TALLINN UNIVERSITY OF TECHNOLOGY

Faculty of Social Sciences

Ragnar Nurkse School of Innovation and Governance

Annika Tammik

THE POSSIBILITY OF AGILE DEVELOPMENT IN THE PUBLIC SECTOR: THE CASE OF ESTONIA

Batchelor thesis

Supervisor: Piret Tõnurist, PhD

Tallinn 2016

I hereby declare that I am the sole author

of this bachelor's thesis and it has not been

presented to any other university for examination.

Author Annika Tammik

…………(date) 2016

The bachelor's thesis meets the established requirements

Supervisor Piret Tõnurist

………. (date) 2016

Accepted for examination ………. (date) 2016

Board of examiners of public administration bachelor's theses

Dr. Margit Kirs

SUMMARY

Public procurement of innovation (PPI) is seen as one of the most potential ways for the public sector to spur on innovation and through that – economic growth. An important part of PPI is the procurement of IT services. The problem with the latter is that they tend to fail: developed IT-systems do not fulfil the expectations of the procurers, are often not finished in time or are over budget. Usually the rigidity of the development systems – difficulties in changing project requirements, lack of communication etc. – is blamed. These deficiencies are linked to the 'waterfall model' (plan-driven, predefined requirements based software development model) also used in the public sector. In 2001, agile development principles were put together and since then agile development has been seen as a solution to the fast changing requirements of software projects in the private sector. The aim of this thesis is to understand if this flexible form of development can also be used in the public sector context. The case of Estonia is used to explore the issue. The empirical findings mainly rely on interviews with software development companies in Estonia who have experience with both public and private sector IT development projects.

Keywords: agile development, information technology, waterfall model, public procurement, Estonia

TABLE OF CONTENTS

INTRODUCTION

Leading countries today try to create conditions which would generate growth that ensures adequate standard of living for their citizens (Mazzucato 2013, 21-22). When talking about growth we cannot go pass competitiveness and when talking about competitiveness we cannot go pass innovativeness (Detelj et al. 2015, 21). In the world of changing conditions and growing expectations innovation in the keyword for success, both in public and in private sector (Freeman 2002).

There are many ways in which public sectors can support innovation. Previously supply-side policy instruments (research and development (R&D) subsidies, tax credits etc.) dominated in the innovation policies, but during the last decade this approach has been slowly changing (Edler 2007, 949). Now more and more focus is put on incorporating also demand-side measures – in essence government demand for innovative products and services (Lember et al. 2010, 1377). Among the former, public procurement is one of the most large-scale and influential measures. In 2014 on average 18% of the GDP was spent on public procurements in each EU country (European Commission 2015) which all together means 2.5 trillion euros spent on procurements.[1] More and more emphasis is put on public procurement to become a tool of driving and spurring on innovation (Lember et al. 2015, 403). At the same time, public procurement of innovation (PPI) is not easy, especially when implemented in the context of standard, formal tender procedures.

A special part of public procurement of innovation is procurement of IT services as IT outsourcing is very common both in the private and public sector (e.g., Miozzo, Grimshaw 2005). There are, however, several problems connected to this area. IT procurements quite often tend to fail; and not in the sense that no one is willing to participate in the procurement tenders, but because the product

---

[1] EU GDP in 2014 was 13,9 trillion euros (http://europa.eu/about-eu/facts-figures/economy/)

delivered does not fulfil the expectations, is not on time or is over budget (Balter 2011, 153; Fernandes et al. 2016, 313). The principles of agile development – mainly in the context of the private sector – have been proposed as a solution for the aforementioned. However, in public sector projects they are still rarely used (ibid.). Consequently, the **aim of this paper is to look into the reasons why agile development, which in the private sector has become a normative standard** (Olsson, Bosch 2014, 327; Moniruzzaman, Hossain 2013, 14; Lee, Xia 2010, 87**), is hardly ever used in the context of the public sector**. In more detail, the paper will focus on the possible barriers in the Estonian public sector in using this more flexible form of IT development. The case of Estonia was chosen due to the country's broad-scale image as a forerunner in public sector IT developments (e.g., Charles 2009). The aim of the analysis is to identify the possibilities and barriers of agile development in the public sector context.

The theoretical part of this paper is divided into two chapters. The first one explains the essence of innovation in public sector, talks about the development of innovation policies and also focuses on what should become the major innovation driver for the public sector – public procurement. The second chapter sheds some light onto software development and the two main approaches used there – the waterfall model and agile development – outlining the potential of agile development. The third chapter of this paper provides an introduction to the public procurement system in Estonia with an emphasis on the IT procurements and PPI. The final, empirical, part of the paper analyses the differences of public and private sector IT developments in Estonia relying on the experience of larger, local software firms doing projects for both private sector companies and public sector organisations. Also Ministry of Economics and Communication, the main coordinator of both IT and demand-side innovation measures, was interviewed. Qualitative research techniques are used with document analysis and semi-structured interviews used as the main vehicles of data collection.

The thesis exceeds the normal length of a Bachelor's thesis due to the novelty and complexity of the topic.

1. PUBLIC SECTOR INNOVATION

The rapid development of information technology started one of the biggest economic growth periods in America. Since then the concept of innovation as a driver of economic growth has been widely acknowledged and focused on by both scholars and the managers, but initially mainly in the private sector (Borins 2001, 8).[2] So, when in the private sector we can say that innovation is already an established field, then in the public sector the scholars and practitioners have just recently become increasingly interested in it (De Vries et al. 2015, 146). Hence, during the last decade many studies on public sector innovation have emerged (e.g., Borins 2002; Lægreid et al. 2011; Arundel, Huber 2013).

When innovation in public sector is talked about the definition of innovation is mostly based on the work of Rogers who defined it as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers 2003 through De Vries et al. 2015, 152). This means that there are two important factors involved: firstly, the innovation must be implemented by using an idea, practice or object of the innovation, and secondly, the innovation must be subjectively novel for the organisation implementing it (Daglio et al. 2015, 4). This definition is primarily used because it is difficult to apply the truly Schumpeterian definition of innovation – focusing on market competition – in the public sector context as public sector organisations do not generally compete with each other for market share (Potts, Kastelle 2010, 123).

---

[2] For a while there was an understanding that the government should only have a supporting role in the innovation process. Despite the fact that the public sector has played a very important part in the development of world-changing innovations like the Web, the GPS etc., it was seen as the enemy not as a potential investor or an initiator of innovation (Mazzucato 2013, 26-27).

New Public Management increased pressure to innovate in the public sector by applying performance targets, creating internal markets and increasing the independence of agencies and senior management (Arundel, Huber 2013, 147; see also Lægreid et al. 2011). The main driver of innovation in these conditions has been the need to be more effective and efficient (De Vries et al. 2015, 154), nowadays this is not enough anymore. More and more focus has to also be put on the 'personalization' and reachability of the public services (Albury 2005, 51). Furthermore, the social and environmental challenges keep getting more complex and next to the local problems, the public sector is also influenced by global challenges (Edquist 2015, 4). Introduction of innovative solutions is the only way to sustain competitiveness in the changing global economy for the public sector (Rolfstam 2015, 1).

However, public sector is still perceived to be a rather non-innovative due to high levels of risk aversion and negative attitude towards change (Mulgan, Albury 2003; Potts, Kastelle 2010; Osborne, Brown 2011). This attitude gets magnified as usually public scrutiny focuses on innovation failures in the public sector rather than successes (e.g., Windrum 2008). While innovations can fail due to a number of reasons – technology uncertainty, reaction by users or lack of resources/capabilities for developing/implementing innovations (e.g., Pärna, von Tunzelmann 2007) – there is a high need for accountability in the public sector (Rainey 2003) relying on strict legal frameworks that standardize operations. Thus, bureaucratic organizational structures and process protocols influence change in the public sector; (e.g., Isett et al. 2012). Consequently, risk-averse public organisations can prevent experimentation.

Thus, there are many factors that influence both innovation culture and activities in the public sector: for example, structural-instrumental (managerial autonomy, result control, budget size), cultural-institutional (agency age, organizational performance culture, individual incentives), task-related (service delivery as the primary task, source of income, external factors (citizen/business demand)) and environmental-institutional factors (political-administrative regime; type of governance) (Lægreid et al. 2011, 1325). Also, the motivation behind innovating is very different in the public and private sector. For companies in the private sector innovation gives a competitive advantage and through that supports revenue growth. In the public sector there is no paramount reason for innovation – objectives differ and compete, while often needing the same resources to succeed.

While in the private sector personal gain is often driving people to innovate, in the public sector altruism also plays an important role (Daglio et al. 2015, 4).

1.1 Innovation policies: towards demand side measures

There are different ways how public policies can support innovation and these are typically divided into two groups (Appendix 1) – the supply side policy instruments and the demand side policy instruments (Aschhoff, Sofka 2009, 1236).[3] Often a combination of instruments – "instrument mix" – is used to meet the objectives (Edquist 2015, 4-5). In the past the innovation policies have strongly focused on the supply-side measures and the demand-side innovation policies have gotten much less attention (Lember et al. 2010, 1377). Lately the focus has shifted and the demand side policies are seen as the way forward – at least in the innovation research (Edquist 2015, 4). In practice, countries still struggle with implementing demand-orientation in their innovation policies (Edler 2009, 25).

