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The Utilization of Public-Private Partnership Framework in the Management of eID Projects

Master's Thesis

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LL.M, MSc

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

This master's thesis examines the nature of public and private sector cooperation, what are its models and how they differ from each other, and how they have been used in project management. The thesis also gives an overview of the theoretical frameworks regarding public-private partnership (PPP) cooperation models. The analysis focuses on eID projects carried out in Estonia and studies them from the perspective of the theoretical approaches brought by various authors and research papers. Conducting the research is valuable because it helps to identify bottlenecks and challenges in the implementation of public-private partnership projects and contributes to making the process more effective.

The aim of the master's thesis is to find out the strengths and weaknesses of the implementation of the cooperation model of public-private partnership in order to suggest practical recommendations and proposals for the development of this field to support the public sector and the private sector while managing PPP projects.

This thesis is written in English and is 74 pages long, including 7 chapters, 1 figure and 4 tables.

Keywords: public-private partnership, PPP, eID, electronic identity, cooperation, project management.

Annotatsioon

Avaliku ja erasektori partnerluse raamistiku rakendamine eID projektide juhtimisel

Käesolevas magistritöös uuritakse avaliku ja erasektori koostöö olemust, millised on selle erinevad mudelid, kuidas need üksteisest erinevad ning kuidas on neid rakendatud projektide juhtimisel. Magistritöö annab ka ülevaate avaliku ja erasektori partnerluse (PPP) koostöömudeli teoreetilistest raamistikest. Analüüs keskendub eeskätt elektroonilise identiteedi projektidele ning käsitleb neid erinevate autorite ja uurimistööde poolt toodud teoreetiliste käsitluste vaatenurgast. Uuringu läbiviimine on oluline, kuna see aitab tuvastada kitsaskohti ja väljakutseid avaliku ja erasektori partnerluse projektide elluviimisel ning aitab kaasa protsessi tõhusamaks muutmisele.

Magistritöö eesmärk on välja selgitada avaliku ja erasektori partnerluse koostöömudeli rakendamise tugevad ja nõrgad küljed, et pakkuda praktilisi soovitusi ja ettepanekuid selle valdkonna arendamiseks, et toetada nii avalikku kui ka erasektorit PPP projektide juhtimisel.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 74 leheküljel, 7 peatükki, 1 joonist, 4 tabelit.

Võtmesõnad: avaliku ja erasektori partnerlus, PPP, eID, elektrooniline identiteet, koostöö, projektijuhtimine

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List of abbreviations and terms

eID	Electronic identity
eIDAS	Electronic identification, authentication and trust services
ISA	Estonian Information Systems Authority
ITL	Estonian Association of Information Technology and Telecommunications
PBGB	Police and Border Guard Board
PPP	Public-private partnership
SK	SK ID Solutions AS (former Sertifitseerimiskeskus AS)

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1 Introduction

Cooperation between the private and public sectors has received much attention from state institutions and researchers. It is necessary to find the best solutions for the needs and interests of different people, so partnership and cooperation are seen as an additional resource to cope with rapidly changing societal needs (Murumägi et al., 2010). However, the state must manage and finance an increasing number of projects to ensure necessary services for its citizens and residents. One solution to decrease this burden is to involve the private sector in provision of public services. According to traditional cooperation models, the state is fully responsible for projects, takes over the entire financing, and bears all risks and additional costs. However, other sectors may also be involved in the projects and in this case, they share the risks.

This master's thesis examines the nature of public-private partnership (hereinafter PPP), what are its different models, how they differ from each other and how the PPP model is used in eID project management. The thesis also gives an overview of the theoretical frameworks regarding PPP cooperation models. The research focuses on eID projects and analyzes it from the perspective of the theoretical approaches brought by various authors and research papers.

The reason for choosing this topic is the increased number of new forms of cooperation (such as PPP, contracting out, privatization), the relevance of public and private sector partnership, and the author's personal interest to analyze the functioning of public and private sector partnerships with the focus on IT domain. Conducting this research is valuable as it helps the identification of bottlenecks and challenges in the implementation of IT-related PPP projects and contributes to making the process more efficient.

The aim of the master's thesis is to identify the strengths and weaknesses of the implementation of PPP's cooperation model in order to suggest practical recommendations and proposals for the development of this field to support the public sector and the private sector while managing PPP projects.

The research problem of the master thesis is formulated as the question of how PPP framework is used in the management of eID projects. To find answers to a research problem it is important to ask the right questions. The following sub questions were asked to carry out the research:

1. How have eID projects been conducted in Estonia?
2. What are the implications of PPP cooperation framework?
3. What have been the success factors of using PPP framework in eID projects?
4. What are the challenges and barriers of PPP in eID projects?

This research is qualitative research, and the research method is case study analysis using semi-structured interviews. Interviews are the primary source to gather data but secondary data sources such as academic literature, websites and guidelines were analyzed as well to complement the findings of the primary sources. To map the situation of PPP cooperation in electronic identity projects in Estonia, the author conducted semi-structured interviews with experts from Estonian Information Systems Authority, Police and Border Guard Board, SK ID Solutions AS, IDEMIA Identity & Security France SAS and Estonian Association of Information Technology and Telecommunications. The author analyzed the functioning of the public-private partnership based on the theoretical approaches described in the second chapter.

The master thesis consists of seven chapters. The chapter after introduction has four subchapters, which provide an overview of the nature of partnership and different forms of cooperation between the private sector and the public sector. It also highlights different theoretical approaches regarding PPP projects, their implementation, and the evaluation of success. Moreover, this chapter gives an overview of existing literature. The theoretical framework discussed in the second chapter supports the analysis of the empirical part of the master thesis. The third chapter introduces the research methodology. The fourth chapter of the master thesis provides an overview of electronic identity management in Estonia. The fifth chapter focuses on the analysis of expert interviews and secondary sources. The sixth chapter presents the discussion about findings and brings out suggestions. Finally, a summary with conclusions about the partnership between the public and private sectors in the field of electronic identity projects is presented, as well as recommendations and possibilities for future research.

2 Public and Private Sector's Cooperation

This chapter aims to give an overview of partnership and brings out different models of cooperation. As the first subsection is a general overview of different models, the second and third subsections concentrate solely on the PPP cooperation model. The second subsection analyses the implementation of PPP cooperation framework, and the third subsection gives an overview of project evaluation criteria and success factors. The last subsection gives an overview of the existing studies in the field of PPP.

2.1 Different forms of partnership

This first sub-section concentrates on the definition of partnership and its different forms which helps to understand what PPP cooperation is and how it is different from other models. It is largely based on the research that the author carried out in 2012 at Tallinn University (Mander, 2012) which has not been published before.

According to Domberger (1995), partnership means a relationship of high trust and close cooperation between two parties that is mutually beneficial. The basis of the partnership is based on support and information exchange, which must be defined in the contractual relationship of the parties (Domberger, 1995). Van Ham and Koppenjan (2001) have defined public and private sector partnership as "cooperation of some durability between public and private actors in which they jointly develop products and services and share risks, costs and resources which are connected with these products or services".

Murumägi et al. (2010) have brought out that the goal of new public management is to find ways to make public management even more productive, while increasing efficiency and evaluating the results of activities. This model also advocates cross-sectoral cooperation, its strengthening and implementation, and considers it as an important administrative tool. Organizations often lack sufficient knowledge to provide high-quality service or create products. The necessary resources, knowledge, information, personnel, and management skills are shared between different organizations. The exchange of resources is essential to achieve goals, make investments and solve problems. As a result,

the importance of hierarchical power and management relationships in society decreases and the proportion of horizontal relationships increases (Murumägi et al., 2010). Partnership between sectors provides enhanced management skills, additional resources and capital, and optimal use of reserves (Tunčikiene et al., 2014).

Partnerships can be conducted in different ways, but the following steps leading to cooperation are common to all of them. Domberger (1995) has pointed out the following stages that accompany finding and choosing a cooperation partner. The first step of forming a partnership is to start the search process which is followed by defining the results of the cooperation. Parties have meetings where they must decide how to achieve the results that were defined in the previous step. After discussions, partners will sign a written agreement. During the project, constant meetings will take place to keep track of the project status and processes in general. It is particularly important to follow "open book" approach and finally review the results (Domberger, 1995).

Choosing between different forms of cooperation is an individual process and it depends on development needs and opportunities which are different in every society (Murumägi et al., 2010). These are, for example, privatization, contractual delegation, and PPP-type partnership which are introduced in the following subsections. In this research, the emphasis has been placed on the analysis of the PPP-type partnership, because it is the most recent form of cooperation, and it is not yet quite common. Other introduced forms are traditional forms of cooperation.

2.1.1 Privatization

Privatization is the transfer or sale of its assets to a private sector company, whereby the public sector loses direct control over production of provision of service (Murumägi et al., 2010). There are several factors that play an important role in the government's choice to sell its assets to the private sector. According to Al-Homeadan (2004), one reason can be that the increase of the public sector is too great and therefore it can lower efficiency. Privatized companies are financed through capital markets, and they can be better managed. The third reason according to Al-Homeadan could be that the state budget can be increased through sales of shares, and it can be an incentive for choosing privatization. Moreover, it increases the availability of capital. Increased state revenue can lower taxes and it can be directed to achieve political goals (Al-Homeadan, 2004).

The reasons for privatization are pragmatic and they are based on the fact that the dynamics of a private company are better suited to achieve certain goals (Grahovac, 2004). In a competitive market, instead of participating, the state gives its companies to the private sector, maintains the role of creator of market rules, and keeps control over the legal order of privatization (Murumägi et al., 2010). Privatization is a complex process that is productive only in a well-functioning economic environment and stable legal conditions. At the same time, it must be considered that the privatization process can have serious social effects, and therefore transparency and supervision are particularly important throughout the process (Grahovac, 2004).

2.1.2 Contractual delegation

Contractual delegation is the contractual transfer of the provision of a public service to the private or third sector, in which case the public sector guarantees the conditions of the service, maintaining the supervision and financing function of the service (Altnurme, 2002). According to the Estonian legal system, state functions can also be contractually transferred to local government units (Murumägi et al., 2010).

In the case of contractual delegation, the public sector retains control over the selection and definition of services, contract administration, evaluation of service provider activities (Jensen & Stonecash, 2005). The aim is to provide a better service without limiting the influence and responsibility of the state during the provision of the service. Contractual delegation makes it possible to provide the service at the lowest possible price, but it is the duty of the state to monitor the quality of the service and prevent possible violations of the public interest. The contract includes and specifies the control tools that will be put in place (Murumägi et al., 2010).

Contractual delegation ensures competition and provides incentive for services providers, and this is the reason it is effective. It helps the government to save costs and increase service efficiency, because there is competition and private companies are not bound by political agreements (Jensen & Stonecash, 2005). But for the process to be successful, the public organization must make extensive and comprehensive preparations.

According to Murumägi et al. (2010), there are several factors to consider regarding the performance of tasks in the case of contractual delegation, for example, the level of importance of the task to the institution, the public interest, the opinions of stakeholders,

the existence of statutory mandates and discretion. Then the state can begin to consider and evaluate the financial benefits. But not only financial benefits should be considered, the state should evaluate the productivity and impact of non-measurable factors as well. For the procurement to be successful, the terms and conditions of the contract, mutual guarantees, described control and coordination mechanisms also play a significant role (Murumägi et al., 2010).

In summary, it can be said that in the case of this form of cooperation, services are delegated to the private sector, the activity and result are clearly defined, the price and quantity are determined, and a clear result is expected. The principles of contractual delegation are that the public sector supervises the execution of the service, finances the service, and guarantees the organization and availability of the service. The principle of subsidiarity is applied, according to which all decisions should be made at the lowest possible administrative level to consider local circumstances. If there is a conflict between market rules and the public interest, then the public interest should prevail. The proximity principle, high-quality services, and the availability of public services are the principles from which procurements are announced.

2.1.3 Public-private partnership

The concept of PPP has been utilized since the 1970s (Mulyani, 2021). In the beginning of 2000s, PPP was defined by Bovaird (2004) as "working arrangements based on a mutual commitment (over and above that implied in any contract) between a public sector organization with any organization outside of the public sector". Over time the definition has become more precise and according to the World Bank (2023), public-private partnership is a "long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility". But it has also been said that the PPP cooperation is based on equality and independence of the parties (Murumägi et al., 2010).

Delmon (2015) has stated that there are five components in the PPP framework: law, institutional element, procurement, public sector funding, and long-term funding mobilization. The organizational aspects of PPP can be characterized through the financial dimension (financial ties between partners) and through the organizational dimension (closeness of relations between partners) (Greve & Hodge, 2005). For PPP

projects to work, clear laws and regulations on PPP projects, a strong and developed capital market and sufficient financial strength of the private sector to invest their resources in the projects and general skill and expertise in the field of the given partnership are needed (Krtalic & Kelebuda, 2010). A PPP collaboration should be voluntary and both parties should rely on each other's strengths, resources should be optimized, and it must be beneficial for both parties. Moreover, written agreements must be in place which cover the aim, governance, and termination of cooperation (Das & Nandy, 2008).

