PUBLIC PROCUREMENT OF INNOVATION

Lessons learned from the procurement of comprehensive solution for pharmacy automation

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Tiivistelmä – Referat – Abstract

This thesis examines public procurement of innovation and its operationalization in the Finnish public health care sector. Public procurement is currently recognized as a suitable instrument to foster innovation and it is thus widely recognized as a tool for demand-driven innovation policies. By recognizing this political interest and the lack of established academic research about public procurement of innovation, the primary objective of this thesis is to add knowledge about the practices of public procurement of innovation. This thesis examines a single case study in which the Kuopio University Hospital's pharmacy service unit procured a comprehensive solution for pharmacy automation. The perspective of institutional approach is adopted in order to find out how organization-specific, endogenous institutions affect the conditions and the results of a public procurement of innovation. This thesis is set to answer how the procurement of the pharmacy service automation in Kuopio University Hospital was implemented and how endogenous institutions affected the outcome of the procurement process.

This thesis is a qualitative research of a case study. The empirical data of this study consist of elite interviews and relevant documentation. Qualitative content analysis is applied in order to examine the empirical data and it utilizes the theoretical framework of public procurement of innovation and endogenous institutions respectively in order to provide suitable classifications for the results. The classifications provide a comprehensive description of the procurement project and endogenous institutional factors that affected the outcome of the procurement.

The results indicate that the Kuopio University Hospital's pharmacy service unit initiated a public procurement of innovation due to an intrinsic need to improve its patient safety and the efficiency of its pharmacy supply processes. The implementation of the project included innovation-friendly procurement practices that enabled development of an innovative solution. Multiple products were developed and commercialized as a result of the procurement. All of the products included elements of radical innovation. Utilizing the new pharmacy supply system, the Kuopio University Hospital's pharmacy supply service has increased its efficiency and safety. The challenges identified regarding the effects of the procurement related to the difficulty of measuring the real productivity of the new system. The procurement also had direct effects for the supplier as multiple products were developed and commercialized in the process. In addition, the procurement opened new markets for the company.

The key findings of this thesis indicate that public procurement can spur innovation even if it is not the primary goal of the procurement. The Kuopio University Hospital case points out the importance of multi-professional collaboration and trust as crucial factors in public procurement of innovation practices. The perspective of institutional approach also proved to be a suitable theoretical framework in examining the conditions that could affect the success or the hindrances of the public procurement of innovation implementation.

Avainsanat – Nyckelord – Keywords
public procurement, public procurement of innovation, institutions, supply of medicines, Kuopio University Hospital

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Tiivistelmä – Referat – Abstract

Tässä tutkimuksessa tarkastellaan innovatiivista julkista hankintaa ja sen käytäntöjä suomalaisella terveydenhuollon sektorilla. Innovatiivinen julkinen hankinta nähdään nykyään hyödyllisenä välineenä innovaatioiden edistämisessä ja siksi se on laajalti omaksuttu kysyntälähtöisen innovaatiopolitiikan työkaluna. Ottaen huomioon tämän hetkisen poliittisen kiinnostuksen innovatiivisia hankintoja kohtaan sekä aihetta koskevan vähäisen tutkimuksen, tutkielman tavoitteena on lisätä tietämystä innovatiivisista julkisista hankinnoista ja sen käytännöistä. Tutkielmassa tarkastellaan hankintatapausta, jossa Kuopion yliopistollinen sairaala uudisti täysin lääkehuollon toimintansa. Hankinta koski lääkehuollon automaatioratkaisua. Tutkielmassa käytetään institutionaalista lähestymistapaa, jonka avulla voidaan tarkastella organisaatiokohtaisten instituutioiden vaikutuksia innovatiivisen hankinnan lopputuloksiin. Tutkielman tavoitteena on vastata kysymyksiin, miten Kuopion yliopistollinen sairaala toteutti lääkehuollon automaatioratkaisun hankinnan, ja miten organisaatiokohtaiset instituutiot vaikuttivat hankintaprosessin olosuhteisiin ja lopputuloksiin.