Public procurement is a demand-side instrument, which occurs when public sector acquires goods and services from external suppliers (Aschhoff, Sofka 2009, 1236). Public procurements can be in the big picture divided into two subtypes: regular public procurement and public procurement of innovation.[4] Regular public procurement is used to purchase ready-made products that do not involve any innovation (e.g. furniture and office supplies) (Uyarra, Flanagan 2010, 127). PPI – before also known as public technology procurement – is used to procure new technologies and innovative products/services which often do not exist at the time of the order (Aschhoff, Sofka 2009, 1236). Nevertheless, procurement of innovation can be considered as an innovation only if the item procured will actually be commercialized or used in the economy/society (Edquist 2015, 5-10).

---

[3] The supply side instruments are related to supporting the innovation with R&D subsidies, education, competence, communication and cooperation. The demand side instruments on the other hand are related to influencing the development and diffusion of innovation with measures like laws, regulations, standards etc. (Edquist, Hommen 2000, 20).

[4] Edquist (2015) also adds innovation-friendly regular procurements and pre-commercial procurement to the division but in the current context the more detailed division does not add extra value.

In the last decade public procurement of innovation (PPI) has gained more and more attention from policy makers (Lember et al. 2013, 2-3). Especially in EU where it is defined as the central tool to boost innovation (Rolfstam 2015, 1). Nevertheless, due to the fact that public sector is very risk averse and has often a negative attitude towards change, combined with the inflexible legal conditions, PPI is unfortunately not yet flourishing (Lember et al. 2015, 403-404).

Edler et al. (2015, 54-57) have defined a list of barriers, which prevent suppliers to propose innovative solutions to tenders (Appendix 2). The barriers can be grouped into four main problem areas. The most important barrier for the suppliers was the focus on price over quality in the award criteria. Second group of problems relates to the discouraging tender specifications which are oriented on the predefined solution, not on the problem that needs solving.[5] The third bigger problem area is length and size of the contracts. There are pros and cons for both large/long and small/short contracts. Larger and longer contracts give companies more incentive to invest in development, but they also involve more risk (lock-in) and create a capacity issue for small and innovative companies and potential problems with lock-in to the procurer. Lastly, Edler et al. (ibid.) also brought out the general lack of demand for innovation and the inadequate management of intellectual property rights but compared to the other barriers mentioned above they were seen as minor problems.

The process of PPI depends on two important decisions which have to be made before the actual call for tender is announced and that based on the barriers listed above may determine the success or failure of the procurement. Firstly, a suitable public procurement type must be selected and secondly, the choice of a suitable award criterion must be made (Appendix 3) (Detelj et al. 2015, 25). EU legislation (e.g., EU 2016) defines five different public procurement types (Appendix 4), but most of them are not suitable for PPI. Open procurement, restricted procurement and electronic auction, which are all based on precise pre-defined specifications, are more suitable and should be used for regular procurement (Detelj et al. 2015, 26). Negotiated procurement, which allows the public organisation to select suitable businesses for contract negotiations, can only be used for certain cases and depending on the scenario may or may not be applicable for PPI. This leaves

---

[5] This problem is strongly linked with other barriers mentioned like the lack of interaction with the procuring body, high risk aversion, poor risk management ability and generally low capabilities of public procurers (especially if market or technical knowledge is required) (Edler et al. 2015, 54-57).

competitive dialog, which is the most innovation friendly procurement type. It allows the public organization that knows the desired outcome, but does not know how to make it happen – which often is the case for PPI as the public organisation is ordering something that they have no experience in / is novel not them – to discuss the possible solutions with capable suppliers and with their help put together the final tender requirements (ibid.).

There are two award criterion that can be used for asserting the public procurements in EU (European Union 2016). Lowest price and combination of criteria with different weights (e.g., price, technical characteristics, environmental aspects etc.) – also known as the most economically advanced tender (MEAT) (Detelj et al. 2015, 26). The easiest choice for an award criterion is obviously lowest price as it is very straightforward. But as also mentioned before, this choice is also the biggest barrier to innovation because it only asserts the quantitative part of the tender and leaves out the qualitative side, ruling out innovativeness. MEAT, on the other hand, gives all imaginable combinations for selecting the best offer, as long as the criteria are clear and measurable. On the other hand, MEAT also requires more resource, knowledge and skills from the public organisation – which, as mentioned above, could also be a barrier – and from the tenders due to the complexity of the measurements (ibid.).

Thus, when choosing the correct procurement type and award criteria, a lot of the barriers can be overcome. With the presumption of course that the skills and knowledge of the public sector will not stand in the way. Both competitive dialogue and MEAT are meant to promote innovation but as they are not as straightforward as open procurement and lowest price criteria then their usage requires skills, knowledge and even – courage.

2. SOFTWARE PROCUREMENT

In the context of new social and environmental challenges (Edquist 2015, 4; Lee, Xia 2010, 87), growing user expectations (Albury 2005, 51) and constantly changing technology environment (Lee, Xia 2010, 87) the old and slow forms of software development are lacking behind (Wrubel, Gross 2015, 1). Innovation and change are becoming a new normality so the mentality of learning in action must be embraced (Meijer 2016, 5). Nevertheless, a recent study in the U.S. showed that only 9% of ICT projects were delivered on budget, while the majority were over budget and also failed to be on time (Fernandes et al. 2016, 313). Furthermore, 45% of all software features of these projects do not meet the actual needs of the users (Lee, Xia 2010, 88).

To overcome the challenges of constant change in user expectations, market needs etc. (Olsson, Bosch 2014, 327), agile software development methodologies were introduced in 2001 (Beck et al. 2001) and have fast become a mainstream development approach (Lee, Xia 2010, 87). They are being used by many private sector companies like IBM, Oracle, HP, etc. (Moniruzzaman, Hossain 2013, 14). In the public sector on the other hand the agile methodologies are just now starting to spread (Wrubel, Gross 2015, 1; Fernandes et al. 2016, 312).

2.1 Waterfall vs agile development

In case of public sector software projects the waterfall-type models are mainly used (Balter 2011, 153), as the regular form of the procurement process strongly supports the plan-driven all-requirements-first approach (Wrubel, Gross 2015, 7). The waterfall model is all about up-front planning (Meso, Jain 2006, 20). In this model, the development process is divided into 5 sequential steps: requirements definition, application design, application development, testing and deployment (Appendix 5, Figure 1). Each step is dependent on the completion of the previous step and there is

no possibility for any feedback or change in requirements (Wrubel, Gross 2015, 7). All the involved roles, activities to be done and pieces to be produced are pre-defined (Meso, Jain 2006, 20).

As mentioned above, in 2001 as a reaction to the inflexibility of the plan-based methods the 4 core values and 12 principles (see Appendix 6) of agile development were defined (Lee, Xia 2010). This created a new software development philosophy and an umbrella term – agile development – for those shared values (Wrubel, Gross 2015, 4). In principle, agile development consists of many short waterfall development cycles, which are known as iterations (Appendix 5, Figure 2) (Balter 2011, 153). In agile development only the high-level vision of the desired product is defined up-front (Wrubel, Gross 2015, 8); the emphasis is put on lean processes and dynamic adaption of change (Lee, Xia 2010, 88). In other words, at the end of each iteration the scope and priorities for the next one are agreed upon (Wrubel, Gross 2015, 8). The focus of each iteration is always on business value and the aim is to add only usable functionality to the IT system (Meso, Jain 2006, 20). It allows the customer/procurer to review the system in a more incremental way and make necessary adjustments on the way (Wrubel, Gross 2015, 10).

2.2 Advantages and challenges of agile development

Agile methods are believed to be more successful due to their adaptiveness (Moniruzzaman, Hossain 2013, 14). Users can start testing the system already from a very early stage of the project, which means that it is possible to "fail fast" and make necessary adjustments if the initial ideas do not work as planned (Wrubel, Gross 2015, 11). A survey from 2011 showed that the three main reasons for using agile development were the time to market, productivity and possibility to change requirements (Moniruzzaman, Hossain 2013, 15).

Thus, using agile methods could help the public sector reduce risk, improve quality and deliver systems, which are actually needed (Wrubel, Gross 2015, 45). And by doing all that they would also save money (Lee, Xia 2010, 90) as the previously mentioned 45% of unused features can never be developed and the changed requirements can be taken into account while developing (Moniruzzaman, Hossain 2013, 13).

Even though agile methods have clear advantages, they also bring new challenges (Zijdemans, Stettina 2014, 78). The first and most important factor to make agile development work is the mind-shift change, which is required from anyone involved, including the procuring organisation itself, which has to adjust its culture and the behaviour to support agile techniques (Wrubel, Gross 2015, 1). The skills and attitude of the people involved is critical for the project's success (Lee, Xia 2010, 90). At the same time, customer involvement can also not be underestimated (Zijdemans, Stettina 2014, 88). It is not possible to succeed in an agile project without a constant input from the customer (Wrubel, Gross 2015, 30).

2.3 Procurement for agile development

Procurement and the following contracts are definitely also some of the domains needing a change when there is a wish to shift to agile development. The procurer has to start tendering for something that is not clearly defined, while the following contract needs to define the practice to use, the standards of governance and communication etc. (Zijdemans, Stettina 2014, 78). If the procurement is based on a detailed specification then already the waterfall development is encouraged (Balter 2011, 6). Compared to waterfall development agile projects have different definition of milestones, different understanding of required documentation, different delivery process and different idea of collaboration (Appendix 7) – the contract has to reflect all of that (Wrubel, Gross 2015, ix).