The public sector is interested in PPP because they can implement high priority projects at a quicker pace. Public institutions can rely on private company's innovative technology and special management techniques which are especially useful while carrying out complex projects. It also increases financial resources and encourages entrepreneurship (Das & Nandy, 2008). The public organization withdraws itself from the regulation of its field and becomes an equal partner of the private sector organization. In a partnership, each partner has certain advantages over the other by performing certain tasks that allow the partner to bring out its best features to carry out projects and provide public services in the most financially efficient manner (Murumägi et al., 2010).

The purpose of a partnership agreement is the obligation and right of a private sector organization to upgrade, build, maintain and/or manage an institution or system that provides a public service. The public sector retains its rights based on these agreements, although the private sector invests financially in the establishment and development of a solution. The partnership also provides an opportunity to use the knowledge and skills of a private sector organization, which leads to greater efficiency. Teisman and Klijn (2002) consider that partners must jointly find the best solutions for achieving effective results, and the public sector does not dominate in this situation.

The implementation of PPP projects and cooperation with the private sector is a relatively common phenomenon in the world. Krtalic and Kelebuda (2010) have analyzed that the best representatives can be considered Great Britain, USA, Japan, Australia, which are all developed countries and meet the above conditions, which are necessary for the successful implementation of a PPP project. The European Union has outlined specific regulations that define the legislative framework for private sector and public sector

cooperation to simplify its implementation. Guidelines have also been issued on how to successfully conduct PPP projects (Krtalic & Kelebuda, 2010).

According to Murumägi et al. (2010), Estonia has no experience in conducting complex and large-scale PPP projects and in order to introduce PPP cooperation form, a model based on an organized theoretical basis should be developed. The model should also include the experiences of other countries, as well as Estonia's needs and the legal field. Moreover, the model must outline the various stages involved in the PPP process, guidelines for selecting partners and how to manage negotiations etc. It has also been recommended to create a competence center that would advise on PPP projects (Murumägi et al, 2010). The author believes as well that clear standards should be established, and the public should be convinced that the involvement of the private sector is a positive approach.

2.2 Implementation of PPP cooperation framework

The second sub-section introduces different types of PPP models. Not all PPP models are covered here but it gives a general overview of what kind of approaches exist for implementing PPP projects. This sub-section also explains the three-layered theoretical framework to analyze PPP projects.

There are different types of PPP models, and these sub-forms differ from each other in terms of public and private sector participation, risk level and responsibilities. For example, large infrastructure facilities are often built with the involvement of the private sector under a BOT (Build-Operate-Transfer) contract where the organizers of the construction take over the financing, organization, and responsibility of the construction and, after the construction is completed, they use, maintain and manage it for a long period. After the end of the given period, the organizers return the facilities to the state for further use (Turina & Car-Pušić, 2006).

The BOT model has transformed into different schemes according to the situation and need. In addition to BOT, the following abbreviations such as BOOT, DBOOT, BOOST,

BRT, BLT, BTO, BOO, BBO, BT, DCMF, DBFO are also known.[1] For example, the main difference between the DBFO and BOT models is that in DBFO, the government pays an agreed monthly payment to the sponsor throughout the project, but BOT contracts are financed by the user of the facility (Turina & Car-Pušić, 2006). Another common sub-form of PPP is the Design-Build-Finance-Maintain-Operate (DBFMO) contract. In this case the private sector partner covers all phases of the project, including construction, maintenance, operation and finding financing. The private sector makes the necessary investments and gives them to the public sector for long-term use in exchange for rent and/or service fees under agreed conditions.

Therefore, it can be said that these PPP sub-forms differ from each other in terms of public and private sector participation, risk level, risk sharing and responsibilities. This is illustrated by figure 1, it demonstrates how responsibilities and risk level are changing between different PPP models.
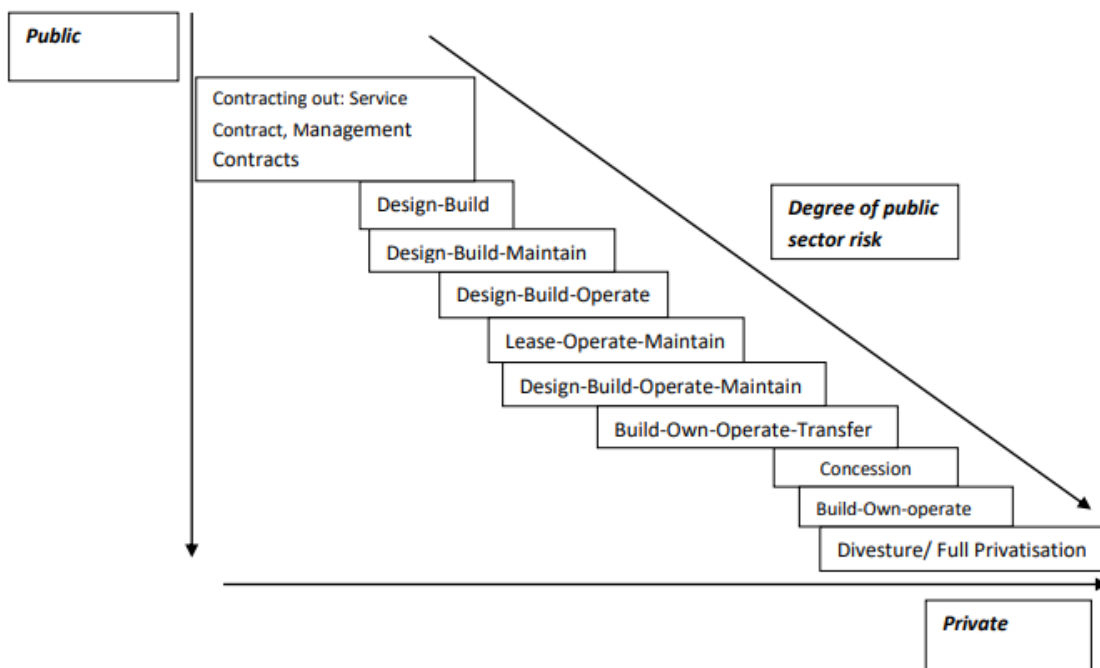
Figure 1. Different PPP models

Retrieved entirely from: Roehrich et al. (2013, p 42)

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[1] BOOT (Build-Own-Operate-Transfer); DBOOT (Design-Build-Own-Operate-Transfer); BOOST (Build-Own-Operate-Subsidize-Transfer); BRT (Built-Rent-Transfer); BLT (Build-Lease-Transfer); BTO (Build-Transfer-Operate); BOO (Build-Own-Operate); BBO (Buy-Build-Operate); BT (Build-Transfer); DCMF (Design-Construct-Manage-Finance); DBFO (Design-Build-Finance-Operate)

Implementation of PPP projects often varies across countries, sectors, and projects. Carbonara, Costantino, and Pellegrino (2013) have developed a three-layered theoretical framework in their research to analyze PPP projects. The three-layer PPP analysis framework proposes three levels – country, sector, and PPP project structure. Each layer is characterized by a series of dimensions and variables that are important for characterizing PPP projects. Table 1 gives an overview of the three-layer PPP framework.

Layers	Dimensions	Variables		Values
Country	Institutional	Political-ideological influences		Existence of national programs supporting PPP
		Design of government institutions		Centralist
				Federalist
		Attitude towards and use of New Public Management in public administration		Degree of outsourcing of public services to private sector
	Legal	PPP formalization by a government legal/statutory framework		Degree of level of regulation by the legal framework (all/few aspects of PPP are formally regulated through the framework)
	Economic	Taxation and its change		Level of taxation
		Indebtedness		Level of public debt
		Investment needs		Development of existing infrastructure
				Maintenance of existing infrastructure
	Financial	Access to capital and credit markets		Existence of strong constraints to obtain capital/credit
Sector	Industry organization	Regulatory regime		Regulated
				Deregulated
		Organizational structure		Level of private sector participation
	Market structure	Demand		Level of demand
				Elasticity of demand
		Competitors		Market monopoly
				Existence of substitute services (in other subsectors)
				Existence of substitute routes (in the same subsector)
	Performance	Attractiveness / profitability		Potential revenues/earning
Project	PPP arrangement's structure	Contract type	Based on the legal structure of the transaction	Institutional PPP
				Contractual PPP
			Based on operational aspects	Management contract
				Leasing model or Build-Lease-Transfer
				Design-Build (and Design-Built with warranty)
				Design-Build-Operate-Maintain
				Design-Build-Finance-Operate
				Build-Operate-Transfer

				Build-Own-Operate-Transfer
				Build-Own-Operate
		Use of private resources and expertise		Degree of involvement of the private sector in the lifecycle of the project (from design to management)
		Time horizon of contract		Medium term (less than 25 years)
				Long term (more than 25 years)
		Revenues sources	Payments based on usage volumes or demand	By private sector
				By public sector
				By public and private sectors
			Public financial contribution	Lump sum payment by public sector
		Special purpose vehicle (SPV)	Company ownership	Private company
				Publicly- and privately held company
			Partnership structure	Number and composition of partners
		Risk allocation		Private sector
				Public sector
				Shared between public and private sectors
	PPP arrangement's financing	Use of private finance		Financing in whole by the private sector
				Financing partially by the private sector
				Government-funded projects (no private capital)
		Type of funding options		Bank debt
				Equity
				Bonds
				Loan from shareholders
				Mezzanine finance
		Debt to equity gearing		Low (debt below 70%)
				High (debt exceeds 70%)
		Investment value		Low
				High

Table 1. The three-layers PPP framework: dimensions and variables

Retrieved entirely from: Carbonara et al. (2013, p 803)

The country layer has been divided into four dimensions which are institutional, legal, economic, and financial. In this layer, Hammerschmid and Ysa (2010) have brought out that PPP taskforces, legislation and government initiatives are particularly important to promote PPP projects and their implementation. Moreover, economic, and financial dimensions can also describe the overall lean towards carrying out PPP method and cooperation model to deliver a certain service (Carbonara et al., 2013).

According to table 1, the sector layer consists of three dimensions. Industry organization can be characterized by regulatory regime and organizational structure which brings out the level of regulations and trends of private sector involvement/participation. Market structure helps to explain the level and elasticity of demand and gives an overview of competitors. Performance dimensions are related to profitability. The project layer is divided into two big dimensions – PPP arrangement's structure and PPP arrangement's financing. This is the most detailed layer with a number of variables, and it deals with contracts, risk allocation, resources, funding options etc. They mostly explain the organizational aspects of both parties.

In summary, there are several models that the PPP cooperation can follow, and they all have their specific characteristics, and the degree of public sector's risk level varies but key features are still present. As PPP projects often vary across countries, sectors and projects, Carbonara, Costantino, and Pellegrino's three-layered theoretical framework helps to analyze the details of the projects.

2.3 PPP project's success factors

The third sub-section gives an overview of different approaches, how to find the right partner, what are the factors for successful cooperation and how to evaluate a project's success factors.

For PPP projects to be successful, there are certain points that should be followed. Jeffares et al. (2013) have indicated that the aim of the partnership must be clear and realistic. Moreover, availability of resources, both financial and human, has a significant role to play in partnership. The culture of cooperation should be open, and trust must be cultivated to succeed with the project. It is often necessary to hold the motivation of employees and they all should have a high degree of involvement to keep that kind of commitment. The roles should be clearly divided, internal policies and defined processes help to keep the cooperation on a proficient level. In this case, risks and benefits must also be mapped and defined so that counterparties know their responsibilities and for what they are striving. The functioning and performance of cooperation should be reviewed regularly and reported. This also helps to communicate with each other, set expectations, develop, and learn during the whole process (Jeffares et al., 2013).

There are several factors to consider when evaluating PPP project's success. Das & Nandy (2008) suggest keeping in mind that exploring the potential, focusing of specific plans, developing concrete governance sharing structure, dealing with project planning details, supporting flexibility, and preparing a timeframe are the most important aspects to achieve success. A number of authors bring out the importance of risk sharing in the PPP projects. Risks should be allocated in a way that each partner bears the risks that they can manage the best (Alexandersson & Hultén, 2009). Partnerships and projects involve uncertainties and risks, but these can be lowered by designing a thorough contract (Lu et al., 2016). Contracts are a necessity in managing PPP projects because they create official business connections between partners (Mwesigwa et al., 2021).

The term "critical success factor" has also been used in describing PPP projects. Rockart (1981) has defined it that these factors are those few key areas of activity in which positive results are necessary for a manager to achieve his goals. A critical success factor is a particularly important aspect that can lead to the failure of a PPP project. Aerts et al. (2014) have outlined an overview of the critical success factors of PPP projects. They are divided into eight categories: economic, financial, legal, political, procedural, societal, structural, and technical success factors.