Tämä tutkimus on laadullinen tapaustutkimus. Työn empiirinen materiaali koostuu asiantuntijahaastatteluista ja tapaukseen liittyvästä aineistomateriaalista. Aineistoa tarkastellaan laadullisen sisällönanalyysin avulla, jossa tutkielman teoreettista taustaa, innovatiivisista hankinnoista ja organisaatiokohtaisista instituutioista, hyödynnetään tulosten luokittelun perusteena. Luokittelun avulla saadaan kokonaisvaltainen käsitys hankintaprojektista ja hankinnan lopputulokseen vaikuttavista organisaatiokohtaisista instituutioista.

Tutkielman tulokset osoittavat että Kuopion yliopistollisen sairaalan lääkehuollon yksikkö toteutti innovatiivisen julkisen hankinnan, tavoitteenaan parantaa lääke- ja potilasturvallisuutta sekä lisätä lääkehuollon tehokkuutta. Hankintaprojekti sisälsi innovaatioystävällisiä hankintakäytäntöjä, jotka mahdollistivat innovatiivisen ratkaisun syntymisen. Hankinnan johdosta useita tuotteita kehitettiin ja kaupallistettiin. Kaikki kehitellyt tuotteet pitivät sisällään radikaalin innovaation piirteitä. Uusi lääkehuollon automaatioratkaisu on parantanut sairaalan lääkehuollon turvallisuutta sekä tehokkuutta. Hankinnan vaikuttavuuden arviointi ja mittaaminen koettiin haasteelliseksi. Haasteet liittyivät ensisijaisesti kykyyn mitata uuden järjestelmän lopullista tuottavuutta. Hankinnalla oli myös suoria innovaatiovaikutuksia toimittajalle, joka pystyi hankinnan kautta kehittämään ja kaupallistamaan useita tuotteita. Hankinta siten avasi yrityksen tuotteille uusia markkinoita.

Tutkimus osoittaa, että julkinen hankinta kykenee edesauttamaan innovaatioiden syntymistä, vaikka innovaatioiden edistäminen itsessään ei olisi ensisijaisena hankinnan tavoitteena. Kuopion hankintatapaus korostaa ammattirajojen ylittävää yhteistyötä ja luottamusta oleellisina tekijöinä innovatiivisen julkisen hankinnan toimeenpanon onnistumisessa. Tutkimuksessa käytetty institutionaalinen lähestymistapa osoittautui toimivaksi teoreettiseksi näkökulmaksi tarkastella erilaisia vuorovaikutustekijöitä, jotka voivat kontekstista riippuen edistää tai estää innovatiivisen julkisen hankinnan lopputulosta.

Avainsanat – Nyckelord – Keywords
julkiset hankinnat, innovatiiviset julkiset hankinnat, instituutiot, lääkehuolto, Kuopion yliopistollinen sairaala

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1. INTRODUCTION

This thesis studies public procurement of innovation and its operationalization in the Finnish healthcare sector. Focus of interest herein is associated to discover public procurement of innovation practices from an institutional perspective. This thesis studies endogenous institutions in the public procurement of innovation process from a context of a case study, where Kuopio University Hospital procured a comprehensive solution for pharmacy automation.

Today public sector organizations are increasingly expected, not only to support private sector innovation, but also to foster innovative public services. In general sense, public procurement of innovation can be defined as a process, in which public organization places an order for new or improved product or service that aims to improve effectiveness, productivity, quality and/or sustainability of public service (Valovirta et al. 2017). Public procurement of innovation is generally identified as a process that can benefit the society in two ways. First of all, it is considered to have potential in answering societal challenges or needs by improving effectiveness and productivity of public services. At the same time, public procurement of innovation would have potential to generate new commercial opportunities and promote economic growth through renewal. From strategic perspective of public agencies' purchasing processes, this indicates fundamental change of organizational culture in how to understand the operational model of public procurement. (Pelkonen & Valovirta 2015: 385)

Traditionally public procurement is understood as purchases of service performances or already commercialized products. This reflects the role of public organization as strict definer of service performance or product in tender procedure. In public procurement of innovation, on the other hand, the emphasis is put on results and capability the procured service or product is desired to provide. In academic literature this is often defined as results-based procurement, where public organization is seen as the owner of purchased service or product, and thus leaving the

development and implementation processes to suppliers, that is private or third sector organizations. (Pelkonen & Valovirta 2015: 386)

