types. SSM methodology was used for the problem identification as well. A number of problems were determined in the course of this research. Therefore, the usage of SSM methodology has enabled flexible information technology approach.
Documentation and understanding of how the immediate social problem has been resolved (equivalent of internal validity)	The immediate social problem was the low digital performance of local governments that did not enable local governments to organise their work effectively. It was started to solve this problem by implementing paperless management, after which it was possible to move on step-by-step – improving the quality of services for certain target groups (citizens) by taking certain services to e-services, involving citizens to decision-making processes via public interface, etc. The development of the e-LocGov model has made it possible for local governments to implement paperless management effectively and efficiently, transfer to e-services and has created platform for more effective communication with citizens.
Description of how the learning developed by the researchers has been generalised to a theory, which has potential for use for solving other problems in other settings (equivalent of external validity)	We offer this framework in the form of the e-LocGov model and its interpretation as an one possible way to implement e-governance. This framework has been described in general and can be replicated by other researchers in other government contexts.

APPENDIX C: TIMETABLE OF THE MAIN DEVELOPMENT OUTCOMES

The Table 11 below brings out the main development and research activities, which have been important for the current thesis.

Tabel 11 Main development outcomes in 2003 – 2012

Year	Activities
2003	Development is initiated with EDRMS Amphora: research is started with the specifics and functioning of local governments.
2004	The first local governments, Põlva and Võru counties start to use the EDRMS Amphora platform. First implementation activities are carried out.
2004–2005	The following local governments join – Pärnu County and partly Tartu County. A new larger local government, City of Pärnu, is added which gives an important development input to the use of EDRMS Amphora. The concept of legal acts management process for local governments emerges.
2006–2007	The developer of EDRMS Amphora promotes and manages the development of Document Ecxhange Centre (DEC). The interfacing of DEC and EDRMS Amphora and the implementation of the digital exchange of documents.
2006	The interfacing of the Citizen Portal and EDRMS Amphora, a letter form was created within the Citizen Portal for local governments using it.
2007–2008	The development of the concept of legal acts' system, analysis and development with the EDRMS and Omalex platforms. The platform was implemented in Pärnu City Council.
2008–2009	Applying for EU Structural Funds support for the development of EDRMS Amphora. More than 70 local governments joined the application. Trainings for the developments in more than 100 local governments.
The beginning of 2010	Implementation methods are created together with the description of a local government specific model environment with a pre-configured document hierarchy and users authorisation. The concept of an e-learning environment becomes more specific, process-based instructions and training videos are made.
2009–2010	Interoperability was enabled in the development of EDRMS Amphora with many state registers. An interfacing engine for making queries from state databases was added to EDRMS Amphora and a possibility to automatically generate them on a form. Wider implementation is planned for 2012-2014 as necessary state-level agreements are absent at present between the EDRMS Amphora service provider and the administrators of the database.
Summer 2010	A concept for the interfacing of local government software Pmen and EDRMS Amphora. The objective is to create a function within the EDRMS Amphora to receive e-invoices

	(based on the invoice XML of the Bank of Estonia), process them and then relay the processing data with the invoice to Pmen.
Autumn 2010	EDRMS Amphora development for interfacing with Pmen software. The pilot project application is based on the example of Kehtna County where the ability to receive, digitally process and relay e-invoices to Pmen using EDRMS Amphora is created.
End of 2010	E-Rapla concept, transition to fully digital management and e-services in county local governments.
End of 2010	Local Government Systems are described which have specific functions with EDRMS Amphora and systems interoperable with it. A realisation emerges that it is important to create an independent competence centre for the development of e-governance in local governments.
Beginning of 2011	An initial development project and research agenda are described with the Rapla County working group.
2011 February-March	The compiling of digital capability parameters assessment methods for local governments takes place based on EDRMS Amphora. A list of SQL queries for activities used most and the ones assessing the decision-making process.
2011 March	The Rapl County work group gathers and describes 24 services used the most. The methods are based on the analysis of Rapla County local government websites. Data sets are compiled out of the chosen forms, which conform to the requirements of the law and are transferred to the Citizen Portal in the format of e-forms.
2011 April	Implementation of e-forms in Rapla County. All websites of local governments have links to e-forms and a possibility to send applications through the Citizen Portal as well as through the public interface of the local government to EDRMS Amphora for fully digital processing.
2011 April-May	The first evaluations are carried out to assess the digital capability of local governments. The results are presented to the mayors of Rapla county local governments, which creates a competitive situation.
Summer 2011	The need to create a competence center becomes more concrete: the document “Concept for e-local governments”. Negotiations with EMOL, ELL, local governments and TTU.
End of 2011	An interface into EDRMS Amphora to relay legal acts to the e-State Gazette where DEC functionality is a mediating link.
Autumn 2011	The e-State Technologies Laboratory is created within the framework of the Institute of Informatics. A plan of action and an interest in the creation of a learning module with this content.
Spring 2012	The development project for the learning module e-Governance Technologies and Services is initiated. First studies and admission are planned for Autumn 2013.

Spring 2012	The creation of an e-correspondence centre into EDRMS Amphora is initiated which enables to send registered letters through EDRMS Amphora.
Summer 2012	Forming activities with the e-State Technologies Laboratory, the e-state direction is associated with the activities of Mectory. Negotiations start with Jiao Tong University in China whose delegation was here in August, 2012. We received a proposal to start cooperation and mutual projects in October 2012 in China.
Winter 2013	Accreditation and first admission of the University Master's Programme e-Governance Technologies and Services (TUT IVGM13) which enables the public sector institutions in Estonia, as well abroad, to send their officials to acquire further education in e-governance field

Although the principles and agreements have been formed, it is necessary to continue development in the given research area. The current thesis offers the main fields of activity and principles, which have applied so far or are being applied. The e-State Technologies Laboratory should provide good opportunities for researching every part of the e-LocGov model more thoroughly.

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