Economic	Financial	Legal	Political
Stable economic situation	Available financial market	Favorable legislation regulation	Stable political situation
Near monopoly situation of the service	Acceptable tariff levels	Standardization engineering contract	Special guarantees and support by the government
Forecast of future (long-term) demand	Reasonable debt-equity ratio	Concrete and precise concession agreement	Select suitable project agencies
Procedural	Social	Structural	Technical

Knowledge transfer High level of respect Open communication Proper stakeholder management Understanding of objectives	Community support Demonstrated and accepted need for the project Sound environmental impact and public safety	Appropriate risk allocation and assessment Strong private consortium Clear definition of responsibilities	Technical innovation Creativity of the private partner Project technical feasibility

Table 2. Critical success factors

Retrieved entirely from: Aerts et al. (2014, p 279)

Osei-Kyei and Chan (2015) have also studied critical success factors of PPP projects and found that the most common elements are "risk allocation, risk sharing, strong private consortium, support at the level of politics, community and citizens and transparent procurement". Sehgal and Dubey (2019) have identified fourteen elements of PPP project success factors while researching existing literature. These factors are "long lasting macroeconomic environment, mutual understanding among private and public sectors, ethical and expeditious procurement process, sociopolitical aspect, government involvements and interference, contractor's attributes, stakeholder's attributes, risk appraisal and assessment, affirmative workforce, financial feasibility, relationship management, institutional factors, cost-benefit analysis, project planning."

Huxman & Hibbert (2009) have brought out five types of success. First is achieving certain outcomes which can be different for each stakeholder. The second type is getting the processes to work which means that people do not concentrate just on the outcome, but the processes must work as well. The third success type is reaching emergent milestones which help to understand whether the partnership and project are going in the right direction with an emphasis on celebrating also the small achievements. Gaining recognition from others and acknowledging personal pride in a partnership are other success types. These are related to personal investment into the project and people often seek recognition to be motivated (Huxman & Hibbert, 2009).

It can be said, that although the implementation of PPP projects varies across countries and sectors, evaluating PPP project's success is particularly important. It helps to make

conclusions and recommendations for making processes and communication better. Successful implementation of a PPP project is important to promote this cooperation form. Due to the complexity of PPP cooperation, there's a variety of risks to be shared and constantly monitored. The success factors may not be the same for all parties, so risks, benefits and outcomes must be clearly defined and monitored throughout the project life cycle.

2.4 PPP related studies

PPP is most often used in infrastructure projects, it has not much been analyzed for IT and e-services projects. While there are many scientific works and studies in the field of PPP, little research has been done on such cooperation opportunities in Estonia. Research has been conducted on PPP in the eID field focusing on factors that influence the distribution of power between public and private sector institutions (Medaglia et al., 2017). There has been only one master thesis, which analyses the Estonian X-road as a tool for organizing cooperation, and it focuses on the PPP aspect, and a research article has been published about it as well (Paide et al., 2018). Paide's research concentrates on cooperation after IT solutions have been developed and implemented but PPP framework should be used in the development phase of new projects as well. This is also one of the reasons to analyze this domain more in-depth and current research would have a different direction and focus. There is another master thesis by Rair Sannik (2013) which concentrates on the partnership of public and private sector, but it is analyzed in relation to the European Union procurement law. At the level of the bachelor's thesis, the cooperation between the public and private sectors has been studied using the example of the construction of the Kose-Mäo section (Parv, 2016). Peeter Peda (2012) has discussed PPP cooperation at the doctoral thesis level, but it focuses on the example of the water sector.

The National Audit Office (Riigikontroll, 2012) has conducted an audit concerning the cooperation between the public and private sectors in local governments. The audit brought out a variety of challenges such as lack of awareness of the requirements, experience in project management and implementation, and lack of sufficient analysis of whether this cooperation model is the most practical option. The audit emphasizes that

this cooperation model needs further research to improve the PPP project management and implementation process.

Recently, one scientific article was published about national eID infrastructure and PPP which analyses the case of Estonia. Lips et al. (2022) have pointed out that existing studies have not given insight into this topic, and it needs more analysis. Therefore, this article has been taken into account while writing the master thesis as it complements the current analysis of key factors that affect PPP in the field of eID but the aim of the master thesis is to go even deeper with the research.

Therefore, it can be said that cooperation between the public and private sectors has been studied in Estonia before, and a few master's theses have been prepared on this topic, but as far as the author knows, they have not focused on the information technology domain, except Paide´s thesis. Since this field has not been studied thoroughly with such a narrow focus before in Estonia, therefore, the study of the topic is novel in this context. Cooperation is a long and interesting process that can be scientifically studied and treated from different angles to add value to the research work that has been already carried out.

3 Research Methodology

This chapter explains the research problem and questions and discusses the research method, data collection techniques, interview design, and the procedures in the data analysis.

3.1 Research problem and questions

The research problem of the master's thesis is formulated as the question of how to develop the implementation of PPP projects so that the process and results are successful. Research questions help to find an answer to a research problem.

The main research question of the thesis is:

- How is PPP framework used in the management of eID projects?

To elaborate the main research question in a more detailed way, following sub-questions have been formed:

- How have eID projects been conducted in Estonia?
- What are the implications of PPP cooperation framework?
- What have been the success factors of using PPP framework in eID projects?
- What are the challenges and barriers of PPP in eID projects?

Main output of this research are policy recommendations to the public sector and private sector for using PPP model in IT projects. Different public and private actors can use this approach and recommendations for developing new eID solutions soon. These recommendations can also be implemented for other PPP IT projects as well.

3.2 Research method

This research is exploratory, **and the research method** is case study analysis using semi-structured interviews, document analysis, thematic analysis, and coding of themes.

An exploratory study is an efficient way of understanding the situation, assessing phenomena in different angles, and presenting a new point of view (Saunders et al., 2009). Regarding the chosen research method, "how" and "why" questions are more explanatory in their nature, and they are likely to lead to the use of a case study analysis (Yin, 2018). As the main research question is „How PPP framework is used in the management of eID projects?," case study analysis was chosen. Qualitative methods, namely document analysis and interviews were chosen as they provide a wider narrative which concludes with explorative discussion (Rajasekar et al., 2013). The results of the research would be used to answer and provide explanation for the main research questions and sub-questions.

Case studies analyze an existing, real-life situation and describe that situation in as much detail as possible. Two case studies will be used to analyze PPP in eID projects - procurements and project management of Mobile-ID and ID-card. As there are two projects which will be analyzed, it follows multiple holistic case study design, namely two-case study analysis (Yin, 2018). Single-case designs are more vulnerable and having at least two cases may be beneficial from the analytical perspective.

3.3 Data collection

This research involves collecting qualitative data and qualitative is "a synonym for any data collection technique (such as an interview) and data analysis procedure (such as categorizing data) that generates or uses non-numerical data" (Saunders et al., 2009). Semi-structured interviews were conducted with key actors who were involved with project management of two mentioned cases.

The author used purposive sampling which leads to greater depth of information from carefully selected cases (Teddlie & Yu, 2007). Main actors who were interviewed were Information Systems Authority (ISA), Police and Border Guard Board (PBGB), SK ID Solutions AS (SK), IDEMIA Identity & Security France SAS (Idemia) and Estonian Association of Information Technology and Telecommunications (ITL). In this case, all relevant public sector and private sector parties, who are involved in Estonia's eID projects, are represented in the research to get an overview and analyze the full situation. A more neutral point of view of public and private partnership was provided by the ITL expert.

A semi-structured interview approach was selected with the aim of gaining insight into how previous eID projects have been carried out. Five interviews in total were carried out in February and March 2023. The author interviewed six people from five different authorities/companies. Four interviews were carried out via video conferencing and one meeting was physical. All interviews were recorded with participants' consent. Interviews were later transcribed manually, and it was followed by thematic analysis.

Identification	Profile	Time
Interview 1	CEO, SK ID Solutions AS	27 February 2023, Recorded MS Teams meeting. 53 minutes
Interview 2	Former Head of Department, Estonian Information Systems Authority	28 February 2023, recorded MS Teams meeting. 42 minutes
Interview 3	Head of Department, Estonian Police and Boarder Guard	01 March 2023, recorded MS Teams meeting. 51 minutes
Interview 4	Head of Public Procurement Working Group, Estonian Association of Information Technology and Telecommunications	05 March 2023, on-site meeting which was recorded with a smartphone. 52 minutes
Interview 5	Vice-President, IDEMIA Identity & Security France SAS International Consultant, IDEMIA Identity & Security France SAS	16 March 2023, MS Teams meeting which was recorded with a smartphone. 52 minutes

Table 3. List of interviews

Interviews were the primary source to gather data for this research. The author also used secondary data sources such as academic literature, websites, and guidelines to complement the findings of the primary sources.

3.4 Interview design

When conducting semi-structured interviews, the researcher has a list of topics and questions to cover but there is also the possibility to skip some of them. Moreover, the sequence of questions can be changed based on the conversation, and the author can ask additional questions (Saunders et al., 2009). The author structured interview questions based on the research questions in three blocks and used open-ended questions (see Appendix I).

The sequence of three blocks were not changed during the interview but some sub-questions were skipped or modified according to the needs of research and covering all themes. As one of the interviewees was not related to Estonia's eID projects (Interview 4), but the expert has a practical knowledge of public procurement processes and public-private partnerships, the researcher skipped first two blocks and concentrated in this case on the third part of the interview guide.

3.5 Data analysis

After the interviews were transcribed manually, the data was read carefully and analyzed in detail. The most valuable information was extracted from transcriptions and key themes were identified to structure the information that was found with the research. To achieve this, thematic analysis was used. Thematic analysis is a "method for systematically identifying, organizing, and offering insight into, patterns of meaning (themes) across a dataset" and it involves the steps of familiarizing with the data, generating initial codes, searching for themes, reviewing potential themes, defining, and naming themes and producing the report (Braun et al., 2012).

When the data was coded and categorized, the author determined patterns to bring out case findings in a structured way. Key themes were the following words or phrases: preparation, procurement, obstacles/shortcomings, roles and tasks, communication, results, evaluation, PPP strengths, PPP weaknesses, lessons learned. This is also helpful to generate main findings, recommendations, and conclusions.

4 Electronic Identity Management in Estonia

This chapter aims to give an overview of electronic identity system in Estonia. The first sub-section maps the most relevant public and private sector stakeholders. The second, third and fourth sub-section elaborates which eID solutions exist and gives some background information to better understand the similarities and differences of each solution.

4.1 e-ID stakeholders

All Estonians have a mandatory and state-issued digital identity, and it is substantial in citizen's daily life as it provides access to different services, and it allows to sign documents. e-ID can be used via state-issued ID-card, Mobile-ID on their smartphone or Smart-ID which is an application. The first two solutions are provided by the state and Smart-ID is a private sector initiative which is provided by SK ID Solutions AS.

Various public and private stakeholders participate in the Estonian electronic identity system and cooperation in this field is significant as the service delivery depends on the cooperation of both sectors. The following table brings out main stakeholders in Estonia with their tasks and mandate.

Public Sector Stakeholder	Responsibilities
Police and Border Guard Board (PBGB)	PBGB is responsible for identification of persons, procurement, and issuance of identity documents (Regulation no. 33, 2014).
Estonian Information System Authority (ISA)	ISA is responsible for eID software, development, management, and supervision of trust services infrastructure, and it also handles national cybersecurity incidents (Regulation no. 28, 2011).
IT and Development Center of the Ministry of the Interior of Estonia (SMIT)	SMIT deals with IT-systems related to identity management and identity documents (Regulation no. 8, 2020).

Ministry of the Interior	Ministry of the Interior develops the policies of identity management and the issuance of identity documents (Regulation no. 39, 2012).
Ministry of Economic Affairs and Communications	Ministry of Economic Affairs and Communications develops the Estonian information society policy (Regulation no. 323, 2002).
Private Sector Stakeholder	**Responsibilities**
Trust service provider (SK ID Solutions AS)	Issuer of the certificates for the Estonian identity documents. Service provider for Mobile-ID and Smart-ID.
ID manufacturer (IDEMIA France S.A.S)	Manufacturer of blank identity documents.
Personalization service provider (Hansab AS)	Personalization of identity documents.
Telecommunication service providers (Elisa, Telia, Tele2)	Issuers of SIM-cards with mobile-ID.

Table 4. eID stakeholders in Estonia

Source: Lips et al. (2023)

This sub-section illustrated how many stakeholders are involved with the policy and implementation of eID framework and solutions.

4.2 ID-card

ID-card has been issued in Estonia since 2002 and it is the main identification document. ID card has a chip, and it uses public key encryption to prove a person's identity in digital authentication and signing. Ninety-nine percent (99%) of Estonian residents have ID card (e-Estonia, 2023).

SK started issuing ID-card e-certificates in 2002 and it has the same role today as well (SK ID Solutions, 2023). Since 2002, the Swiss company Gemalto AG (former name: Trüb AG, current name: Thales Group) had produced Estonian ID-cards but after 15 years, namely since December 2018, the French company IDEMIA Identity & Security France SAS started to deal with the production of cards. Currently, the Estonian company Hansab AS covers cards' personalization.

The financing model of the ID card is quite simple: to get a new ID card citizens have to pay a one-time fee which covers the costs. It covers chips, plastic cards, trust services,

signing, authentication. When a citizen uses a service, he or she does not pay themselves, but the e-service providers pay for it to SK (Interview 2).