This topic can be considered timely, due to the increasing political, academic and practical interest and support to enhance the innovation potential of public procurement. During the last couple of decades public procurement is increasingly identified as an instrument for innovation policy especially in the Western countries. European policy makers and academics have supported the idea of public procurement of innovation as demand-side innovation policy tool to tackle various problems resulting from financial, environmental and demographic challenges faced recently (Rolfstam 2015). For instance, European Commission indicated the importance of public procurement of innovation in accomplishing the set objectives for the Europe 2020 strategy:

> *"Public authorities should make the best strategic use of public procurement to spur innovation. Buying innovative products, works and services plays a key role in improving the efficiency and quality of public services while addressing major societal challenges. It contributes to achieving best value for public money as well as wider economic, environmental and societal benefits in terms of generating new ideas, translating them into innovative products and services and thus promoting sustainable economic growth."* (2014/24/EU, introduction, section 47)

These ideas are also adopted by the current Finnish government. The strategic programme of Prime Minister Juha Sipilä's Government for the period of 2015-2019 includes a target that the level of innovative public procurement is five per cent of all public procurement in Finland. Public procurement is considered as a tool for digitalization and experimentation in occasions of, for instance, boosting digital businesses and the cleantech industry. (Valtioneuvoston kanslia 2015: 26-27) Supportive action has already taken place: The recent reform of Finnish public procurement legislation, to the new public procurement act, is now including innovation partnership as a method of public process to enable the use of innovation. (Act on Public Procurement and Concession Contracts 1397/2016)

According to OECD (2017), public procurement represents 12% of gross domestic product (GDP) and 29% of total government expenditures on average across OECD countries. According to the Confederation of Finnish Industries, the annual value of public procurement in Finland comprises approximately 30 billion euros. By recognizing this financial potential of public procurement, many governments' have started to enhance this potential to support policies such as fostering innovation. (OECD 2017: 3, Lember et al. 2015: 403)

Research objectives and questions

In this thesis, the objective is to study how a single public procurement of innovation process is conducted in practice. As public procurement of innovation is increasingly adopted as an instrument of demand driven innovation policies especially by European governments, there is a growing need to develop more profound and updated analysis that could help inform policy and methods development and implementation. Many studies have pointed that there are problems with the deployment of public procurement of innovation policies. Several scholars argue that in order for successful policy development, it is important to understand the variety of forms that exist in public procurement, nature of innovation, innovation effects, and how public procurement affects innovation (Zelenbabic 2015: 267). By analyzing single case of public procurement of innovation, the objective of this thesis is to provide in-depth knowledge about innovative procurement project practices from a context-specific point of view.

This thesis also takes an institutional approach to study what type of conditions are needed for successful implementation of public procurement of innovation. Drawing on Rolfstam (2013: 4) public procurement of innovation can be seen as a special case of social processes that are governed by institutions. This calls for understanding of the "rules of the game" of public procurement and how these regularities could potentially affect the conditions of public agencies to procure innovation. According to Rolfstam (2013: 34), the primary claim underlying the institutional analysis departs from the idea that institutions, as collectively agreed on *ex ante*

structures, govern, regulate, support and/or regulate human collaboration. Drawing from Rolfstam (2013), I conceptualize institutions as *"the rules of the game in a society that shape interaction"* or the *"sets of habits, routines, rules, human interaction"*. This perspective would provide a comprehensive approach to discover how certain, context specific, conditions function as success factors or barriers for implementation of public procurement of innovation. Institutional approach could thus provide a useful perspective for theoretical discussion and policy development of public procurement of innovation.

In general, this thesis can be considered relevant from an academic perspective. Wesseling & Edquist (2016) mention that "*research on innovation related public procurement is still in an early stage of development and can therefore still profit from case-oriented research with an explanatory objective.*" This thesis is conducted as a single case study. I will introduce and discuss the modernization project of Kuopio University Hospital's (KUH) pharmacy service and discover how endogenous institutions have affected the conditions and result of the procurement.