The Agile Manifesto states that customer collaboration should be valued over contract negotiations, even though both are important (Beck et al. 2001). This means that the contract should, on the one hand, protect both parties and state the desired outcome; but on the other hand, also leave room and flexibility to adapt and prioritize the requirements within the agreed scope as needed (Wrubel, Gross 2015, 14). The negotiations are especially important if the parties do not have previous collaboration experience or if the procuring party has no previous experience with agile development. The negotiations build trust which is very important for the future cooperation and gives a possibility to define the essential needs for the collaboration (Zijdemans, Stettina 2014, 78). As also mentioned before, agile development does not work without the constant input and feedback from the customer.

Thus, it is suggested to document the customer's commitment to provide an authorized user representative who would work side-by-side with the development team and would be authorized to make the decisions about priorities within the project scope (Wrubel, Gross 2015, 30; Zijdemans, Stettina 2014, 90-91). This, however, requires quite a lot of resources in the development phase and a different type of approach to public procurement process that may not be currently feasible in the in the public sector context.

Next to the object of the contract (detailed specification versus a vision of the result) the method of payment chosen for the contract is equally relevant when contracting agile. It is important to understand the different impacts of those two contract types – 'fixed price contract' and 'time & material contract'. Fixed price contract has been a standard way for procuring waterfall projects and there are several arguments why not to use it if you want to have an agile project (Vashishtha et al. 2014, 3-4). Fixed price contract means that all three elements of the "Project Management Triangle" (ibid.) – time, cost and scope – are fixed in the procurement process (Cauwenberghe 2005, 6). The time and scope is defined by the procurer and a commitment with the cost statement is made by the supplier (Book et al. 2012, 194). As the actual effort needed to fulfil the scope is always unforeseeable then this method leaves the whole risk of the project to the supplier (Book et al. 2012, 194) which is not the best starting point for cooperation and makes the project very expensive. Even though the procurer does not seem to bare any risks then the fixed price contract is still unreasonably extensive for the procurer (due to the risk coming from the uncertainty of the scope) and has a fixed scope which cannot be changed[6] (Eckfeldt et al. 2005, 161). Thus, due to the fixed scope, waterfall method is favoured. The time & material contracts, on the other hand, are perfect for agile development as all the payments are based on the actual work done (Book et al. 2012, 194) which means that the scope is not fixed and can be changed at any point of the way (Vashishtha et al. 2014, 3). Though, with this contract the project risk lies fully on the procurer who thus has to be able to keep the focus and control of the project (Book et al. 2012, 194). There are obviously other variations of contracts that could be used (for example cost-type contracts) but at the end of the day,

---

[6] The "Project Management Triangle" states that if one side of the triangle changes, it also changes the other sides. This means that it is not possible to change the scope without also changing the cost or the time (Vashishtha et al. 2014, 4).

as illustrated above, the compatibility of the contract type depends on whether the scope is fixed or not (McNally 2014, 5). These issues will be elaborated through the case of Estonia below.

3. ESTONIAN PPI AND IT DEVELOPMENT CONTEXT

After regaining independence in 1991 Estonia had to build up the whole economy – including the public procurement system – basically from scratch (Lember, Vaske 2009, 410). As a reaction to the Soviet state-controlled system the reforms focused on liberalisation (Lember, Kalvet 2014, 128) so during the last two decades the focus of the Estonian economic policy has been on transparency and openness. All theoretical policy side-goals like social and economic development have been seen as a step towards discrimination and a danger to the free economy (Lember, Kalvet 2012). Nevertheless, the Estonian innovation policy has undergone some significant changes through the influence of the EU (Lember, Kalvet 2014, 129-130). This transition has in recent years, resulted in the incorporation of demand-side policies into the innovation policy-mix, however, in reality policy-making continues to be heavily unbalanced towards supply-side instruments (Romanainen et al. 2014, 12; Lember et al. 2013, 17).

The Estonian public procurement policy has similarly to the general approach in the economy been focused on transparency, openness and equality (Lember, Vaske 2009, 413) instead on focusing on the creation of demand. Lember and Vaske (2009, 411-412) describe the evolution of the public procurement system in Estonia from a chaotic system in the beginning of 1990ies to the adoption of various revisions of public procurement acts after 2000. The first Estonian Public Procurement Act focused strongly on transparency and non-discrimination, while leaving a lot of freedom to procurers themselves (thus, supporting PPI also in the context of IT developments (Lember, Kalvet 2014, 141)); the following iterations of the Public Procurement Law (adopted 2000; amended 2003) restricted this flexibility; while the Public Procurement Act of 2007 adopted more flexible tools in EU directives aimed at PPI (e.g., competitive dialogue, functional specifications and also brought

"back" the framework agreement) (ibid.).[7] The Statistics in Table 1 from E-procurement Estonia shows that competitive dialogue has been used on 62 occasions in the IT procurements since 2006, while the most common procurement procedures is open procurement. Furthermore, competitive dialogue as an example of more flexible form of procurement has been used mostly by central government bodies or their agencies (municipal cases have been rather rare (Riigihangete register, 2016)).

Table 1. Procurement procedures for IT services* (2006-2016)

Procurement procedure	No of tenders	No of contracts	Cost	Contested
Total	3456	3519	224 085 515	92
Open procurement	876	1001	80 052 909	55
Negotiated procedure with prior publication of contract notice	159	134	24 069 694	16
Open design contest	11	23	10667	0
Simplified procurement	1740	1688	36 673 673	8
Services contracted for by simplified procedure	12	12	2 118 310	0
Restricted procurement	8	9	918 780	0
Negotiated procedure without prior publication of contract notice	588	590	63 663 349	1
Competitive dialogue	62	62	16 578 133	12

Source: Riigihangete register, accessed 18.05.2016. *CPV 72000000-5.

When it comes to IT development in the public sector, and e-government solutions in particular, most of these have been built using some forms of PPI (Lember, Kalvet 2014, 138). But as also mentioned before, PPI has never been an acknowledged policy measure, so, it has been mostly "accidental" (Lember et al. 2013, 17). IT-development has been led by visionary civil servants, long-term government support and high competency level of the local suppliers – in other words due to development-driven strategy instead of strategy-driven development, as would be expected (Lember, Kalvet 2014, 139). While the concept of PPI public policy making emerged on the EU

---

[7] EU has been a large influence on the procurement regulations in Estonia. Since 2004, when Estonia joined the EU, the relevant laws and institutions in Estonia are rather similar to the ones in other EU countries (Lember, Kalvet 2012). In the EU the legal framework for the procurement process is set on the union level in order to ensure equal possibilities for all suppliers (national and foreign) and all directives are mandatory for the member countries to implement (Wernham 2012, 260-261). Estonia is one of the few countries in the EU which has chosen to not have – expect in the field of environmental policy – sector-specific public procurement policies (Lember, Kalvet 2012).

level in the second half of the 2000s – defined now as the central tool for boosting innovation (Rolfstam 2015, 1) –, due to the generally weak position of the demand-side policy measures it did not really take off in Estonia (Lember, Kalvet 2014, 130). So, it was not until 2011 when the Ministry of Finance – the central policy-maker of public procurement in Estonia – actually started looking into PPI as a possible policy tool (ibid., 135). Subsequently, a new version of the Public Procurement Act will take effect in 2016 with a new procurement method – innovation partnership – and possibility to change 10% of the requirements of the contract and qualification norms,[8] also influencing software development in the Estonian public sector (Matteus 2015). In parallel, the Ministry of Economic Affairs and Communications has developed the ministerial decree act on the support conditions of innovation procurement.[9] In other words, Estonia is working on promoting innovation through public procurement, but the work continues to be resource- and EU-driven not as a part of a domestic governmental policy rationale (Lember et al. 2013, 16).

Even if legislature supports innovation procurement (Romanainen et al. 2014, 15) – it is hardly ever used (Lember, Kalvet 2014, 141). The main conditions currently limiting the usage of PPI in Estonia have been outlined in prior works:

1) Over-use of the open-procurement and price-dominance in the award criteria (Lember, Kalvet 2012) which leads to solution-orientation instead of problem-orientation and price orientation instead of overall cost orientation (Romanainen et al. 2014, 18)

2) Low level of skills (technical competence, knowledge of the market etc.), cooperation and limited possibilities/willingness to invest to the procurement (Lember, Kalvet 2012) incorporated with weak training system which focuses too much on the legal side and too little on the strategic and managerial side (Lember, Kalvet 2014, 136)

3) The system is decentralized. The central body responsible for the public procurement policy – the Ministry of Finance – is in charge of the policy creation, monitoring, advising and

---

[8] There are two important things, firstly, the documentation proving the qualification is only asked from the winning tenderer, secondly, a limit to the minimum turnover requirement was decreased to double of the expected payment of the tender. Both of those changes should make it much easier for SMEs to participate in the tenders. (Matteus 2015)

[9] Majandus- ja Kommunikatsiooniministeeriumi 12.02.2016 Ministri määruse eelnõu nr 16-0176 "Innovatsiooni edendavate hangete toetamise tingimused"

training. The actual implementation is up to the procuring organisations. The system lacks coordination and cooperation (ibid.).

4) Usage of the annual budgeting which does not support longer perspectives needed for innovation (Lember, Kalvet 2012).

5) The administrative culture is risk adverse (Romanainen et al. 2014, 18).