4.3 Mobile-ID

People can use Mobile-ID with their smartphone, and it has the same functionality as an ID-card, but it does not require a card reader. It is based on a SIM card, and it must be acquired from a mobile phone operator (e-Estonia, 2023). The certificates are issued by PBGB (id.ee, 2023a). Currently, there are three telecommunication companies in Estonia who provide SIM cards with Mobile-ID support – Telia, Elisa and Tele2. Each company can make their own requirements about age limits, service fees and other conditions to provide the service, but they must follow national requirements so that it works the same with different providers (id.ee, 2023b). Mobile-ID certificates are valid for up to 5 years (PBGB, 2023).

Regarding the historical background, Mobile-ID was created in 2007 and it received recognition as a new innovative solution (SK ID Solutions, 2023), but Mobile-ID which can be used as digital identity has been issued in cooperation with PBGB since 01.02.2011 (Mobile-ID, 2023). By the end of 2012, there were about 35 000 Mobile-ID users in Estonia and by the end of 2020, there were 245 000 users (SK ID Solutions, 2023). Since the beginning, there has only been one private sector provider, namely SK, who has provided Mobile-ID and cooperated in this regard with the public sector.

Interviewee 1 explained the financing model of this service. Telia, SEB, Swedbank, who were the owners of SK back in 2007, decided to finance this project to develop such a service. In 2009, two other telecom companies (Tele2 and Elisa) decided to join the project because it proved to be an attractive service and some clients decided to change the telecom service provider and use Telia's services for that reason. Tele2 and Elisa made big investments, as it required a different kind of SIM card which was more expensive. Regarding service fees, the mobile operator is entitled to ask SIM card exchange fees if the customer signs a Mobile-ID contract and the customer pays regular fees for using the service – this is the moment when the end user pays for the service. SK's is making a profit from signing and authentication as they sell this functionality to e-service providers (Interview 1).

4.4 Smart-ID

Smart ID was launched in 2017 by SK which is a popular personal identification solution (Smart-ID, 2023). With Smart-ID, people can use a mobile application instead of connecting it to the SIM-card on their mobile phone. To use this service it is required to have an internet connection so Smart-ID could be used on smartphones and tablets (e-Estonia, 2023). In 2023, Smart-ID has 676 620 users in Estonia (Smart-ID, 2023). Using Smart-ID for personal identification is free and unlimited for the end-user (e-Estonia, 2023).

As this solution is solely provided by the private sector, it will not be covered by this master thesis, and research focuses on the eID projects that are provided by the state.

5 Case Findings

This chapter presents the findings of the two case studies. The aim is to explore how the cooperation took place between the public and private sector and what were the challenges and success factors.

5.1 ID-card

This sub-section covers the case findings of ID-card procurement. It concentrates mainly on the 2017-2018 public procurement, but other ID-card procurements were commented on during the interviews as well. The findings are divided into five sub-sections such as roles and responsibilities, preparation phase, project progress, project outcome and evaluation, and lessons learned.

5.1.1 Roles and responsibilities

In Estonia, an outsourced PPP model is implemented for ID card production that covers all processes starting from enrolment up to production, personalization, and issuance. In Europe, there are only a few countries operating this way. For example, in Lithuania, outsourced partner deals with only ID-card blanks and all other processes are carried out by the state. In Latvia, personalization is carried out by the state, but all other processes are outsourced (Interview 5).

In Estonia, there's a number of parties involved in the ID-card procurement. PBGB is the contracting authority from the public sector's side and ISA is responsible for digital elements of the ID-card (Interview 2). Currently, IDEMIA Identity & Security France SAS is the manufacturer of the ID-cards, Hansab AS covers their personalization and SK issues ID-card e-certificates. These contractual relations illustrate well how many parties participate in one project.

Interviewee 2 explained further the division of responsibilities between different parties. In the case of the ID card, the state is looking for a single partner from whom to receive all three services – the entire process of plastic and chip production, personalization and

trust services is outsourced. The responsibility lies with one strong partner, who must find subcontractors and start delivering results. Another option would be to make three separate procurements – the first for chip and card, the second for personalization and the third for trust services but then the state would have to manage this relationship network itself and settle possible disputes. If there is one partner, then all the responsibility lies in the hands of one partner, and the disputes must be handled by that private sector party (Interview 2).

The ID-card procurement in Estonia involves several public sector authorities. Regarding cooperation between different public institutions, Interviewee 2 confirmed that before the ID-card crisis took place in Estonia in 2017, the cooperation was good (Interview 2). Namely, a flaw was discovered in the smart card chips made by Infineon Technologies AG and because more than half of the Estonian population received ID cards from the state that had the vulnerable chip, it put the e-state's resilience at risk (Parsovs, 2020). The national ID document is an essential element in Estonia and even though there is an alternative solution such as Mobile-ID, e-Estonia must be operational and for that reason overlapping or backup solutions should be created (Interview 5). As a result of the so-called ID-card crisis, the roles and responsibilities of each public sector authority were defined more clearly (Interview 3).

Interviewee 3 stated that the ID-card crisis in 2017 proved that the legal environment which was in force at that time had not made it clear who is responsible for what. Practices were developed, PBGB procured contracts (both the trust service and the document itself), implemented it and issued ID-cards. ISA was involved with chip requirements because ISA has technical competence in the state. The entire procurement process at that time was structured in such a way that PBGB was the procurer and owner of the project, but the owner of one component, the chip, and its application, was ISA. This was also stipulated in the contracts (Interview 3). Interview 2 confirmed that ISA's role was to deal with the technical side, ID-card software DigiDoc and all the components that are related to e-services.

Due to the crisis in 2017, the government gave the task to make the responsibilities clear between different authorities. The government also decided to separate physical and digital identity. As a result, the national legislation was changed in the fall of 2021. In October 2021, the Identity Documents Act and the Electronic Identification and Trust

Services for Electronic Transactions Act came into force, which seemed to make the situation clear. PBGB has the following understanding according to the Interview 3 – the ID Act states that the Ministry of the Interior issues the physical identity document and that the digital identity with trust services and certificates is issued by the Ministry of Economic Affairs and Communications. The Electronic Identification and Trust Services for Electronic Transactions Act states that the framework, organization and principles of trust services must then be regulated by the competent authority of the state. The competent authority appointed with eIDAS regulation. In this case, according to the law, the competent authority should be ISA under the Ministry of Economic Affairs and Communications (Interview 3).

To sum up, according to the explanation given by Interview 3, e-identity and trust services should be under the responsibility of ISA, and physical identity and physical documents should be under the responsibility of PBGB which is under the Ministry of the Interior (Interview 3). Interviewee 2 confirmed that after the crisis, it was agreed that PBGB is responsible for the plastic cards, card issuance, personalization (mainly physical aspects) and ISA is responsible for the digital side of ID card, namely chip requirements, chip software, certification, user software etc (Interview 2). In the context of the ID card, SK has less of a view as they have no other involvement with the service, except for issuing e-certificates (Interview 1).

Although the roles have been defined in different acts in 2021, practical processes are still similar to those in 2018. The digital identity is managed, and the requirements are set to be procured by PBGB (Interview 3). Interview 3 also brings out that the goal of PBGB is not that ISA must start to fulfil its role. The legal environment can also be changed back, where the eID is also under the administration of the Ministry of the Interior (therefore under PBGB). But it is important to follow the legislation and the authorities should have the resources that are actually allocated to them by the legislation to fulfil its tasks (Interview 3).

Relations between the private and public sector have changed as well over time. According to Interviewee 2, at first, ID-card software DigiDoc was provided by a private sector company, namely by SK. SK developed all the components so that people could use ID-cards and sign digitally using the DigiDoc software. The more people signed documents digitally, the more beneficial it was for the company. At some point, ISA took

over and started to act as the product owner of DigiDoc. At first, SK was a contractor and ISA was the client. After some time, other IT companies became partners for ISA in the development process of DigiDoc software (Interview 2). This shows that product owner roles have also changed between the two sectors.

Regarding roles and responsibilities, interviewees agree that a common goal should be established, and all parties should follow it (Interview 2, 3). All parties should gain from the project and openness in joint projects is critical. The aim of a partnership is to gain value and all parties must be involved as much as possible to get the best results. When all parties are concentrating on their own goals, conflicts arise. Good cooperation without blaming is key in resolving problems effectively (Interview 2).

5.1.2 Preparation phase

Market research is an effective way to start the partnership process. Regarding the ID card procurement, no market research was carried out but there were some discussions with potential suppliers at the beginning of the procurement where the requirement specifications were defined. Market research allows the government to specify specifications and make corrections. In the public sector, it is not necessary to have full resources to know all the elements and the current market status. It is essential to conduct research and collect opinions on what is possible, what is innovative, what are the future trends, and the private sector can provide input. For example, national document has a very complex environment and there are many elements to consider such as document security elements, chips, different regulations etc (Interview 5).

There are many technology companies that are interested in demonstrating what they can offer but it is quite difficult for the state to meet and listen to all of them. Choices must be made but it is ultimately a useful approach for developing ideas and discussing possibilities. The collaboration with the suppliers has generally been very good in the market research stage (Interview 3).

One shortcoming in the preparation phase is that sometimes too generic requirements are established and it can lead to a situation where unfair suppliers take advantage of it. Interview 5 brought this out as a potential major risk for the state. In this case, legal penalties would not help, and the consequences may be drastic. Therefore, requirements must be carefully analyzed and considered, and the scope should be clear so that suppliers

would know what they must quote and that they would not underestimate some elements. Everything should not always be defined in the smallest details because the state should be adaptable and flexible but there should be a balance and finding the right partner is important (Interview 5).

One obstacle that the public sector must consider when they conduct public procurements is the contestation of the procurement result. When there are many bidders, there is a high probability that others who did not win the contract will contest the result and it will stop the process for a long period (Interview 3). This is the biggest obstacle and risk for the public sector in the preparation phase. The state must guarantee that the service provision and ID-card issuance will not stop due to disputes (Interview 2). Therefore, the risk of contesting the procurement result also leads to early preparations of a procurement. When one procurement process has ended, then preparations for the next procurement already start although the contract can last for up to 5 + 2 years. The time for disputes and contestation procedures which may take one year must be considered in the time planning (Interview 3).

As an example of contesting the procurement result, in 2018, Idemia won the ID-card public procurement and Gemalto was left aside after 16 years of cooperation with the state of Estonia. The first procurement process failed but it was related to legal technicalities. The contracting authority realized that the process failed, they were weak as a contractor and decided to try again with stronger legal advice by their side. A law firm was hired to support this process, and this firm had an extraordinarily strong background in procurement processes and contestation procedures. Although these guidelines sometimes seemed to be very detailed and strict, they helped to end the procurement by concluding a contract (Interview 3). Therefore, strong legal competence can help with large scale and complicated procurements.

The currently ongoing ID-card procurement in 2023 is a competitive procedure with negotiation which is one of the most complicated procurement forms. But this time, a strong legal partner is involved in carrying it out. Competitive procedure with negotiation is a procurement form which needs a clear and strict framework. This form supports innovation, and the public sector has used it before with the Mobile-ID but unfortunately, at that time, it was not successful. Now the public sector has learned from this experience and the state has been satisfied with the results. As the public sector does not need to have

such competence in the institution, it is an effective way to be innovative and open to new solutions in the market (Interview 3).

Regarding contract negotiations, contracts should be sustainable, balanced, and reasonable. All interviewees from the private sector mentioned that contract negotiations are long and some requirements and/or penalties are substantial (Interview 1, 4, 5). Companies cannot always take commitments on unlimited and unknown risks (Interview 5) and this shows that balanced approach and true partnership is much appreciated by the private sector in contract negotiations.

5.1.3 Project progress

In case of large-scale production procurements, PBGB outsources the project management service. It also involves risk management. The outsourced project manager describes the resources, tasks, and deadlines of PBGB and other committed authorities (such as ISA). Regular project management meetings take place, and the project manager gives an overview of the project, risk monitoring and risk realization probabilities. The biggest risks are usually the overlap of resources and delays that result from it. Although the project management is outsourced, an expert from PBGB is highly involved in the project management during the entire process (Interview 3).

From the private sector side, Idemia sets up the whole ecosystem, where they have clearly drafted a communication map to define in a detailed manner who is responsible for which topics and elements. All parties are mapped, and different streams are managed. It is essential to map all stakeholders and define responsibilities. As there are many institutions involved in a large-scale project, there must be a leading party from the private sector and from the public sector who centrally manages communication, negotiations and disputes (Interview 5).

Regarding the public sector's cooperation with the private sector, PBGB considers themselves a demanding partner as they monitor strictly how the contracts are followed by the private sector. There have also been a few legal disputes during the contract with Idemia and the private party has also had to compensate for some issues. Nevertheless, communication throughout the contract was good (Interview 3). If PBGB looks at the cooperation with SK, SK has been the only trust services and certification provider and there have not been any changes over time. As a novel approach, PBGB just started to

procure trust services separately so that PBGB can choose their own partner. Until this, the main supplier has chosen the subcontractors. The novel approach also helps with increasing the competition in this field, which has been stagnant since the beginning (Interview 3).