The chosen case study of this thesis consists of a public procurement of innovation where Kuopio University Hospital reformed its whole pharmacy supply system by procuring a comprehensive solution for pharmacy service automation. The respective procurement took place in 2013. In this procurement KUH and awarded supplier not only provided an already commercialized product of storage and retrieval robot but also developed and commercialized multiple health technology products, including automated dispensing cabinets, a robot for compounding intravenous medication. Procurement also included software development and integration of different information systems.

The respective case was discovered and chosen during my internship in VTT Technical Research Centre of Finland, where I was working on a research project focusing on public procurement of innovations in Finland. The main reason to choose this case derived from the fact that it can be considered to resemble a classic case of direct public procurement of innovation. This type of procurement, where new

products are commercialized as a result of public purchasing, can be still considered rare in Finland. In their study, Valovirta et al. (2017: 11) point out that majority of public procurements in Finland, that have included elements of promoting innovation, have merely enhanced diffusion of new solutions to new markets rather than development and introduction of totally new solutions.

Case study of a single procurement project was considered as relevant strategy for this topic of research. Focusing on a single procurement would provide more detailed knowledge about the process of innovative public procurement in its specific context. Here the context is the healthcare sector, more specifically pharmacy service and its related health technology. Also, a single case study enables to explain and add knowledge on conditions needed for implementing innovation procurement in a sector specific institutional context.

By noting the aforementioned, research questions in this thesis are the following:

- How the procurement of pharmacy service automation in Kuopio University Hospital was implemented?
- How did endogenous institutions affect the outcome of the procurement processes?

In order to answer the first question, it is necessary to discuss the relevant scholarly literature regarding public procurement of innovation and procurement processes. By analyzing the existing literature on innovative public procurement, the objective is to understand what the identified need or goal for the procurement was. Also, questions how the procurement was implemented (including question of what type of tender procedure was applied), what was the novelty of the results, and what were the impacts the procurement generated for procurer and supplier, are answered.

The objective for the second research question is to find out what type of endogenous institutions were identified to have an effect on implementing the procurement

process. By analyzing the case study from a perspective of endogenous institutions, it possible to provide a set of success factors and barriers that affected the operationalization of the project. Content analysis is implemented to study the collected empirical data. Theoretical discussion of public procurement of innovation and endogenous institutions are utilized in the analysis of results.

In order to collect primary data, I conducted five interviews in October 2016 in KUH. In addition, official documents, such as project plans, procurement presentations and news regarding the case were utilized to support the primary data. This thesis can be considered as abductive research. The thesis can also be considered explanatory by its purpose as it intends to add to the knowledge of research focusing on institutional aspects of public procurement of innovation by introducing the perspective of endogenous institutions as a research element in public procurement of innovation research.

The study is divided into the following sections. Chapter two consists of the theoretical framework of the thesis including the academic discussion of public procurement of innovation and institutional approach. In chapter three, methodological issues of the thesis are discussed. In chapter four research results and relevant findings are discussed. Chapter five includes conclusion of the study.

2. THEORETICAL FRAMEWORK

In this chapter, I will introduce and discuss the theoretical framework of the study. In the first subchapter, theoretical discussion of on public procurement principles, public procurement of innovation and its policy design are provided. The second subchapter focuses on institutional approach as analytical perspective for public procurement of innovation research.

2.1. Public procurement principles and process

Public procurement refers to the purchase of goods and services by a public agency that uses public funds. The definition also refers to a specific type of written purchasing contract, in which procurement unit is acting as a buyer and private company or other actor as a supplier, and in which agreement is made regarding purchasing of product, implementation of service or commissioning of public work against payment. Procurement units as public purchasers are most often government and municipal officials, federation of municipalities, public utilities and public corporations. Public procurement units can also include church officials and in certain cases private companies that are operating by virtue of special privilege or receiving public funds. (Pekkala & Pohjonen. 2015: 21)