While agile development procedures have not been studied in the context of Estonia there have been some opinion stories touching on the topic.[10] In connection to PPI, there are also different initiatives that deal with introducing the principles behind agile. For example, the biggest public sector procurers and the biggest suppliers of software development service are trying to reach a common understanding by defining what a good procurement of IT services should be like.[11] Furthermore, there are different working groups in the Estonian Association of Information Technology and Telecommunications which work on topics like how to choose a form of the procurement, which requirements to use, how to set the award criteria, what should the contract look like etc. All those recommendations are strongly influenced by the principles of agile development.

All in all, it seems that – based on the discussion presented above – similar problems which stand in the way of PPI in Estonia also prevent the usage of agile methodologies in the public sector. Problems and their significance for PPI and agile development are compared in Table 2 below.

Table 2. Main problems of innovative public procurement and agile development

PROBLEM	Influence on PPI	Influence on Agile Development
Focus on price	Innovation is expensive, but it is aimed at value creation. Thus, there is usually a choice between price or innovativeness.	Would most probably lead to a fixed-price contract which is not a recommended contract type for agile development due to the fixed scope that will derive.

---

[10] Some examples: Alamäe, P. (2015) *Targa Tallimise kunst*. Reachable: http://majandus24.postimees.ee/3202721/priit-alamae-targa-tellimise-kunst, 15.05.2016; Tennisberg, T. (2013) *Kuidas tellida tarkvaraprojekti*. Reachable: http://www.targotennisberg.com/tarkvara/2013/01/22/kuidas-tellida-tarkvaraprojekti/, 15.05.2016.
[11] Avaliku sektoriga seotud IT praktikud (2016) Reachable: https://itpraktikud.eesti.ee/dokuwiki/, 15.05.2016.

Dominance of the open-procurement	Open-procurement means that the required solution has to be predefined in great detail leaving little room for innovation.	If the solution is predefined in such detail that the supplier is able predict the costs and time without discussions, then it signifies the waterfall methodology.
Lack of skills	When procurement skills are low, lowest price and open procurement are used – rules out possibility for innovation solutions.	Lack of skills means lowest price and open procurement which means waterfall methodology.
Lack of cooperation	Solution-oriented products are procured instead of problem-oriented products - rules out innovation.	Solution-orientation comes with detailed technical specifications about the solution that cannot be changed (to avoid discrimination) – rules out agile development.
Decentralised system	Very different level of skills, understandings and abilities among procurers – very different levels of partnering in PPI. Rooting the principles of PPI will be complicated and time consuming due to the number of different procurement organisations.	Very different level of skills, understandings and abilities among procurers meaning that in some cases usage of agile methodologies is possible and in other cases it is not. Rooting agile principles would be complicated and time consuming due to the number of different procurement organisations.
Risk aversion	Innovation is always risky as it creates something that has never existed before. The decision to start procuring for goals instead of solutions and prefer unknown to safe and familiar definitely needs a mid-shift.	Agile development helps public sector reduce risk as the procurer is always in charge of the priorities and can get fast feedback on the implemented functionality. Though, a decision to start practicing it is still somewhat of a leap into the dark and needs some courage.

Source: Author.

In the next section the thesis will analyse the possibility of agile development in the public sector from the perspective of IT developers with experience in both in the public and private sector.

4. AGILE DEVELOPMENT IN THE ESTONIAN PUBLIC SECTOR

4.1. Methodology

To get some insight on the innovative solutions and the usage of agile development in the context of IT developments in the public sector 8 semi-structured interviews were conducted with the main software development companies in Estonia. The list of companies was compiled using the Estonian Association of Information Technology and Telecommunications members and Internet searches to verify that the companies do participate in public procurement tenders. In total 11 companies were contacted out of which 8 joined the study. All the companies interviewed have projects in both – public and private sector – though, the division of those projects varied quite a lot from company to company. The list of interviewees and the questionnaire is provided in Appendices 8 and 9 respectively. To get the most open information from the interviewed experts the interviewees were anonymised and references to concrete interviews will be done using alphabetical coding (e.g., A, B, C etc.). In addition, Ministry of Finance, as the coordinator of the public procurement system in Estonia, was contacted for an interview; however, they felt they lacked practical knowledge within the topic to partake in the study.[12] Similar request was made to the Ministry of Economics and Communications (MKM), who initially refused to give an interview on similar grounds, but at the final stage of the study it was possible to meet the head of the Department of Information Systems and discuss the procurement process viewed from the procurer side.

---

[12] E-mail from the Ministry of Finance, May 16, 2015.

4.2 Findings

4.2.1 Differences between public and private sector IT development process

Overall, the results of the interviews show that generally IT companies do not see big sector specific differences between public and private sector customers. However, the specific organisations and people the companies work with vary considerably in their work style and flexibility. The result and success of the project always depends on the people involved in the project, the cooperation and the time invested. Those characteristics vary a lot between the different customers irrespective the sector:

> *"Our long-term partner is very competent and we have a really good cooperation with them, so, we got an illusion that everything in the public sector was so pretty and nice… And then came the next public sector customer with whom it was… all but easy and nice..."* *(Interviewee F).*

Nevertheless, there are still quite a lot of differences in the public sector projects coming from the bureaucracy and the public procurement process: *"Public sector contracts are not changed, they are fulfilled!* (Interviewee D).

The biggest actual difference – which is not directly related to the form of public procurement, but more to the mind-set and the general specifics of the public sector – is the reason why the systems are procured in the first place. Again, differences accrue between the organisations, but all in all the private sector systems are much more value- and need-based. In the public sector the drivers vary from an actual need, to requirements stated in laws (often not initiated by organisations themselves), to having to maybe even *"burn the money"* in the process of maximising budgets (getting as many grants as possible): *"I see the wasting of money day to day. For an enormous amount of money, a system is procured which… Well, is not something that brings value."* *(Interviewee C).* Another interviewee (H) stated about the specifics of public sector IT projects: *"If someone already starts producing a stack of requirements they go full on."*

At the same time, the overall quality of projects was said to not really differ between the public and the private sector. Though, a clause was made that obviously one has to understand that if the focus

is on the price then the result of the projects cannot be the best possible version of it. "*As the supplier has to tender the cheapest price then they also have to make compromises in the solutions, testing etc. – if they want to win it.*" (Interviewee D).

The topic of innovation was also discussed and there where quite different understandings about what is innovation: a few times mainly technical innovation was seen as the main way to innovate in software development (Interview C, F) and sometimes it was questioned if it was at all possible to offer innovative solutions in public procurements (Interview D, H). Two main things became evident: even though there are public organisations, who knowingly procure innovative solutions,[13] in most of the procurements alternatives are not welcome:

> "*You cannot do it too often as the solution is dictated for you and also the checkmark is put (*author: in the procurement environment*) that alternative solutions are not acceptable.*"
> (Interviewee H).

In addition to the different understanding in what exactly is innovation, there is a noticeable gap in the understanding of what is and should be considered as agile development. While there is no doubt that a lot of different agile methods and good practices are used by the development teams on daily bases – in both public and private project – in order to increase work effectiveness and efficiency, in most cases it cannot be called agile development by the text-book definition. However, all of the companies said that they do use agile and most of them even said they 'mostly' use agile. Two interviewees, who were more up to date with the theories of agile development, said that at best the form used in public procurement can be called water-scrum-fall.[14]. "*A mixed version is still the most common one. There is also this completely clean scrum used, but maybe only a little.*" (Interviewee H). Even though in most cases the methods used for development can be chosen by the supplier, some organisations in the public sector have also learned to add agility as a requirement to their

---

[13] "*There are very cool things done in Estonia. It is not always innovation in the context of the world, but at least for the procurer. There is also world scale innovation.*" (Interviewee D)

[14] Water-scrum-fall means that only the parts which are influenced by the development team, use agile. Areas like project planning and release management, which cannot be influenced by them, continue to use the more traditional approach. - West, D. (2011) *Analyst Watch: Water-Scrum-fall is the reality of agile*. Reachable: http://sdtimes.com/analyst-watch-water-scrum-fall-is-the-reality-of-agile/, 15.05.2016.

procurement. Though, as outlined above, the meaning of the term is often misunderstood and misused also by the public sector:

> *"The term 'agile' is used as a synonym of things not thought through by oneself and of endless flexibility. Not in a sense of cooperation and format and team and the mind-set of leadership, but just as 'I do not know what I am doing'."* (Interviewee H)

4.2.2 The influence of the public procurement process to agile development

One of the main gains of agile development is the flexibility it gives on changing the requirements upon need and setting priorities according to the creatable value. The all-requirements-up-front public procurement does not support that in theory so one of the topics discussed was the need for requirement change and how to do it. All the interviewees agreed that the requirements do change and there are also possibilities to change them. As was put by one of the interviewees (G): *"The law does not prevent anything."* At the same time, the projects differ in their form, level of detail and financial instruments. The form and the level of detail is something that can be chosen by the procurer and is up to the procurer's skills to be chosen wisely. Well-chosen form of procurement and procurement object help the procurer a lot in making the scope somewhat flexible: "*You shouldn't define what is needed but the goal which is aimed to be reached*" (Interviewee A) The financial instruments, though, are rather fixed in the public sector context. The interviewees agreed that it is very difficult to change the requirements in the projects financed from the EU Structural Funds as audits are performed and if you fail the audit then you lose the money. *"There is no procedure for making an agreement about the scope changes with the auditing organisation on an ongoing basis."* (Interviewee G) At the same time, the needs do change already due to the long period which often stays between the setting of requirements and the actual development (esp., in case of the EU funded projects) so creativity helps if the law does not: *"If at the end some - honoured auditor - would look into it, then I'm not really sure if some constructions in there and the replacement of some things, weather it is totally okay or not"* (Interview E), or as it was put by interviewee A: *„The paper, after all, stands anything."* and interviewee B: *„On paper everything looked correct but the actual work was performed differently."* Though, as IT skills are not that prevalent in the public sector nor the supervisory organs, code is rarely, if ever, audited. Hence, the

ability to change requirements comes down to the procurer's skills on interpreting the laws and regulations and the courage to do it differently; but it sure is not made easy.