From the private sector side, the comments on cooperation were related to two different approaches. Interviewee 1 explained that there are two separate parts – lifecycle management and service provision. According to Interview 1, the state is more involved with the first part. Regarding the service provision, if there is a wish to make changes and/or developments during the procurement contract to make the service better, obstacles rise very quickly, and different parties and competences are found in conflict (Interview 1). Innovation during the existing procurement contract should be more supported.

One recent example of conflict of competences is the issuance of ID cards in Selver grocery stores. The issuance of ID cards started at Selver information counters of six grocery stores on January 27, 2023. By February 15, 2023, 1748 ID cards had been ordered, of which approximately 1100 were handed out to people. On February 15, ISA submitted an order to the SK, who is responsible for ID card certification, which obliged the company to stop issuing ID card certificates from Selver information counters and to invalidate the certificates of cards already issued in Selver. In this regard, PBGB suspended the issuance of ID cards at Selver information counters, and it was possible to exchange documents with suspended certificates at PBGB services free of charge (Information Systems Authority, 2023).

According to ISA, the issuance in stores had to be stopped, because neither the auditor nor ISA had yet been able to give their approval to the new way of issuing documents, which also issues e-signature certificates. For the state to be able to issue documents with PIN codes, i.e., they can be used electronically, the service provider must submit information that complies with ISA and an assessment by an independent auditor, which confirms that the issuance meets the requirements established by Estonia and the European Union (Information Systems Authority, 2023). However, the founder of the trust service itself, SK ID Solutions, informed ISA about the violation. Regular meetings between PBGB, ISA and SK take place constantly, so the procedures and plans should have been known to all parties (ERR, 2023). Nevertheless, this situation shows that there

have been shortcomings in procedures, roles, responsibilities, and communication between agencies.

Regarding ongoing cooperation between different public authorities, procurement committee meetings are held regularly during the project. Representatives from the public sector side are ISA, PBGB and the Ministry of the Interior, representatives from the private sector side are SK and Idemia (Interview 2, 3). In 2016-2020, e-ID coordination group meetings took place. It was a working group, where the private sector, representatives of the state, various agencies were represented, and where an overview was given of what are the developments in the field of eID. PBGB and ISA led the working group and gave an overview of the situation, what needs to be changed, what service innovations are taking place and what European regulation changes are planned (Interview 2). Interview 3 stated that e-ID forums where ISA, PBGB, Ministry of Economic Affairs and Communications and Ministry of the Interior are still taking place and they are represented by the heads of authorities and they discuss e-ID directions, news etc. Although there are different cooperation forums and structures in place, there are examples why this may not be enough (Interview 3). The ID-card issuance in Selver grocery stores that was described in previous paragraphs can be one of the examples.

Communication also plays a large part in effective cooperation. In the case of ID-cards, there are different people of different nationalities involved in the project. Even in cases when miscommunication existed, the private sector and the public sector have managed to find a solution. Common goal is the driver and transparency, and open discussions contribute to it. Even if there is a dispute situation with a previous supplier or a national incident has taken place, communication and teamwork can contribute to solving situations (Interview 5). Helping in situations where there is no legal requirement or defined role can be a characteristic of a good partnership relation. This may also bring options to the table that were not considered at first and it could benefit all sides in the end.

Interviewee 5 finds the communication between parties is good. There must be a set framework for communication such as steering committees and regular program meetings. It is essential to exchange thoughts and discuss different matters on diverse levels so that everyone is up to date and problems get resolved constructively. The program should be developed in a way that the discussions are ongoing on the technical

level, on the legal level, on the management side and all the parties should have a chance to speak and express their thoughts (Interview 5).

5.1.4 Project outcome and evaluation

The benefits of PPP cooperation apply to both sectors. Interviewee 2 explained that the state itself does not have to manage everything if it can be purchased from the private sector. There is no need to produce plastic cards or chips, or set up a trust service, even if it would make sense in terms of risk mitigation because SK is currently the only provider of trust services. With this kind of partnership, the private sector has a client, it can experiment, innovate, and use it as a reference. Estonia is not a profit-making project for any smart card manufacturer, it is a reference. Companies may want to produce identity tools for the digital state of Estonia and be a part of it. It is a quality mark and brand that helps to sell elsewhere (Interview 2).

The same was confirmed by Interviewee 3. The state has a good knowledge of the manufacturers who can provide card security, chip and chip applications, personalization. The state has a good knowledge of what the market is capable of. Although Estonia is a small state with small quantities, the interest from the market is still quite high. One of the reasons could be that manufacturers can use this project to advertise themselves. For example, Idemia's Estonian ID-card have won awards (Interview 3).

One more positive aspect is that Estonia is a small country and decision-making processes are rather quick and easy. All decisions about how the ID-card looks, what security elements are used and what functionality it has, are essentially based on three or four people. Therefore, Estonia does not have a long coordination of authorities and procedures, it can be considered to be quick and flexible (Interview 3).

In terms of evaluation criteria, they are important performance indicators that are already presented in the production contracts. All these criteria are fixed in a detailed way in contract annexes. All processes and outcomes are evaluated, and they are monitored during the project management phase and risk monitoring. All criteria are extremely strict and sanctionable (Interview 3). Idemia also confirmed that all the requirements of the program are set up in a document which follows along the program. This is a good checklist to follow during the program. The results are therefore factual and clear, and the

evaluation can be done by looking to see if the company is compliant or not (Interview 5).

From the point of view of the project outcome, PBGB is content with the ID-card as it is visually beautiful document and secure. Unfortunately, the ID card does not use its full capacity. There is a contactless chip on top of the ID card, which was obtained with the Idemia contract, so that this chip can carry various functionalities in addition to biometrics when using services. It has been paid for but unfortunately not used (Interview 3). For that reason the public sector can say that the outcome has not been completely successful, but it is probably not due to the cooperation but due to some other reasons.

5.1.5 Lessons learned

One of the lessons for the public sector is that when one procurement process has ended, then preparations for the next procurement already start although the contract can last for 5 + 2 years. Also, the time for disputes and contestation procedures must be considered in the time planning which may take up to one year. Moreover, as it was already mentioned, competitive procedure with negotiation is a relatively new form of procurement in the public sector where there is not much experience. Therefore, the biggest lesson was to create a strong legal competence and a qualified law firm was hired to support these processes in the future (Interview 3).

In terms of rules and responsibilities, relations with private sector partners are based on contracts and there are noticeably clear boundaries. The public sector does not regulate itself with contractual relations, but it is regulated by statutes, regulations, and laws. Unfortunately, in the public sector there is too much looking at boundaries, task division, other priorities and projects can be delayed (Interview 3). As authorities are regulated by laws and regulations, the mandates should be clear to avoid conflicts and misunderstandings.

The main issue with responsibilities is with the separation of digital identity and physical identity in the form that it was tried to do with the 2021 law amendment. Interviewee 3 considers it a failed project. For something to succeed, it is necessary for the project to have one owner, a truly clear one person in charge and have the appropriate means and resources to carry this responsibility. Projects where responsibility for one goal seems to

be in two or three places, then no one is responsible. It would be important to have one owner with full competence and resources to implement it (Interview 3).

From the private sector's viewpoint, Interviewee 1 discussed the option of giving financial resources purposefully to the public sector to develop some kind of feature. For example, SK developed DigiDoc software and when ISA and SK ended the cooperation in this field and SK found that there are features that clients need, there were no opportunities to find an agreement. Even if SK had supported this development with financial resources, there was no option to make such an agreement. The state is missing the capability and mechanism to accept investments from the private sector to develop certain features that could benefit all sides. The private sector may be willing to finance some features, it is not only the case of DigiDoc but X-Tee and AI "Kratt" could also be good potential cases in Estonia. The complexity in this situation is that the private sector cannot develop it itself as a freeware because the state will get the obligation of acceptance testing. The state also must manage the code so that it will be in next releases as well and it would not get broken. Also, the private sector cannot take the risk of developing something in hope that the state will start using it (Interview 1).

At the end of Interview 2, the interviewee brought out an interesting thought about partnerships. The interviewee discussed that if the project is a fundamental service in Estonia, then it should be easier to partner up with Estonian companies. The reason is quite straightforward, it is more difficult to explain the importance of some services in Estonia to a global corporation who aim only profits. Cooperation with Estonian companies brings these topics and problems closer to home and the motivation to come through is bigger. Estonian counterparties feel the impact and value more and in case of problems, parties will join and try to solve them. Of course, this approach is not always reasonable, and some international scale will probably join the scheme. For example, there is no good reason to start producing chips in Estonia when there is no chip factory, so the international cooperation is unavoidable in some cases. Also, is would be costly to do everything in Estonia on a small scale (Interview 2).

5.2 Mobile-ID

This sub-section covers the case findings of Mobile-ID procurement. The findings are divided into three sub-chapters such as preparation phase, project progress and outcome evaluation, and lessons learned.

5.2.1 Preparation phase

Mobile-ID was created in 2007 as a private sector initiative by SK (Interview 1). In 2011, elections were held in Estonia and there was a pressure to add the possibility to use Mobile-ID for e-elections but as it was a private sector solution, the citizens were not able to use it for e-voting. Finally, it was decided to nationalize Mobile-ID and make it an official alternative authentication method of the ID card so it can also be used in the e-voting process (Interview 2). The legislation had to be changed to accommodate this need. The only aspect that changed with nationalization was that the service list was updated and e-voting by Mobile-ID was added to the legislation (Interview 1).

In 2011, there was no market analysis carried out prior to the procurement process. The goal was to expand the number of tools used in elections, there were no other possible solutions in Estonia (Interview 1). It is the complexity of a small country where there are a small number of certain solutions and service providers (Interview 2). Nevertheless, it was agreed by many interviewees that market research is a beneficial tool (Interview 3, 4, 5), but in this case, there was no other alternatives on the market, and it was difficult to find one that had the same number of users and met the requirements set by the state (Interview 1, 2). Mobile-ID was already used in state portals and public e-services and the situation was similar to Smart-ID nowadays – people can use it almost everywhere for authentication and signing but it cannot be used for e-voting (Interview 1, 2).

As Mobile-ID was the only service on the market which met the requirements, there were no other alternative solutions to procure. In 2021, it was the first time that a procurement in the form of competitive procedure with negotiation was carried out. It can be a beneficial procurement form to find new and innovative solutions. The process of competitive procedure with negotiation can be difficult and there's much uncertainty, but the value is in innovation that it can promote. It seems that there was not enough experience and competence in carrying out this procurement form (Interview 1). According to Interview 2, the interviewee agreed that the public sector did not have much

experience with this form of procurement and the process took a long time, but it was not the greatest obstacle. The failure of this procurement was because there was no innovative solution on the market that would have brought additional value to the people and Mobile-ID in the current form still worked. Stronger and bolder decisions should have been taken, when it was clear that there's no innovative solutions on the market and the procurement should have been skipped to save resources (Interview 2).

After the procurement phase was over, contracts were negotiated, agreed and signed. The contracting parties in the case of Mobile-ID were PBGB and SK, since 2022 ISA and SK In 2022, as the last procurement failed, concession contract was signed. Telecommunication companies have been the subcontractors of SK. The negotiation of contract requirements has always been a long process. The state and the private sector each have their own interests. There are two separate parts – lifecycle management and service provision (e.g usability). According to Interviewee 1, the state is more involved with the first part. Regarding the service provision, it is stated that service level requirements must be maintained and cannot be lowered. But if there's a wish improve the service and make any changes or developments during the procurement contract, obstacles rise quickly (Interview 1).

One of the most important aspects in project management is to set clear roles and responsibilities. The roles and responsibilities in the public sector have changed during Mobile-ID service provision. In 2017, so-called ID-card crisis took place in Estonia which led to defining roles more clearly than before. The crisis proved that an alternative method for digital authentication is necessary (Interview 1). The legislation was changed in the fall of 2021 to make roles and responsibilities clearer (Interview 3). As a result of the changes, ISA had the responsibility to procure Mobile-ID service.

Interviewee 2 explained in more detail that at the beginning, ISA's role was to deal with ID-card software DigiDoc and all the components that are related to e-services. After the crisis, it was agreed that PBGB is responsible for the plastic cards, card issuance, personalization (mainly physical aspects) and ISA is responsible for the digital side of ID card, namely chip requirements, chip software, certification, user software etc. In case of Mobile-ID, there´s no physical aspects to cover and a question was risen – why should PBGB deal with the procurement of Mobile-ID when it is related to digital solution (Interview 2). Interview 3 confirmed that before the change in the legislation in the fall

of 2021, the Mobile ID provider was PBGB, but as Mobile-ID does not depend on a physical carrier such as a plastic card or some other format and it is a pure digital identity and can be used in a digital environment, Mobile ID procurements were transferred to ISA. The procurement process was ongoing at that time, and it was given over to ISA in the middle of the process, but the currently valid contract is already signed with ISA (Interview 3).

Therefore, it can be said that the tasks and responsibilities between the public and private sector have been relatively clear in the case of Mobile-ID. There are situations where the existing competent authorities in the public sector disagree with each other, and this does not benefit the state. Responsibility should be in one place and there must be a clear understanding of what is procured, how it is regulated and what is left to be regulated by the private sector (Interview 1).