Finnish public procurement law, based on the principles of the EU procurement directives (2004/18/EY & 665/1989/ETY), directs public procurement process linked with competitive tendering. Competitive tendering of product or service refers to procedure, where procurement unit publicly announces, in accordance of the procurement law, about upcoming purchase of product, service or contract. The announcement including the invitation of tenders indicates what the object of the purchase is, and what are the criteria utilized in choosing of the tender. In other words, competitive tendering can be defined as a competitive contract activity, in which bidders are obliged to fulfil the criteria set by the buyer, in order to have the tenders accepted. (Pekkala & Pohjonen 2015: 21-22; Lundström 2011: 32)

The aim of competitive tendering points to the overall purpose of using public funds as efficiently as possible. This means purchasing of products and services with advantageous prices in relation to the price-quality ratio. The background for competitive tendering retains as assumption that the motive for putting a product or a service on tender would motivate organizations to adapt and introduce new practices, and thus improve productivity and other qualities of public services. However, in practice many cases have indicated that the primary motives for competitive tendering are concerned more about fairness and custom of procurement rather than organizations' measures aiming for solving problems. (Hansen 2010: 259)

Legal rules regarding public procurement affects every public procurement according to appointed threshold value. Procurement law regulates only the tender procedure and the invitation to tender by minimum content. Tender procedure is initiated by publishing of a call for tenders and is concluded with the signing of a contract. In public procurement of innovation, the often-utilized tender procedures are negotiated procedure, competitive dialogue and reverse auction. The advantage of negotiated procedure and competitive dialogue is that procured solution is not necessary to define beforehand, and that initiation of procurement can be approached first with a focus on procurement needs and objectives. In reverse auction, prospective suppliers are competing only in regards of quality as procurer has already defined the price. Outside the tender process, the other procurement phases such as the strategic principles of the development phase, market dialogue, defining of procurement content and conditions don't belong under the jurisdiction of public procurement law. Drawing up of a call for tenders and comparison of tenders are only minimally regulated in the public procurement law. Procurement phases, after the tender process, such as defining of the content of contracts and the evaluation of contracts, are also outside the jurisdiction of public procurement law. (Pekkala & Pohjonen 2015: 23, 45 & 385)

It can be thus said that majority of procurement processes and work related to public procurement is outside the regulation of public procurement law, and these phases are essentially important in the public procurement of innovation. Edquist et al.

(2015: 10) point out that the process of innovative procurement is divided into different stages and these tend to be interrelated and intertwined in practice. In general sense, the process of public procurement of innovation can be depicted in the following manner:

1. Identification of need or challenge: public agency needs or grand societal challenges that are formulated as lack of satisfied human needs or unsolved societal problems.
2. Translation of the identified challenge or need into functional specifications.
3. Tendering procedure: opening of the bidding process through a tender, translation of the functional specification into technical specifications by potential suppliers, submission of formal bids by potential suppliers.
4. Assessment of tenders and awarding of contracts.
5. Delivery process: development and production of the product and final delivery to the procuring organization. (Edquist et al. 2015: 10; Edquist & Zabala-Iturriagagoitia 2012: 1759)

2.2. Public procurement of innovation

2.2.1. Research about public procurement for innovation

In academic literature, the discussion about public procurement of innovation has been active for around 15 years. European countries and the European Union have increasingly been interested of the potential of public procurement to not only enhance the performance of public services but also innovative capacity of the markets. Public procurement of innovation is thus often linked to demand-driven innovation policy as a policy instrument. The proliferation of public procurement of innovation is also affected on the increasing amount of research related to the topic. (European Commission's Action Plan; Aho et al. 2006 & Edler et al. 2007)

The academic literature has described public purchasing of innovation in many different ways, such as innovation-oriented public procurement (Rothwell & Zegveld 1981), public technology procurement (Edquist & Hommen 2000), public procurement for innovation (Edquist & Zabala-Iturriagagoitia 2012), innovative public procurement (Edler & Georghiou 2007) and strategic public procurement (Edler 2010). The definition of public procurement of innovation has thus evolved and expanded during the last years. The variations reflect the different perspectives the research has taken, for instance regarding the end users of the procured product or service (Edler et al 2007 & Hommen et al 2009), the strategic nature of the procurement (Edler et al 2007), the market position of public sector in relation to suppliers (Rothwell et al. 1981 & Edquist et al 2000) or the type of innovation and the phase of technological life cycle, in which the innovation is seen to happen (Edquist et al 2000, Edler et al 2005 & Hommen et al 2009). Despite of the different connotations and nuances regarding the substance of the term, all the aforementioned definitions in general refer to public purchasing activities that foster innovation (Lember, Kattel & Kalvet 2014: 14).