> "*Many government officials are afraid of the responsibility and they also do not dare too. So even if he/she has the possibilities for changing it then they seem to be afraid of it (*author: the scope*).*" (Interview C)

The second important part of agility is the cooperation and customer involvement. There were both good and bad examples from the public organisations. The main influents here are the fixed-price contracts which acquired with the lowest price criteria were defined as the destroyers of willingness to cooperate from the supplier side due to the opposing objectives of the procurer and the supplier (Interview A, E). The procurer wants to get as much as possible out from the contract and the supplier wants to do as little as possible as he/she never knows how long exactly will solving all the requirements take. There is no win-win situation with fix-priced contracts.

> "*The motivation of the procurer is to demand from this supplier every last 'decimal place'. /.../ Our motivation, if we go to this miserable fixed-price contract is to figuratively speaking do as little as possible.*" (Interviewee E)

4.2.3 Customer input and skill gap

In order to be able to get a good system, the procurer has to contribute to the project and know what is it for – what problems is it aimed to solve or which value to create. If the procurer is not able to answer those questions, then it is highly unlikely that the system will be able to solve those undefined problems or create the needed value – expecting that it exists. Also, if the customer knows it but this information is not clearly communicated to the developers, the problem is the same. Different interviewees (Interview A, D, E, G, H) brought out that often the projects are assigned to regular public servants (not full-time project managers) who get this as an extra task next to their everyday assignments.

> "*If it would be possible for the public sector to organize the projects so that they would not be extra work for the people…*" (Interviewee D)

This often means that they neither have the skills of project management nor the knowledge of the field the system is aimed for nor the time needed and often they also lack the power to make decisions: "*This is also a problem that they do not have the power to make decisions. It (*author: each decision*) can't go for a coordination round in the office!*" (Interviewee B).

Another somewhat unprofessed topic which was brought up by one of the interviewees is the skill gap which is often between the developers and the expectations put upon them by the agile development. Text-book agility expects all members of the team to be technically excellent and at the same time be also able to discuss business with the customer:

> "*But this (*author: agile development*) demands a lot from the team. That everyone would be very skilled. If some are so called 'factory-programmers' then with them, it is hard to be agile. They need someone to so called do some of the agility for them.*" (Interviewee D)

The 11th principle of agile says that "The best architectures, requirements, and designs emerge from self-organizing teams" which means that the team should have all the skills needed to develop the required system and should self-organize to manage all the required assignments. In other words, there should not be positions like „project manager" – there should be a team which works together to get the project done in the best manner:

> „*I also know development companies who come and say that they do it in the agile way and 'here is our project manager'. I ask who is the project manager you have there? What do you need a project manager for if you do it agilely?*" (Interviewee B)

4.2.4 Legislative requirements

Last but not least, an interesting factor that influences the system development in the public sector was brought out (Interview C, E, G) – „*the agility of the Estonian law space*" (Interviewee G). In other words, numerous systems have been developed in Estonia because a draft law says that there should be a system. What is especially peculiar is that the system is often developed before the actual law is adopted. Consequently, the development of those systems is in many cases ordered by people who are not clear about the exact implementing acts of laws (or they have very short

deadlines due to the former), and thus, do not really understanding the assignment or requirements of the system exactly:

>*"It was said from the Ministry that this system will be required by the law and it must be implemented by a certain date."* (Interview C)

What tends to happen in situations like that is that the law drafts and their implementing acts can considerably change, so, the procurer can end up with a fully developed system and nothing to do with it. Soon another draft is created and adopted but due to the changed conditions more development needs to be ordered for money which was already used. At the same time, as the implementation deadlines are so short, then it is also not possible to start developing such systems after the law has actually been adopted. In connection to this one interviewee (G) noted: *"I have seen way too many procurements go down the drain."*

4.2.5 Suggestions by IT companies

There were quite a few suggestions made by the Interviewees about which improvements could be made to use agile development in the public sector context. Nevertheless, it was acknowledged that there are no quick and simple fixes as the balance between openness, non-discrimination and flexibility in the context of not so daring public sector is definitely very difficult to achieve: *"I do not envy the position of the people putting together the procurements, where they have to figure out how not to be 'milked', but on the other hand get good things."* (Interviewee H)

Trust was one of the most important keyword mentioned by a lot of the Interviewees (Interview A, B, C, D) as the bases of cooperation and better results. *"If they would learn to trust and listen to the advice, then we would have much better projects and IT systems."* (Interviewee C) The people in the software development companies often do know better how to solve different software related problems as this is their everyday job and they are willing to share their knowledge.

Another very important suggestion from the Interviewees (Interview A, B, C, E, H) was for the public sector to learn to ask themselves why should the system be developed in the first place – what problem should it solve or what value should it create. *"Be a conscious procurer. Fix up your*

organization so that you understand what are you procuring and which problem are you solving with this procurement." (Interviewee B) If the answer to those questions is unclear then do not develop the system. If there is no resource or skills to answer those questions then some highly competent business analysis people should be hired – even though those people are probably expensive, they definitely are worth it.

Last but not least, agile development might not always be the best method to use, so it should not be mandatory, but the Interviewees agreed that in most of the cases it does create better results and adds value. Even though it was noted by some (E, H) that text-book agile development is basically impossible in the public sector, the same people stated that the closest thing to agility in the current public procurement system is framework agreement with negotiated procure with prior publication of contract notice where the award criteria is 60-70% evaluates and 30% concentrates on price. In the framework agreement labor hours should be bought (time & material principle) and the system should be developed in small steps where first basic analysis is made, then a prototype is built etc. In this format the scope can be changed based on the completed developments and market/organization needs; usually the organizations able to pull this format off are very good development partners with good understanding of the agile principles. The only constraint here is that in case of EU founded projects this format is not possible as there the scope has to be predefined and afterwards fulfilled accordingly to get the money.

4.2.6 A glimpse to the procurer side

As usually, then it all looks a little bit different from the other side. Kaiklem said that MKM uses mostly open procurement with price as the award criteria. The reason why for example negotiated procurement is rarely used by them is that it just takes too much time (up to 1 year) and most of the projects are time critical. There are the draft laws which have very short implementation deadlines and actually also quite fixed scope (coming from the draft). There are the projects founded from EU Structural Founds where again the scope is even more fixed and the deadlines are again rather short. And last but not least there are their own projects which are related to the fiscal year and where the 1 year of negotiations again just does not fit.

The reason why the price criteria is used is that it is faster and easier and the only fully objective criteria. Kaiklem brought Estonian Road Administration as an example where a lot of the procurements have been contested because they have tried to do it better.

Kaiklem also brought out some valid facts about why the public customer is not good at knowing their "business". Often the systems are procured for someone else which means that the business knowledge is not reachable from the same house or maybe even from the same city. Also usually the people whose input is needed just do not have time to contribute as fast as needed.

Also sometimes the system needs do come from a law which is politically initiated and maybe does not even make sense to the procurer but as it is a law then it has to be fulfilled. In other public sector just has its specifics. But the general understanding is the same:

> "*In order for the projects to succeed, everyone's very strong input is needed*" (Kaiklem)

5. CONCLUSIONS

Increasingly more and more innovative solutions are expected from the public sector. In the world of IT development agile development has been used as the solution to create more flexibility in projects and thus, give a better chance for innovation. Agile principles are also increasingly used in the public sector. This thesis has looked into the topic if agile development methods are possible in the context of the public sector. For this the theoretical part of the work outlined the problems associated with public sector innovation and PPI, in addition to outlining the problems with the current mainstream software development methodology in the public sector – the waterfall method. Next to this, agile development sets high demands on development teams and also requires flexibility and continuous change which may not be possible in a public sector/public procurement environment. To exemplify these problems, the case of Estonia was explored with the perspective and experience of main IT companies dealing with both public and private IT-projects examined.

Previous research (see section 3) has shown that there are many serious problems with implementing PPI in the context of Estonia including focusing on lowest price, dominance of open procurement, lack of skill, risk-aversion and cooperation in the public sector and a decentralized procurement system. Comparing these issues to the demands the agile development sets, then these problems can also limit the use of agile development in the public sector context.