5.2.2 Project progress and outcome evaluation

There were no major obstacles or shortcomings on the project management side, all objectives have been achieved and delivered, although there have been some challenging moments (Interview 1). Regular procurement committee meetings and procurement project management meetings take place which creates the environment to discuss project progress and upstanding issues. Regular meetings between ISA, PBGB and SK take place to discuss digital identity and cooperation formats. Regular meetings (about once a quarter) between the Ministry of Economic Affairs and Communications, the Ministry of the Interior, PBGB and ISA representatives take place to discuss the trends in the field of e-ID (Interview 2).

According to Interviewee 1, communication between public and private parties have become more formal in time which makes processes clear and transparent. Formality also may have a negative impact on cooperation. All parties who are dealing with the same project or service should be interested in solving problems together, but parties tend to concentrate on the formal division of responsibilities and where the lines have been drawn. Parties need to have a clear understanding that in order to be successful, good partnership and relationships need to be developed (Interview 1). In terms of partnership, it is mostly related to the people, communication and having a common goal. If parties have different goals, the partnership will not be successful. Especially private sector

authorities tend to focus on their own responsibilities, but the problem is common for all, and it should be dealt with joint efforts (Interview 2).

Regarding the evaluation of project outcome, Interviewee 1 brought out that Mobile-ID is like a service, and it is measurable by business metrics. Business results are the main source of evaluation. The service must be profitable and viable. To this day, Mobile-ID has not failed in this sense. Even if the contract ends with the state, SK will continue with telecommunication companies to provide this service, if technological sustainability still supports it (Interview 1).

5.2.3 Lessons learned

Interview 1 brings out that Mobile-ID has not been a PPP project and it is only an image that has been created with the e-Estonia brand. SK has developed this service and the state makes payments but there has been no joint effort to really partner up and create something together. Today, SK provides its services through procurements but it is not a public-private partnership in that sense because it's always competitive. Interviewee 1 also brings out that the public sector does not use the private sector's potential enough and does not delegate out from the public sector (Interview 1). Interviewee 2 agrees with the approach that the government brings the tools, and the private sector brings the value. In this case, the public sector gives the tools or a platform in a general sense and the private sector creates business value with concrete solutions and applications (Interview 2).

One of the most important lessons came from the situation when PBGB handed the procurement of Mobile-ID over to ISA. The procurement process was already ongoing at that time. Interview 3 brought about that if an authority organizes a procurement of an identity document, which Mobile-ID is in a digital format, it cannot be procured as a technology, it is a service that needs to meet the requirements of eIDAS. There is a fundamental difference between those two approaches. Although handing over of the Mobile-ID procurement to ISA was correct from the legal point of view, ISA had no previous experience in providing services to the public. ISA had the competence to procure technology but not services. On the other hand, PBGB has had this experience for very many years, and handing over the procurement in the middle of the process to ISA carried many substantial risks that could have led to a failure. Lessons learned in this case is that handing over the procurement was legally a correct step but there should have

been time to let the receiver develop an overall understanding and competences and have enough time to prepare to carry this role (Interview 3).

Regarding competitive procedure with negotiation, it is a good approach as it gives the opportunity to ask the market about technology, but it requires a very knowledgeable customer. Interviewee 3 explained their experience. A customer must know the needs and be able to describe and define the requirements as accurately as possible. In the case of competitive procedure with negotiation, it is also important how people set the environment and framework for conducting the dialogues at the very beginning, so that they do not turn into chatting, processing of materials, and endless rounds of questions and answers. The organization of dialogues is very important (what will be asked and what answers are expected), because as a result of the dialogues, the authority must be able to get an idea from the providers what else is on the market and what are the service providers capabilities and define the final technical input. Unfortunately, in this case, the execution of the competitive procedure with negotiation was a failure. There was a lack of systematicity, correctness, adherence to agreements, validation of positions, prior clarity on the part of the customer and what exactly was looked for. At the end, it was clear that the market did not understand what the state was looking for and it was clear that the state failed to make it understandable (Interview 3).

Competitive procedure with negotiation is a very complicated procurement form. As this is a good way to research the market and supports innovation it has many positive sides as the contracting authority does not need to build this competence in the institution. The market is willing to present their ideas and it gathers potential partners who are interested in cooperation. Compared to the market research, the latter is rather laconic and includes certain standard questions which gives a general overview, but competitive procedure is more thorough and gives an opportunity to communicate with potential partners. Yet the contracting authority needs to have a clear knowledge, strict framework and a very strong legal competence or legal support from the outside to carry out competitive procedure with negotiation (Interview 3).

In the PPP partnerships, there are not always only two actors – one private and one public sector party. Both sectors may involve several authorities or businesses which makes their relations more complicated. A common goal should be established, and all counterparties should follow it and try to achieve it. All counterparties should gain from the project and

solutions that satisfy all parties should be found. Roles should be followed but understanding the general environment is also important to avoid potential conflicts. Openness in joint projects is the key. The aim of a partnership is to gain value and all parties must be involved as much as possible to get the best results (Interview 2).

As it was for the ID card procurement, clear roles and responsibilities should be established. The separation of a digital identity and a physical identity in the form that it was attempted to do with the 2021 law amendment is considered to be a failed project. A successful project must have one owner, clearly one person in charge, and the authority must have the appropriate means and resources to carry out this responsibility. A very clear chain of command should be in place. Projects where responsibility is divided between two or three institutions will result in conflicts. To finalize projects, it is important to have one owner with full competence and resources to achieve the goal (Interview 3).

Interviewee 2 stated that there is no reason to find another solution if the new one does not provide any additional value (Interview 2). Interviewee 3 mentioned that Mobile-ID is an old technology based on SIM-cards and there has not been any development in 15 years, which is unfortunate (Interview 3). Currently, mRiik, which is a national mobile application, is being developed and planned to be launched in the middle of 2023. It will make the usage of public services more convenient and in the future, it will bring identity documents to the smartphone (Ministry of Economic Affairs and Communications, 2023). Once this platform is used to make a new innovative approach to replace Mobile-ID, it would have additional value and the state could provide something new to the public (Interview 2).

5.3 Promotion of public-private partnership

Two interviewees from the private sector believe that no true PPP project has been carried out in Estonia (Interview 1, 4). The cooperation in the context of procurement is simply limited to asking the private sector to carry out a certain project. Instead, cooperation should be enhanced, and true partnerships should be formed. However, the trend is that the public sector is hiring more experts to create full teams and capacities in their departments (Interview 4). The suggestion from Interviewee 4 would be to procure more services from the private sector and use the tax money efficiently. Interviewee 5 also

brings out that the PPP gives the state the possibility to concentrate on the overall outcome with their limited resources. If the state manages to select the right partner, it makes project management easier and it is more cost-efficient. Otherwise, the state would need to hold too many functions and knowledge inside its institutions (Interview 5).

As Estonia is fully dependent on its supplier, selecting a non-suitable or unfair partner is the most significant risk. The supplier may not always be present, or they do not mitigate internal risks. For example, during the COVID-19, there was a global chip shortage. Idemia anticipated and forecasted this situation and Estonia was not affected by the shortage of ID documents. There were countries with smaller suppliers who did not anticipate the crisis and negotiations with chip producers were not successful. As the ID-card is an essential element of identification and e-services in Estonia, it would be a substantial risk and selecting a right partner is key to success (Interview 5).

The most typical IT procurement forms are simple procedure, open procedure, restricted procedure, competitive procedure with negotiation, dynamic purchasing system. Dynamic purchasing system have become popular in recent years. Most public sector institutions use open procedures for large-scale projects. But the dynamic purchasing system is like a framework agreement, with the only difference that the contracting authority can add providers to the agreement over time. Therefore, it is not fixed, it is dynamic. The contracting authority can decide exactly how to adjust it for each procurement, and it just gives more flexibility. It should be kept in mind that it is designed to procure products not services (Interview 4).

Regarding competitive procedure with negotiation, it is not much used and may not be the most convenient procedure for procurers and for providers. According to the statistics, many competitive procedures with negotiation have failed. To succeed, it needs an informed and experienced procurer. The scale of the project itself is also important – if it is a large-scale project, this form might be good. Parties must look at the time required to prepare the offer versus the volume and scale of the contract. Those that have failed are largely because the number of hours required to prepare a bid is so great that it renders a potentially winnable contract meaningless. It is also important for the public sector how many final bids the procurer receives at the end. Initial applications may be offered by many bidders, but the result may be different. Moreover, competitive procedures with negotiation are taking place around one table, and it may affect the openness of bidders.

But it is an effective procurement for when the procurer is not certain what the result should be (Interview 4).

Before carrying out public procurement, the public sector should carry out a market research. It should be done through the public procurement register, and it is beneficial to make a separate notification either from the public procurement register or by a separate e-mail to potential bidders. The market research deadline must also be reasonable, considering that all companies have different workflows and procedures. For large-scale projects, one month would be a reasonable deadline so that companies can have their in-house discussions and provide timely feedback (Interview 4). With the ID-card procurement, which is currently ongoing, market research was carried out beforehand and potential bidders had the opportunity to provide answers. This approach was perceived as positive and open (Interview 5).

Market research allows to ask specific questions and validate the technical description and specification. It gives feedback on whether something is missing, whether it is understandable, whether requirements for the development team are reasonable, whether the technology makes sense etc. As market research can be comprehensive, the public sector may not receive all answers but if several potential bidders answer questions, the institution gets adequate feedback. Market research allows to make changes in the supporting documents, but it is not possible to do it when no changes can be made once the procurement has been already announced. The dialogue with the market is beneficial but it is also important to be transparent and not to give any advantage to anyone. The competition must be fair and transparent, and market research materials must be disclosed for the procurement phase as well (Interview 4).

To promote PPP, the responsibilities between all parties should be divided clearly but it is necessary to agree on tasks and responsibilities in the participating parties as well. Usually, authorities are reluctant to add a certain contact person to the procurement documents, but it enhances the sense of responsibility. Some authorities say that it avoids corruption but to enhance cooperation, bidders would like to communicate, address questions and discuss options (Interview 4).

ITL is currently drafting a standard contract that can be used as a basis for contract negotiations which could promote smoother contract negotiations. Best practices can be

a good foundation to achieve a balanced contract. The bidder should not have only obligations and the contactor only rights (Interview 4). Moreover, ITL has developed a guideline for IT-related public procurements which is helpful for procurement specialists, compilers of requirements and technical specifications, and other persons involved in procurement process (Nemberg, 2022).

According to Interviewee 4, more private sector people should work in the public sector and vice versa. It helps to blend these two sectors and both sides can understand each other better. Some authorities in Estonia are very innovative and managed in a modern way but there are also authorities, who would benefit of having some new perspectives (Interview 4).

Another factor that could promote PPP projects is financing. According to Interview 5, financing means that the supplier must sponsor the project until a certain moment when the government starts making payments. Therefore, properly set financials schema is essential because otherwise the state would potentially overpay in the long run. This would mean that the citizens start to pay more for a service because the state is charging them for a public service. It is essential to set a proper payments schema, which motivates private sector suppliers to enter PPP projects (Interview 5) but is also fair from the state's side.

The public sector and the supplier want to share the success. The supplier wants to get a good reference, and the procurer wants to get a good solution. The private sector has a wider view regarding technology, and they can bring this knowledge here. Communication is the key (Interview 4). But Interview 5 brings out a hypothesis that Estonia might be counting too much on the reference aspect. Although Estonia is a very well-known reference but at some point, it may not work anymore. This is still a business with earning goals and the state cannot count that businesses are sponsoring the state to have the reference. The government should give a commitment to a minimum amount of production, which is essential for the supplier for their business. Otherwise, companies can make investments, but they would not get a return (Interview 5). This approach is applied in Estonia's ID-card project but not in all other countries.

Therefore, certain committed minimum volume of services to be procured is essential to have fair legal relations contractually, and to have a balanced financing model. Co-

financing at the build phase of a PPP project could encourage more companies to join the projects, not only large corporations, if the state wishes to promote local Estonian companies. Currently, if a smaller company would like to enter into a PPP agreement, they would need to find third-party financing for such a project. This may lead to a much more expensive service for end users. The state should always keep in mind that at the end the citizen is paying for these products and services and therefore a smart and balanced ecosystem should be created to ensure better prices (Interview 5).

Another idea that came from the interview 2 is that carrying out public procurement every five years is not always reasonable in the case of technology. Interview 2 explained that at first, when the state brings a new technology to the market, there are no users. The state needs to market the solution, make investments and increase the number of users. But after five years when the state has achieved the goals, they may have to take up a new technology and start over due to the contract termination and public procurement processes. It is not efficient, and it also leaves previous users in a complicated situation. Technology can last more than five years and longer partnerships in technology could also be a solution. It could be that the state itself can be the service provider and procure the sub-components which will be updated in this case (Interview 2).

6 Discussion

This chapter discusses the findings of the case studies and describes the results of the thesis according to the research question and sub-questions. The overall objective of this research was to explore how public and private partnership cooperate in different eID projects. This paper addresses the main research question „how PPP framework is used in the management of eID projects". Sub-questions helped to map different aspects of PPP cooperation to make conclusions in this field.

The results show that the interviewees have a different understanding of the PPP framework and whether it is used in Estonia or not. On the one hand, Estonia is a good example, where the country has outsourced many of its functions: if we take ID card production as an example, various sections of the work have been completely handed over to the private sector. In the case of Mobile ID, the situation is more unique, it has been taken over by the public sector in the form of nationalization, and the Mobile-ID solution was not developed in cooperation between the two sectors. Therefore, the author cannot call it a pure PPP project, although the partnership has been used after the nationalization of the solution.

The PPP framework allows sectors to focus on their strengths and competences. The state does not maintain production or strong IT development competence in institutions, and it encourages the conclusion of partnerships. The private sector has been active in presenting its solutions and opportunities, and if the public sector creates mechanisms for structured market research and familiarization with innovative approaches, the competences of both sectors can be merged. However, a clearer framework, internal procedures and additional resources are needed to achieve this. It is also facilitated by the organization of a competitive procedure, but as can be seen from the cases - it requires strong legal competence and experience, and if it does not exist in the state institution, an external advisor or law firm must be procured to support the entire process with their extensive knowledge and advice.

One of the indicators of the PPP cooperation framework is long-term cooperation within one project/service. In practice, it has been the case that the Estonian state has had reliable partners, but this is rather due to the peculiarity of a small market, because the competition is relatively low. For both projects and services, partners have been found within the framework of procurement, but this excludes long-term technological cooperation with a specific partner. The next new company may be the winner of the procurement and it is still an ongoing competition.

When analyzing PPP cooperation, acting according to specific and clearly defined roles has emerged as the main concern. When it comes to cooperation between the public and private sector, cooperation has been relatively clear in the case of Mobile-ID. Throughout history, SK has been the only partner for the state, and telecoms are subcontractors. This partnership framework between the public and private sectors is in place and long-term. In the case of the ID card project, there are more parties involved, it is more complex and interesting, because the roles have also changed over time, and it offers more approaches for an analysis. Disputes have also taken place within procurements, which makes project management conditions more difficult. This leads to a situation where, in addition to new partners, the state has also to consider parties with whom they have previously been in partnership, but now it is necessary to continue communication with them and settle disputes and offer the service continuously at the same time.

The research showed that the biggest bottleneck is in the public sector itself. In the form of Mobile-ID and ID card projects, these are large-scale projects related to the governance areas of different agencies and ministries, which leads to disagreements about roles. The ID card crisis in 2017 highlighted the need for clearer roles, but after the updated legislation in 2021, the updated division of roles has not been implemented in practice according to the interviews. Therefore, the author believes that the bigger conflict of PPP is not between public and private sector, but between public sector authorities. This shows that cooperation, when there are several parties in one sector, makes project management more difficult.

The above-mentioned shows that the cooperation between the public and private sector is formulated with contracts and clearly defined roles, tasks and boundaries. The framework for cooperation in the private sector is relatively clearly defined (both between the public and private sector and between the private sector and subcontractors), but if

there are several parties in one sector, it can make the location of responsibility unclear. There are no contracts in the state and the law must be interpreted to determine roles and responsibilities, but often different parties interpret it differently.

In cooperation, it is important to act for a common goal and all parties must agree on it. If there is a common goal in mind and there is not too much focus on what is the task of one party and what is the failure of the other party, by acting together and solving problems, a better solution is reached faster. Otherwise, processes get slowed down and instead of solving situations, problems are pushed on to others.

Open communication and the creation of different communication layers can be considered as a success factor. It is important to create various committees to discuss the progress of the project and solve emerging problems. This should be done at the technical level as well as at the senior management level so that the various elements are covered. An open atmosphere and the opportunity to speak and express one's views must be encouraged. A clear communication framework supports routines, regularity and monitoring.

When analyzing the PPP cooperation, the second main concern is the contestation procedure of the procurement. Contesting a procurement requires many resources from the public sector, both time and financial resources. From the point of view of the procurement, it is important to consider the time of contestation procedure, but it is extremely important to clearly outline the project's scope, requirements, evaluation criteria from an early stage. In the case of newer and more complex procurement processes, it is worthwhile to include strong legal competence, which, for example, PBGB has also done. When it comes to roles and responsibilities, institutions must rely on their strengths, and if there's no in-house competence, a partner from outside the organization should be selected.

In general, PPP cooperation between the parties has been assessed good, and eID projects have been successful. Making changes during the existing contract on the part of the private sector is the biggest concern. This has been considered impossible on the part of the public sector, but they are expected to be more flexible. Continuous improvement of the product or service is considered important, and for this it is also necessary to

implement innovations within the ongoing cooperation and contract. Instead, rigid contracts do not encourage this and additional obligations are not desired.

There are certain bottlenecks in the results of the analyzed cases, and it is desired to improve their performance. For example, in the case of the ID card, it was pointed out that the chip is not being implemented to its full potential, and in that sense, it is not a fully successful project. However, the obstacle is probably not in the cooperation between the public and private sectors, which has been analyzed in this research, but in other aspects. In the case of Mobile ID, outdated SIM-based technology has been cited as a disadvantage, but the project as such has been successful. The upgrading of technology and the development of alternative authentication methods must come from the need, and now there are no better options mapped by the public sector.

The author points out recommendations that could be applied to PPP projects so that cooperation between the public and private sectors would be successful. They are based on the analysis of two eID projects, but they can also be applied more broadly to procurement in the field of public sector and information technology.

- To encourage PPP projects, it is necessary to introduce a clear PPP framework in the public sector so that institutions follow it and are open to this form of partnership. Analyzing lessons learned from previous experience and sharing experiences between institutions to learn from others' mistakes or sharing identified bottlenecks would also contribute on the positive side. However, this requires a more systematic approach and a policy that would encourage this form partnership. Also, the creation of PPP guidelines would support this form of cooperation.

- The public sector could consider longer-term partnerships to develop and market certain technologies. Changing partners every five years is not conducive to strong partnerships, while competition can be a driving force. It is necessary to analyze the project in question to choose the most appropriate approach, but a long-term technological partnership framework could exist in the state.

- The state is missing the capability and mechanism to accept investments from the private sector to develop certain features that could benefit all sides. The private

sector may be willing to finance some features. This mechanism could be a solution for some development issues.

- To promote innovation and successfully implement projects, the competences of both sectors must be merged. Institutions should have clear internal procedures, frameworks and allocated resources to support the partnership. It helps to monitor opportunities, the market and the implementation of projects.

- If there is a desire to develop innovative solutions, it is important to conduct market research in a structured manner before starting a procurement. This provides an opportunity to get feedback on requirements, prices, availability of providers and other aspects. Thorough market research ensures more successful procurement.

- Communication with market participants is also important on an ongoing basis, not only in the procurement preparation phase. This should be encouraged more in the public sector and mechanisms should be put in place to grasp the knowledge of the private sector. This also provides the opportunity to involve the private sector at an early stage.

- Innovation and creativity must be encouraged in the public sector, but the public sector must feel a clear need to develop a solution, just the idea of innovation is not enough. New solutions must justify themselves and then the corresponding steps can be taken. Feasibility analysis must be carried out.

- If there is no specific or precise knowledge of what the final solution should look like, then instead of open procurement, a competitive procedure with negotiation could be considered. Since the public sector does not have strong experience or competence in this regard, it is very important to involve strong legal support. If the requirements are clear, it is advisable to use an open procurement, in which there is more experience, but legal competence is important here as well.

- When planning the procurement, the time schedule must also consider contestation procedure, which can last up to a year. This requires early procurement planning.

- In the case of procurement, clear requirements and the scope of the procurement are important information to make an offer and analyze the commitment. Market research before announcing an open procurement helps to assess the clarity of the requirements and make corrections, if necessary.

- The PPP financial model must be acceptable and beneficial to both parties. Depending on the project, this needs to be thought through so that potential partners in the private sector want to get involved.

- The public sector must carefully choose a partner so that an unfair situation does not arise. The company must be an experienced and strong partner, as eID projects are indispensable services in Estonia.

- ITL has developed an advisory guideline for conducting procurements and the basis of the contract, which can be useful in incorporating best practices and standardizing processes.

- Both the public sector and the private sector concentrate and rely on their competences and strengths. The risks must be assessed and the sharing of risks between the parties should be logical and equal. Defining responsibilities is important.

- If several parties/institutions are involved in a project from one sector, there should be one principally responsible institution so that the responsibility between different parties does not get blurred. This requires a clear negotiation of roles and the allocation of resources necessary to carry out the tasks.

- During project management, open communication, respect between the parties, suitable management of the parties and working towards a common goal are important. Communication must take place at different levels and activities must be coordinated.

- After a project, the analysis of lessons learned must also be carried out in order to draw conclusions for the next procurement and cooperation project.

These observations do not constitute a complete framework but provide a basis and are helpful in drawing conclusions and creating a framework.

7 Conclusion

PPP is a complex matter between private and public sector actors. This research explored ID-card and Mobile-ID case studies and challenges of PPP in eID projects in Estonia. The aim of the thesis was to understand how PPP framework is used in the management of eID projects. The author carried out five semi-structured interviews with public and private sector representatives related to the eID projects to find answers for research questions.

The thesis started with an introduction, and it was followed by literature review which gave an overview of theoretical concepts and background to explore the topic of PPP. Research methodology in chapter 3 outlined the research method and the steps of data collection and analysis. Analysis presented the findings of interviews and secondary sources. It was followed by a discussion, where the author brought out main ideas and discoveries of the research with proposed recommendations.

The results of this study indicate that the interviewees have a different understanding of the PPP framework and whether it is used in Estonia or not. ID card production has been completely handed over to the private sector and the public sector largely relies on the private sector. In the case of Mobile-ID, the situation is more unique, it has been taken over by the public sector in the form of nationalization, but the partnership has been used after the nationalization of the solution.

The state does not maintain production or strong IT development competence in institutions, and this encourages the conclusion of partnerships. There are many different forms of procurement on how to find and select partners. Market research and familiarization with innovative approaches is important for the public sector to get advice from the private sector.

When analyzing PPP cooperation, acting according to specific and clearly defined roles has emerged as the main concern. When it comes to cooperation between the public and private sectors, cooperation has been relatively clear in the case of Mobile-ID. In the case

of the ID card project, there are more parties involved, it is more complex and interesting, because the roles have also changed over time, and it offers more points of analysis. The research showed that the most substantial bottleneck is in the public sector itself.

When analyzing the PPP cooperation, the second main concern is the contestation of the procurement. Contesting a procurement decision requires many resources from the public sector, both time and financial. It is extremely important to clearly outline the project's scope, requirements, evaluation criteria from an early stage and include strong legal competence to carry out procurements.

Overall, eID projects in Estonia have been considered successful. The private sector's biggest concern is making changes during project management when the contract already exists. Continuous improvement of the product or service is considered important and therefore flexibility in this regard is advisable.

Some of the author's recommendations that could be applied to PPP projects include a clear PPP framework in the public sector, analyzing lessons learned, sharing experiences, conducting market research in a structured manner before starting a procurement, enhancing communication through different forums and layers, establishing clear requirements and scope for projects, plan enough time and accept the contestation risk. Also, the PPP financial model must be acceptable and beneficial to both parties, partners must be carefully chosen and both sectors should rely on its competences and strengths. If several parties/institutions are involved in a project from one sector, there should be one principally responsible institution so that the responsibility between different parties does not get blurred. Open communication, respect between the parties, suitable management of the parties and working towards a common goal are important.

To conclude, the master thesis addressed the main research question as well as sub-questions in full. The thesis offers a view on PPP from both theoretical and practical perspectives. PPP is a good approach to solve complex issues and to merge the competence, knowledge and experience of both sectors. However, achieving good cooperation between public and private sector institutions is a complex matter that requires structured governance, collaboration, communication and resources.

7.1 Limitations and future research

This paper discussed the public and private sector's cooperation in eID project management. There are also some limitations regarding this research. Firstly, procurement contracts are confidential, and cooperation is ongoing, so none of the interviewees were able to fully disclose all requirements related to these projects. Also, these partnerships are still in place and interviewees may not have been able to comment on all aspects of cooperation, as this would have impacted their work. Moreover, two case studies are still limited to make conclusive decisions and interpretation, so more IT-projects could be analyzed to get a comprehensive overview on this topic.

This thesis focuses on cooperation between the public sector and the private sector. As a future work, more research could be done by analyzing cooperation between different public sector authorities because in the case of large-scale projects, there is not only one public sector authority involved on the state's side but several. Cooperation between public sector institutions was addressed in this thesis as well but future research could go further and focus solely on this as this research shed light to many existing problems in this field.

Moreover, it is also important to set a framework for procurements and partnerships inside the public sector. Guidelines for carrying out these projects and rules of procedures in an authority would be a prerequisite for successful cooperation with outside partners. Therefore, it is also important to establish a framework within the institution so that each institution can effectively fulfill its role in cooperation models. Future research could focus on creating PPP frameworks for public sector institutions.