The interviews with IT-developers showed, that while the companies do not perceive the customers of IT-development to be much different between the public and private sector, public procurement rules do influence the possibility to use agile methodologies on public sector IT developments. Due to finance and legislative issues more flexibility means greater risks to public servants (and as discussed in the theoretical part risk aversion is characteristic to public sector employees). Willingness to take these risks and introduce more agility – and thus, the potential for innovation – into the development process is very person-specific from the procurers' side at least from the

perspective of IT developers. Thus, in some cases formal rules are perceived as strong barriers to agility, while in other cases procurers are able and willing to work around them. This is probably facilitated by the highly decentralised procurement system in Estonia. In some cases, developers together with the procurers need to even borderline cheat the initial procurement project to get the best possible system. At the same time, not all companies are willing to do that, especially when public servants themselves apply the fixed-price contracts with unchangeable checkmarks and unwavering demand to get everything initially tendered for. On the other hand all Interviewees confirmed that requirements do change all the time, so if Estonia does not want to end up with the statistical 45% of unused features and dysfunctional systems then the implementing of agile development methods should be promoted.

Nevertheless, the barriers to adopting agile methodologies do not solely lie with the public servants, some companies also conceded that their own employees (so called line/factory programmers) may not have the necessary skills to live up to the agile manifesto. Based on the interviews we can say that the bigger software development companies in Estonia use agile development methods during their development processes. Although, the full process cannot be classified as text-book agile and in most of the cases the text-book agility – at least in the public sector context – can never be used due to the essence of the procurement process. What can and is being used though is a form most similar to 'water-scrum-fall', which means that the agile way of working is combined with not the most flexible procurement or launching of the system.

Consequently, applying agile development methodologies in the context of the public sector is not easy. Many of the problems lie with personal interpretation of procurement rules, but also with how projects are managed and if civil servants have the time, skills and power to concentrate of implanting agility in their IT-developments. These issues should be dealt with by not only further education of procurers, but also by creating guarantees and showing how risks can be taken and managed in the procurement process. As most IT-companies emphasised that the public sector needs to think through the needs for IT-system, before the procurement process, Estonia should also consider creating a separate policy and regulations for IT-procurements, which would support the best practices of IT-development and simplify the procurement process. The interviewed software development companies would surely be willing to help on the certain recommendations for the

policy. Here also full-time IT-system developers/procurers on the side of the public sector would be a step forward.

In conclusion, we can say that the public sector gets what it orders. Developing good IT-systems needs a very clear definition of the problem it should solve, competence and time from the procurer. If those are lacking, then the final system is also lacking.

SUMMARY IN ESTONIAN

Agiilse arenduse võimalikkusest avaliku sektori kontekstis: Eesti näide

Hetkel on riikide peamine väljakutse leida võimalusi muutuvates oludes majanduskasvu ja kodanike heaolu tagamiseks. Majanduskriis ning keskkonna ja sotsiaalsed väljakutsed nõuavad uusi lahendusi ning lahendusena nähakse nüüd innovatsiooni. Riik saab omaltpoolt innovatsiooni panustada nii pakkumise- kui ka nõudluspoolsete instrumentidega. Pikka aega nähti riiki kui pelgalt koordineeriat, kes nõudluspoole meetmetega pigem tegelema ei peaks, et mitte sekkuda turu vabasse toimimisse. Tõusmas on uus konsensus, mis ütleb, et riigist peaks saama innovatsiooni tellija ja tekitaja ning seda just läbi nõudluspoolsete vahendite.

Nõudluspoolsetest instrumentidest kõige suuremat potentsiaali nähakse innovaatilistel riigihangetel, kuna riik kui tellija kulutab hangete peale arvestatava osa oma eelarvest (Eesti näiteks üle 2 miljardi euro aastas). Üks eriline ja samas oluline osa riigihangetest on IT hanked, mis kipuvad minema üle aja, üle eelarve ning valmis saades mitte vastama kasutajate ootustele. Üheks peamiseks põhjuseks selles nähakse nn 'waterfall' arendusmudeli kasutamist, mis näeb ette, et kõik nõuded peavad olema enne arenduse algust väga detailselt defineeritud ning et arendus käib täpselt nende alusel. Tänapäeva muutuvas maailmas juhtub aga tihti, et selleks ajaks kui süsteemi arendamiseni jõutakse, on reaalne vajadus juba muutunud. Aegunud waterfall-mudel aga muudatusi ei võimalda, mis tähendabki, et IT-arendus ei vasta tihtipeale valmis saades enam ootustele. Tegemist ei ole siiski uue probleemiga ning erasektoris on sellega juba pikalt tegeletud. Aastal 2001 tuldi välja Agiilse Manifestiga, mis defineerib agiilse arenduse põhimõtted. Agiilne arendus koosneb paljudest väikestest tsüklitest, mille vahel saab klient tehtud töö üle vaadata ning vastavalt vajadusele parandusi teha või järgnevaid nõudeid asendada ja ümber prioritiseerida – ikka selleks, et saavutada parimat versiooni loodavast IT-süsteemist.

Antud töö eesmärk on uurida agiilsete arendusmetoodikate kasutamise võimalikkust Eesti riigihangete kontekstist. Et saada ülevaade Eesti IT hangetest viidi läbi 8 poolstruktureeritud intervjuud Eesti tarkvaraettevõtete esindajatega, kellega arutati agiilse arenduse ning innovatsiooni võimalikkust Eestis riigihangete kontekstis. Omapoolse sisendi andis intervjuul ka Majandus- ja Komminikatsiooniministeerium.

Töö empiiriline analüüs näitas, et Eestis on agiilsete arendusmeetodite kasutamine avalikus sektoris teataval määral võimalik, aga samas see sõltub paljudest muutujatest alustades hankemenetluse liigist ning hindamise kriteeriumist. Olulise erisuse loob ka klient – sektoripõhiselt intervjueeritavad klientides suuri erinevusi ei täheldanud, küll aga organisatsiooni ning isiku tasandil. On organisatsioone ning ametnikke, kes on väga kvalifitseeritud, koostööaltid ning avatud paindlikkusele, kuid on ka neid, kellel puuduvad nii julgus, oskus kui aeg, et projekti panustada. Lisaks isikupõhistele omadustele on avalikus sektoris täiendavateks väljakutseteks ka finantseerimisvahenditest ning hanke vormist tulenevad piirangud, mis takistavad agiilsete metoodikate kasutamist. Ka nendele piirangutele lähenevad aga erinevad hankijad erinevalt – osad on parima tulemuse nimel valmis reegleid tõlgendama vastavalt vajadusele nii, et tulemus oleks parim, teised aga selliseid lükkeid teha ei julge.

Lisaks kliendi ja avaliku sektori spetsiifikale takistavad definitsioonijärgse agiilsuse kasutamist ka metoodikaga arendajale pandud ootused, mis eeldavad väga suurt ning laiahaardelist kompetentsi, mis osade arendajate jaoks käib üle jõu. Seetõttu on osades tarkvaraettevõtetes lisaks tavalisele agiilsele tiimile inimesed, kes aitavad tiimil osa agiilsusest ära teha. Ühesõnaga, fakt on see, et kõik intervjueeritud ettevõtted kasutavad agiilseid metoodikaid, kui paljud teevad seda definitsiooni järgi ja milline on üldse see õige definitsioon, need on juba eraldi küsimused.

Töö leiab, et agiilsus ei peaks projektides olema kohustuslik – olenevalt olukorrast ei pruugi see alati olla kõige optimaalsem viis süsteemi arendamiseks. Samas peaks selle rakendamist avaliku sektori IT-projektides siiski soodustama, sest hetkel on selle rakendamine takistatud isegi nendes situatsioonides, kus see silmnähtavat tulu tooks. Intervjueeritud tarkvaraettevõtted tegelevad arendustega igapäevaselt, praktiseerides sealjuures valdavalt agiilseid metoodikaid, sest nende

kogemus on näidanud, et nii on tulemus kõigi jaoks parim. Riik kui suurtellija peaks tegelema sellega, et ta ei piiraks nende ettevõtete oskuste ja teadmiste kasutamist, kui nad riigile teenust osutavad. Selleks ei tuleks mitte ainult kaaluda hankijate koolitamist Eesti detsentraliseeritud hankesüsteemis, vaid ka IT-sektori spetsiifilise hankepoliitika loomist.

REFERENCES

Albury, D. (2005) "Fostering innovation in public services" *Public Money and Management 25,* 51–56.

Arundel, A., Huber, D. (2013) "From too little to too much innovation? Issues in measuring innovation in the public sector." *Structural Change and Economic Dynamics.* Vol. 27, 146-159.

Aschhoff, B., Sofka, W. (2009) "Innovation on demand - Can public procurement drive market success of innovations?" *Research Policy.* Vol. 38, No. 8, 1217-1396.

Balter, B. J. (2011) "Towards a More Agile Government. The Case for Rebooting Federal IT Procurement." *Public Contract Law Journal.* Vol. 41, No. 1, 149-177.

Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., Thomas, D. (2001) *Manifesto for Agile Software Development*. Reachable: http://agilemanifesto.org/, 02.01.2016.

Book, M., Gruhn, V. Striemer, R. (2012) "adVANTAGE: A fair pricing model for agile software development contracting." *Agile Processes in Software Engineering and Extreme Programming*, Vol 111, 193-200.

Borins, S. (2001) "The Challenge of Innovating in Government" *PricewaterhouseCoopers Endowment for the Business of Government*. Reachable: http://www.strategie-cdi.ro/spice/admin/UserFiles/File/CA%20The%20Challenge%20of %20innovating%20in%20government.pdf, 20.02.2016

Borins, S. (2002) "Leadership and innovation in the public sector." *Leadership & Organization Development Journal.* Vol. 23, No. 8, 467 - 476.