References

Aerts, G., Grage, T., Dooms, M., & Haezendonck, E. (2014). Public-Private Partnerships for the Provision of Port Infrastructure: An Explorative Multi-Actor Perspective on Critical Success Factors. *The Asian Journal of Shipping and Logistics, 30*(3), 273-298.

Alexandersson, G., & Hultén, S. (2009). Prospects and Pitfalls of Public-Private Partnerships in the Transportation Sector. Theoretical Issues and Empirical Experience. *International Journal of Transport Economics*, *36*(1), 97-119.

Al-Homeadan, A.M. (2004). Privatization in Saudi Arabia: Is it time to introduce it into the public sector? *Journal of American Academy of Business Cambridge: Hollywood. 4*:1/2, 109.

Altnurme, R. (2002). *Avalike teenuste lepinguline delegeerimine kolmandale sektorile*. Tallinn: Tänapäev.

Bovaird, T. (2004). Public–Private Partnerships: From Contested Concepts to Prevalent Practice. *International Review of Administrative Sciences - INT REV ADM SCI*. 70, 199-215.

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA Handbook of Research Methods in Psychology, Vol. 2: Research Designs: Quantitative, Qualitative, Neuropsychological, and Biological*, 57-71. Washington DC: American Psychological Association.

Carbonara, N., Costantino, N., & Pellegrino, R. (2013). A Three-Layers Theoretical Framework for Analyzing Public Private Partnerships: The Italian Case.

Organisation, Technology and Management in Construction: An International Journal, *6*(2), 799-810.

Das, S.C., & Nandy, M. (2008). Public Private Partnership: An Emerging Issue. *The ICFAI Journal of Infrastructure*, *6*(1), 18-23.

Delmon, J. (2015). *Creating a Framework for Public-Private Partnership Programs: A Practical Guide for Decision-makers*. World Bank, Washington, DC.

Domberger, S., Farago, S., & Fernandez, P. (1995). *Public Management - Public and Private Sector Partnering: A Re-Appraisal*. Sydney, N.S.W.: Graduate School of Business, University of Sydney.

E-Estonia. (2023, March 15). *E-Identity.* https://e-estonia.com/solutions/e-identity/id-card/

ERR. (2023, February 16). *Selverites ID-kaardi väljastamise prohmaka süüdlane pole veel selge*. https://www.err.ee/1608887450/selverites-id-kaardi-valjastamise-prohmaka-suudlane-pole-veel-selge

Grahovac, B. (2004). *East and West European Public-Private Partnerships. Public Companies in Restructuring and Privatization*. New York: Nova Publishers.

Greve, C., & Hodge, G. (2005). *The Challenge of Public - Private Partnerships*. Cheltenham: Edward Elgar Publishing.

Id.ee. (2023a, March 12). *Mobile-ID: digital identity document on smart phone*. https://www.id.ee/en/article/mobile-id-digital-identity-document-on-smart-phone/

Id.ee. (2023b, March 12). *Applying and activating Mobile-ID.* https://www.id.ee/en/article/applying-and-activating-mobile-id/

Information Systems Authority. (2023, March 13). *PPA vahetab välja Selverites väljastatud ID-kaardid*. https://www.ria.ee/uudised/ppa-vahetab-valja-selverites-valjastatud-id-kaardid

Jeffares, S., Sullivan, H., & Bovaird, T. (2013). Beyond the Contract. The Challenge of Evaluating the Performance(s) of Public-Private Partnerships. In Greve, C., Hodge, G.A. (Eds.), *Rethinking Public-Private Partnerships: Strategies for Turbulent Times*. Abingdon, UK: Routledge, 166-187.

Jensen, P.H., & Stonecash, R.E. (2004). The Efficiency of Public Sector Outsourcing Contracts: A Literature Review. *Melbourne Institute Working Paper No. 29/04*, 1-32.

Hammerschmid, G., & Ysa, T. (2010). Empirical PPP Experiences in Europe – National Variations of a Global Concept. In: Hodge, G.A., Greve, C. & Boardman, A.E. (Eds.), *International Handbook on Public-Private Partnerships*. Cheltenham: Edward Elgar Publishing, 333-353.

Huxman, C., & Hibbert, P. (2009). Hit or Myth? Stories of Collaborative Success. In O'Flynn, J. & Wanna, J. (Eds.), *Collaborative Governance*. Canberra: ANU Press.

Krtalić, S., & Kelebuda, M. (2010). *The Role of the Public-Private Partnership in Providing of Public Goods: Possibilities and Constraints*. 5th International Conference of the School of Economics and Business, Sarajevo.

Lips S., Tsap V., Bharosa N., Krimmer R., Tammet T., & Draheim D. (2023). Management of National eID Infrastructure as a State-Critical Asset and Public-private Partnership: Learning from the Case of Estonia. *Information Systems Frontiers*.

Lu, W., Zhang, L., & Zhang, L. (2016). Effect of contract completeness on contractors' opportunistic behavior and the moderating role of interdependence. *Journal Construction Engineering Management*, *142*(6).

Mander, S. (2012). *Avaliku ja erasektori koostöö.* Tallinna Ülikool.

Medaglia R., Hedman J., & Eaton B. (2017). It takes two to tango: Power dependence in the governance of public-private e-government infrastructures. In: *Proceedings of ICIS'2017 – 38th International Conference on Information Systems: Transforming Society with Digital Innovation.*

Ministry of Economic Affairs and Communications. (2023, April 10). *Registreeri end mRiigi testijaks.* https://www.mkm.ee/digiriik-ja-uhenduvus/digiteenused/registreeri-end-mriigi-testijaks

Mobile-ID. (2023, March 16). *Mis on Mobiil-ID?* https://web.archive.org/web/20110822081948/http://mobiil.id.ee/mis-on-mobiil-id/

Mulyani, S. (2021). Critical success factors in public-private partnership. *Journal of Accounting Auditing and Business, 4*(1), 81–86.

Murumägi, M., Sahk M., & Almann, A. (2010). Public and Private Sector Cooperation in Estonia: Background and Perspectives. *EBS Review, 27,* 87-103.

Mwesigwa R., Bagire V., Ntayi J. M., & Munene J. C. (2020). Contract completeness as a foundation to relationship building among stakeholders in public private partnership projects. *International Journal of Public Administration, 43*(10), 890–899.

Nemberg, M. (2022). *Tarkvaraarenduse riigihangete parimad praktikad*. ITL.

Osei-Kyei, R., & Chan, A. P. C. (2015). Review of studies on the critical success factors for public–private partnership (PPP) projects from 1990 to 2013. *International Journal of Project Management, 33*(6), 1335–1346.

Paide, K., Pappel, I., Vainsalu, H., & Draheim, D. (2018). On the Systematic Exploitation of the Estonian Data Exchange Layer X-Road for Strengthening Public-Private Partnerships. *ICEGOV '18: Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance,* 34-41.

Parsovs, A. (2020). Solving the Estonian ID Card Crisis: The Legal Issues. In: *ISCRAM 2020 Conference Proceedings - 17th International Conference on Information Systems for Crisis Response and Management*. Blacksburg, Virginia (USA), 459–471.

Parv, O. (2016). *Avaliku ja erasektori koostöö võimalikkus riigimaantee E263 Tallinn-Tartu-Võru-Luhamaa Kose-Mäo lõigu ehitamise näitel*. Bachelor thesis: Tallinna Tehnikaülikool.

Peda, P. (2012). *The relationship between governance and performance in water services provision in Estonian municipalities*. Doctoral thesis: Tartu Ülikool.

PBGB. (2023, March 12). *Mobile-ID.* https://www.politsei.ee/en/instructions/mobile-id

Rajasekar, S., Philominathan, P., & Chinnathambi, V. (2013). *Research Methodology.* University of Cornell.

Regulation no. 28 (2011). Statute of the Estonian Information System Authority. Minister of Economic Affairs and Communications. https://www.riigiteataja.ee/akt/122022022003.

Regulation no. 323 (2002). Statute of the Ministry of Economic Affairs and Communications. Government of the Republic of Estonia. https://www.riigiteataja.ee/akt/123102021005.

Regulation no. 33 (2014). Statute of the Estonian Police and Border Guard Board. Minister of the Interior. https://www.riigiteataja.ee/ akt/115062022010.

Regulation no. 39 (2012). Statute of the Ministry of the Interior. Government of the Republic of Estonia. https://www.riigiteataja. ee/akt/123032022009.

Regulation no. 8 (2020). Statute of the IT and Development Centre of the Ministry of the Interior of Estonia. Minister of the Interior. https://www.riigiteataja.ee/akt/130102020029.

Riigikontroll. (2012). *Avaliku ja erasektori koostöö kohalikes omavalitsustes*. https://www.riigikontroll.ee/tabid/215/Audit/2235/WorkerTab/Audit/WorkerId/66/language/et-EE/Default.aspx

Rockart, J. (1982). The Changing Role of the Information Systems Executive: A Critical Success Factors Perspective. *Sloan Management Review*, *24*(1), 3-13.

Roehrich, J., Barlow, J., & Wright, S. (2013). Delivering European Healthcare Infrastructure Through Public-Private Partnerships: The Theory and Practice of Contracting and Bundling. In Das, T.K. (Ed.), *Managing Public-Private Strategic Alliances.* Cambridge: MIT Press.

Sannik, R. (2013). *Avaliku ja erasektori partnerluse alused EL riigihankeõiguse paradigmas.* Master Thesis: Tartu Ülikool.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). In Pearson Education, UK.

Sehgal, R., & Dubey, A. M. (2019). Identification of critical success factors for public–private partnership projects. *Journal of Public Affairs, 19*(4), e1956.

SK ID Solutions. (2023, March 12). *History.* https://www.skidsolutions.eu/ettevottest/ajalugu/aasta-2007/

Smart-ID. (2023, April 09). *Main page.* https://www.smart-id.com

Teddlie, C., & Yu, F. (2007). Mixed Methods Sampling a Typology with Examples. *Journal of Mixed Methods Research, 1*(1), 77-100.

Teisman, G.R., & Klijn, E.H. (2002). Partnership Arrangements. Governmental Rhetoric or Governance Scheme? *Public Administration Review*, *62*(2), 197-205.

Tunčikiene, Ž., Grenčikova, A., & Skačkauskiene, I. (2014). Development of Public-Private Partnership: Managerial Aspects. *Business: Theory and Practice*, *15*(1), 11-21.

Turina, N., & Car-Pušić, D. (2006). *Overview of PPP Models and the Analysis of the Opportunities for Their Application*, 7th International Conference: Organization, Technology and Management in Construction, Zagreb.

Van Ham, H., & Koppenjan, J. (2001). Building Public-Private Partnerships: Assessing and Managing Risks in Port Development. *Public Management Review*, *3*(4), 593-616.

World Bank. (2023, April 22). *What are PPPs?* https://ppp.worldbank.org/public-private-partnership/about-us/about-public-private-partnerships

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods*. 6th ed. Thousand Oaks, CA: Sage.

Appendix 1 – Interview Guideline

The interviews were conducted in a semi-structured format which helped to discover new information and added value to the case studies. The following questions were considered as a guideline for conducting interviews:

1. **How was the eID project (Mobile ID/Smart ID/ID card) carried out in Estonia?**

Preparation phase:
- In which e-ID projects have you participated in?
- How was the need for the project defined?
- Why was it decided to use PPP partnership within the project?
- What obstacles appeared during the project preparation phase?
- Was a market analysis performed before the procurement process?
- Was there any outside support for the implementation of the PPP project?
- Which legislation/legal framework had to be considered?
- How did the partner selection process take place? How was the decision reached?

Contract phase:
- Who were the partners/parties?
- How were the details of the contract negotiated? What were the difficult moments?
- Was a risk assessment carried out? What risks were mapped?
- How were the risks distributed between the parties?
- How was the project financed?
- How were tasks and responsibilities divided between the public sector and the private sector?

2. **What are the success factors of the PPP framework for this project? What were the obstacles and challenges?**

Project progress:
- Were there any obstacles that slowed down the implementation of the project (both in cooperation and within the institution/private company)?
- Was there any risk overlooked in the preparation phase that could have materialized or even materialized?
- How do you evaluate the communication between the parties during the implementation of the project? What were the pros and cons of the partnership (resources, understanding of goals, commitment, cooperation culture and trust, reporting, communication and development, clear definition of risks)?

Evaluation of results:
- Did the outcome correspond to the conditions established in the preparation phase of the project?
- What were the benefits for both parties? Were there any losses?
- What were the strengths and weaknesses of public sector and private sector cooperation in this project?
- Were the metrics for evaluating the success of the project established?
- Are there lessons learned from this project to consider next time?
- What benefits did this form of partnership bring to the state and the private sector?

3. In general, what is the evaluation of the PPP form of cooperation and the recommendations for the future?

Opinion/assessment of public-private partnership:
- Is it practical to implement PPP projects? What are the pros and cons?
- What are the recommendations for the implementation of PPP projects?
- Is it difficult to create partnerships and why?
- How would it be possible to encourage/promote the partnership between the public sector and the private sector?
- Are there any other thoughts-suggestions to add?

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