Cauwenberghe, P.V. (2005) "Agile Fixed Price Projects part 1:'The Price Is Right'." Reachable: http://www.nayima.be/download/fixedpriceprojects.pdf, 12.05.2016.

Charles, A. (2009) "The electronic state: Estonia's new media revolution." *Journal of*

Contemporary European Research. Vol.5, No.1, 97-113.

Daglio, M., Gerson D., Kitchen H. (2015) "Building Organisational Capacity for Public Sector Innovation." *OECD Conference "Innovating the Public Sector: from Ideas to Impact"*. Paris, 12-13.11.2014, 1-35. Reachable: http://www.oecd.org/innovating-the-public-sector/Background-report.pdf, 02.01.2016.

Detelj, K., Hribernik, T. M., Pihir, I. (2015) "Measuring Public Procurement for Innovation on the Country Level and the Role of ICT Support." *JIOS*. Vol. 39, No.1, 21-32.

De Vries, H., Bekkers, V., Tummers, L. (2015) "Innovation in the public sector: a systematic review and future research agenda" Public Administration, Vol. 94, No. 1, 146-166.

Eckfeldt, B., Madden, R., Horowitz, J., Grotta, E. (2005) "Selling Agile: Target-Cost Contract." *Agile Conference 2005*. Colorado – Denver 24.-29.07.2005, IEEE, 160-166.

Edler, J., Georghiou, L. (2007) "Public procurement and innovation - Resurrecting the demand Side." *Research Policy*. Vol. 36, No. 7, 949–963.

Edler, J. (2009) "Demand policies for innovation." *Manchester Business School working paper*, No. 579. Reachable: http://www.econstor.eu/handle/10419/50691, 02.01.2016.

Edler, J., Georghiou, L., Uyarra, E., Yeow, J. (2015). "The meaning and limitations of public procurement for innovation: a supplier's experience." In Edquist, C., Vonortas, N. S., Zabala-Iturriagagoitia, J. M., Edler, J., Elgar, E. (eds.) *Public Procurement for Innovation*. Cheltenham: Edward Elgar, 3–21.

Edquist, C., Hommen, L. (2000) "Public Technology Procurement and Innovation Theory." In Edquist, C., Hommen, L., Tsipouri, L. (eds). *Public Technology Procurement and Innovation.* Vol.16. New York: Kluwer Academic Publishers, 5-50.

Edquist, C. (2015) "Innovation-related Public Procurement as a Demand-oriented Innovation Policy Instrument." *Papers in Innovation Studies*. No. 28. Reachable: http://wp.circle.lu.se/upload/CIRCLE/workingpapers/201528_Edquist.pdf, 02.01.2016.

Eesti Kaubandus-Tööstuskoda (2015) Uus riigihangete seadus. Reachable: http://www.koda.ee/en/?id=24146, 03.03.2016

European Commission (2015) *Single Market Scoreboard. Public procurement.* Reachable: http://ec.europa.eu/internal_market/scoreboard/_docs/2015/09/public-procurement/2015-09-scoreboard-public-procurement_en.pdf, 02.01.2016.

European Union (2016) *Public contracts - Rules & procedures.* Reachable:

http://europa.eu/youreurope/business/public-tenders/rules-procedures/index_en.htm, 27.03.2016.

Fernandes, M. C., Alencar, A. J., Schmitz, A.S., da Silva, M. F., Stefaneas, P. S. (2016) "Evaluation of Agile Software Projects in the Public Sector: A Literature Review." *Journal of Software.* Vol. 11, No. 3, 312-325.

Freeman, C. (2002) "Continental, national and sub-national innovation systems - complementarity and economic growth". *Research policy.* Vol. 31, No.2, 191-211.

Isett, K. R., Glied, S. A. M., Sparer, M. S., Brown, L. D. (2012). "When change becomes transformation: A case study of change management in Medicaid offices in New York city." *Public Management Review.* Vol. 15, No. 1, 2013, 1–17.

Lee, G., Xia, W. (2010) "Toward Agile: An Integrated Analysis of Quantitative and Qualitative Field Data on Software Development Agility." *MIS Quarterly.* Vol.34, No.1, 87-114.

Lember, V., Kalvet, T. (2012) *Riigihanked ja innovatsioon Eestis: milleks kulutada 11 miljonit päevas?* Reachable: http://www.riigikogu.ee/rito/index.php?id=16247, 01.05.2016.

Lember, V., Kalvet, T. (2014) "Estonia: Public procurement, Innovation and 'No Policy' Policy." In Lember, V., Kattel, R., Kalvet, T. (eds.) *Public Procurement, Innovation and Policy: International Perspectives*. Heidelberg: Springer, 127-149.

Lember, V., Kalvet, T., Kattel, R. (2010) "Urban Competitiveness and Public Procurement for Innovation." *Urban Studies.* Vol. 48, No. 7, 1373-1395.

Lember, V., Kattel, R., Kalvet, T. (2013) "Demand-side innovation policy in Estonia: rationales, limits and future paths." *Working Papers in Technology Governance and Economic Dynamics*. No. 56. Reachable: http://technologygovernance.eu/files/main/2013122012033838.pdf, 02.01.2016

Lember, V., Kattel, R., Kalvet, T. (2015) "Quo vadis public procurement of innovation?" *Innovation: The European Journal of Social Science.* Vol.28, No. 3, 403-421.

Lember, V., Vaske, V. (2009) "Public Procurement in Post-Transitional Context: The Case of Estonia." In Thai, K. V. (eds.) *International Handbook of Public Procurement*. Boca Raton, FL: Taylor & Francis Group, 409–426.

Lægreid, P., Roness, P. G., Verhoest, K. (2011) "Explaining the innovative culture and activities of state agencies." *Organization Studies*. Vol. 32, No. 10, 1321-1347.

Majandus- ja Kommunikatsiooniministeeriumi 12.02.2016 Ministri määruse eelnõu nr 16-0176

"Innovatsiooni edendavate hangete toetamise tingimused"

Matteus, K. (2015) *Uus riigihangete seadus – milliseid muutusi on oodata*? Reachable: http://www.cobalt.legal/en/news/uus-riigihangete-seadus-milliseid-muutusi-on-oodata/713, 03.03.2016

Mazzucato, M. (2013) *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. London: Anthem Press.

McNally, F. (2014) "Enabling Acquisition Success for Agile Development." *Advisory*. Reachable: https://www.asigovernment.com/documents/enabling_acquisition_success_for_agile_devel opment_advisory.pdf, 12.05.2016.

Meijer, A. (2016) "Governance of Urban Innovation." *IRSPM 2016*. China – Hong Kong 13.- 15.04.2016, 1-27.

Meso, P., Jain, R. (2006) "Agile Software Development: Adaptive Systems Principles and Best Practices." *Information Systems Management*. Vol.23, No.3, 19-30.

Miozzo, M., Grimshaw, D. (2005) "Modularity and innovation in knowledge-intensive business services: IT outsourcing in Germany and the UK". *Research Policy*. Vol. 34, No.9, 1419-1439.

Moniruzzaman, A. B. M., Hossain, S. A. (2013) "Comparative Study on Agile software development methodologies." *Global Journal of Computer Science and Technology*. Vol. 13 No. 7, 5-18.

Mulgan, G., Albury, D. (2003) "Innovation in the Public Sector." Reachable: http://www.sba.oakland.edu/faculty/mathieson/mis524/resources/readings/innovation/inno vation_in_the_public_sector.pdf, 02.03.2016.

Olsson, H. H., Bosch, J. (2014) "Towards Agile and Beyond: An Empirical Account on the Challenges Involved When Advancing Software Development Practices." In Cantone, G., Marchesi, M. (eds). *Agile Processes in Software Engineering and Extreme Programming*. Vol 179, 327–335.

Osborne, S.P., Brown, L. (2011) "Innovation, public policy and public services delivery in the UK: The word that would be king?" *Public Administration.* Vol. 89, No. 4, 1335-1350.

Potts, J., Kastelle, T. (2010) "Public sector innovation research: What's next?" *Innovation: Management, Policy & Practice*. Vol. 12, No. 2.

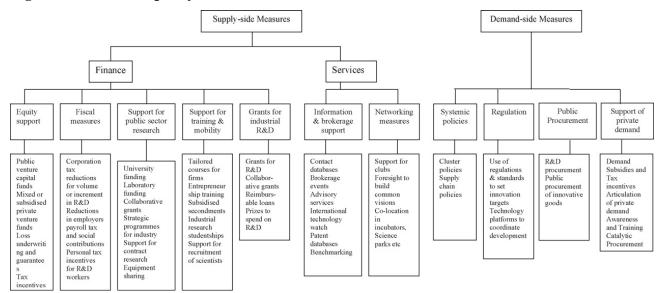Pärna, O., von Tunzelmann, N. (2007) "Innovation in the public sector: Key features influencing

the development and implementation of technologically innovative public sector services in the UK, Denmark, Finland and Estonia." *Information Polity.* Vol. 12, No. 3, 109-125.

Rainey, H. G. (2003). *Understanding and managing public organizations.* San Francisco: Jossey-Bass.

Riigihangete register (2016). Väljavõte registrist. Reachable: https://riigihanked.riik.ee, 18.05.2016.

Rolfstam, M. (2015) "Measuring effects of public procurement of innovation." *XIX IRSPM Conference*. University of Birmingham 30.03 - 1.04.2015, Aalborg University, 1-10.

Romanainen, J., Eljas-Taal, K., Rigby, J., Cunningham, P., Iszak, K., Männik, K., Angelis, J., Kosk, K., Vallistu, J. (2014) *Feasibility Study for the Design and Implementation of Demand-side Innovation Policy Instruments in Estonia: Final report part 1 – Market Potential and International Experiences.* Reachable: https://www.mkm.ee/sites/default/files/final_report_part_1.pdf, 02.05.2016.

Uyarra, E., Flanagan, K. (2010) "Understanding the Innovation Impacts of Public Procurement." *European Planning Studies.* Vol.18, 123-143.

Vashishtha, S., Kaur, H., Jindal, R., Singh, G. P. (2014) "Agile Implementation in a Fixed Bid Project." *GlobalLogic*. Reachable: https://staging-www.globallogic.com/wp-content/uploads/2014/07/Agile-Implementation-in-a-Fixed-Bid-Project.pdf, 12.05.2016.

Wernham, B. (2012) *Agile Project Management for Government*. London, New York, Sidney: Maitland and Strong.

Windrum, P. (2008) "Innovation and entrepreneurship in public services." In Windrum, P., Koch, P. (eds.). *Innovation in public sector services: Entrepreneurship, creativity and management.* Cheltenham: Edward Elgar, 3–21.

Wrubel, E., Gross, J. (2015) *Contracting for Agile Software Development in the Department of Defense: An Introduction*. Reachable: http://resources.sei.cmu.edu/library/asset-view.cfm?assetid=442499, 02.01.2016.

Zijdemans, S. H., Stettina C. J. (2014) "Contracting in Agile Software Projects: State of Art and How to Understand It." In Cantone, G., Marchesi, M. (eds). *Agile Processes in Software Engineering and Extreme Programming*. Vol 179, 78-93.

Appendix 1

Figure 1. Innovation policy tools

Source: Edler, Georghiou 2007, 952.

Appendix 2

The barriers of public procurement of innovation:

1. Too much emphases on price
2. Lack of interaction with procuring body
3. Variants not allowed
4. Risk aversion of public procurers
5. Specifications too prescriptive
6. Low capabilities of procurers
7. Poor management of risk
8. Contracts not long enough/too long
9. General lack of demand for innovation
10. Contracts not large enough/too large
11. Inadequate management of intellectual property rights (IPR)
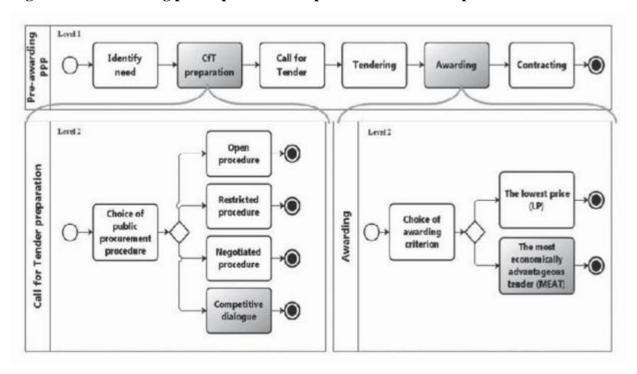
Source: Edler et al. 2015, 55.

Appendix 3

Figure 1. Pre-awarding public procurement process with two sub-processes

Source: Detelj et al. 2015, 25.

Appendix 4

Types of public procurement in EU:

1. Opened procurement - every organisation can participate
2. Restricted procurement - every organisation can ask to participate but only the ones who are pre-selected can submit a tender
3. Negotiated procurement - only invited (minimum of 3) organisations can participate, the terms of the contract are negotiated with the invited organisations.
4. Competitive dialogue - everyone can request for participation. Minimum of 3 candidates must be invited for a dialogue during what the final technical, economic and legal criteria is set. When the dialogs are over, the candidates can submit their final offers.
5. Electronic auction - everyone can submit a tender, all applicable can participate in an auction. The winner will be chosen based on a mathematical formula which determines ranking.

Source: European Union 2016.

Appendix 5

Manifesto for Agile Software Development

We are uncovering better ways of developing
software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on
the right, we value the items on the left more.

Source: Beck et al. 2001.

Principles behind the Agile Manifesto

We follow these principles:

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

4. Business people and developers must work together daily throughout the project.

5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

7. Working software is the primary measure of progress.

8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

9. Continuous attention to technical excellence and good design enhances agility.

10. Simplicity--the art of maximizing the amount of work not done--is essential.

11. The best architectures, requirements, and designs emerge from self-organizing teams.

12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.
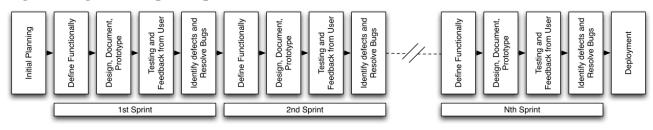
Source: Beck et al. 2001.

Appendix 6

Comparison of Waterfall to Agile Software Development Timelines
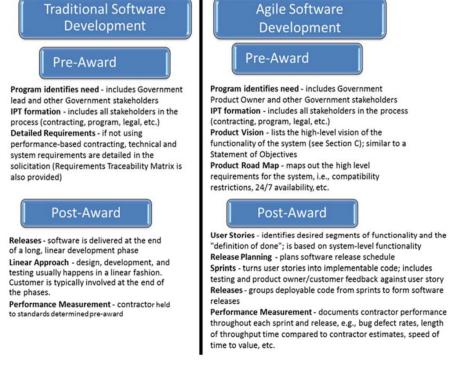
Figure 1. Waterfall development process

Source: Balter 2011.

Figure 2. Agile development process

Source: Balter 2011.

Appendix 7

Figure 1. Differences in the procurement process of traditional vs agile development

Source: Wrubel, Gross 2015, 29.

Appendix 8

Interviewees

1. Raul Meriloo, Project Team Manager, Tieto, 21.04.2016 (audio recording)
2. Agu Leinfeld, Director of Technology- and Software Development, Datel, 26.04.2016 (audio recording)
3. Erle Raudsepp, Area Manager, Icefire, 26.04.2016 (audio recording)
4. Birgit Ärm, Team Manager, Net Group, 27.04.2016 (audio recording)
5. Tarmo Kiivit, Head of Public Sector Solutions, Helmes, 29.04.2016 (audio recording)
6. Erik Tiits, Project Manager, CGI, 02.05.2016 (audio recording)
7. Lauri Tammiste, Business Area Director, Nortal, 03.05.2016 (audio recording)
8. Dea Oja, Managing Director, Ignite, 04.05.2016 (audio recording)
9. Kristjan Kaiklem, Head of Department, Ministry of Economic Affairs and Communications, 04.05.2016 (audio recording)

Appendix 9

Questionnaire (In Estonian)

1. Milline on olnud Teie isiklik kokkupuude era- ja avaliku sektori IT-projektidega?
2. Milline on teie ettevõtte projektide jaotus era- ja avaliku sektori projektide vahel?
3. Millised on peamised erinevused era- ja avaliku sektori projektide vahel?
    a) Hankeprotsess?
    b) Projektide läbiviimine?
    c) Projektide keerukus?
    d) Tellija oskused? Valmidus võtta riske? Otsuste tegemine?
    e) Tähtajad?
4. Kui tihti on vaja esialgu kokku lepitud tingimusi muuta arenduste käigus?
5. Kas avaliku sektori projektides on võimalik projekti käigus tingimusi muuta?
6. Kui palju on avaliku sektori projektides koostööd tellijaga?
7. Kuidas hindate avaliku sektori tellijate oskuste taset võrreldes erasektori tellijate omaga?
8. Kuidas hindate avaliku- ja erasektori projektide kvaliteeti? Kas seal on erinevusi? Kui jah, siis milliseid?
9. Kui tihti tuleb ette, et projekti ei õnnestu lõpetada planeeritud aja jooksul, see ületab eelarvet või ei täida tellija ootusi? Kas siin on erisusi avaliku- ja erasektori vahel (nt põhjused, miks projektid kukuvad läbi)?
10. Kuivõrd innovaatilised on olnud Teie projektid/lahendused? Palun tooge võimalusel näiteid avalikust ja erasektorist?
11. Kas Teil on kogemusi innovaatiliste riigihangetega? Mis võimaldavad, takistavad viimseid avalikus sektoris:
    a) madal hind (hangetele järgnevad kaebused)
    b) hanketingimused

    c)   projektide pikkus ja suurus (avaliku sektori fiskaalplaneerimine; liikumine ühest eelarveaastast teise);

    d)   intellektuaalomandiõigus)?

12. Kui tihti kasutab teie ettevõte oma projektides agiilseid arendusmetoodikaid?

    a)   Kas olete kasutanud agiilseid arendusmetoodikaid ka avaliku sektori projektides?

    b)   Millised on teie jaoks kõige olulisemad agiilse arendusprojekti tunnusjooned?

    c)   Millised on agiilse projekti eelised?

13. Kas agiilsete metoodikate kasutamist avaliku sektori projektides peaks soodustama? Miks?

    a)   Millised võimalused on hetkel agiilsete arendusmetoodikate kasutamiseks riigihangete kontekstis?

    b)   Millised on peamised barjäärid (seadusandlus, oskused jne) agiilsete arendusmetoodikate kasutamiseks riigihangete kontekstis?

14. Mida võiks avalik sektor erasektorilt IT-projektide läbiviimisel õppida?