In their study, Edquist et al. (2000) make a distinction between regular public procurement and public technology procurement. By public technology procurement they refer to the procurement of new product or system that is currently not available in the market but has potential to be developed within a reasonable time. This definition emphasizes product development as a part of the public procurement process. Technology public procurement is thus based on the definition of a process, which culminates in purchasing of a developed product or system. The object of procurement is identified here as a concrete technological product, and hence it is not taking into account the procurement of services. The debate over public technology procurement has been the starting point for the further definitional discussion of public procurement of innovation.

Uyarra & Flanagan (2010: 124) point out that the definition of public technology procurement, as purchasing of a new technological product, ignores many categories of innovation. These are, for example, combinations of existing services and

products, innovations related to implementation of services, and innovations in the procurement process. Public procurement for innovation is basically understood as the public sector purchasing with the purpose of advancing innovations (Lember et al. 2014: 14-16 & Rolfstam 2013: 4-5). This modernized definition includes concepts such as novel combinations of products, new methods of production and organization, and also opening of new markets. (Rolfstam 2015)

Recent research literature is marked with demand-based perspective in public procurement for innovation. Developing procurement practices and capabilities, with an innovation friendly attitude, are seen to have influence in the preconditions of creating innovations. This is often referred to as innovation-friendly procurement, which points to regular procurement process, where innovative solutions are taken equally into account with commercialized "off-the-shelf" products or services. According to Knutsson et al. (2014: 245) innovation-friendly procurement refers to the ability, by means of the procurement process, to be able to enlarge the market for a certain type of product or service to facilitate the emergence of a new standard technology or to change the market structure by making it attractive for new entrances. Public procurement is identified to serve primarily public needs, yet secondarily they can be seen as an incentive to the development of innovations, and thus modernize and advance the markets. (Edler 2015, Zelenbabic 2015, Knuttson et al. 2014 & Uyarra et al. 2010)

Edquist et al. (2016: 6-10) separate innovation-friendly procurement from public procurement for innovation by approaching the definition from a results-based perspective. The emphasis in defining public procurement for innovation is based on describing the calls for public procurement in functional terms rather than strict descriptions of desired products or services. Unlike public procurement for innovation, innovation-friendly procurement, as itself, doesn't set requirement for innovation but more facilitates its development and introduction. In their definition, the objective of public procurement for innovation is primarily to target functions that satisfy human needs, solve societal problems or support agency missions or needs.

The act of public procurement still necessarily includes some form of product or process innovation before delivery can take place.

Edquist et al. (2016: 8-10) classify different forms of public procurement for innovation under three dimensions. The first dimension relates to end-users of the procurement. Here, public procurement for innovation can be understood either as direct or catalytic public procurement. Direct public procurement for innovation is often identified as a 'classic' case, where the procuring organization is also the end-user of the developed and introduced solution. Catalytic public procurement for innovation, on the other hand, is when a public organization acts as buyer, but is not the intended end-user of the purchased product or service.

The second dimension relates to the character of the innovation embedded in the resulting solution. Public procurement for innovation can be seen as incremental or radical. Incremental public procurement for innovation refers to a purchased, already commercialized, product or system that is adaptive and new only to significant end-users, such as a public agency, a country, a region or a city etc. Radical public procurement for innovation is about completely new-to-the-world product or service that is created as a result of a procurement process. And finally, the third dimension emphasizes the fact that public procurement for innovation can be characterized by different degrees of collaboration and interactive learning among procurers, suppliers and sometimes other organizations. These elements are generally identified determinants of the development and diffusion of innovations, and these all can be linked to the aforementioned categories. (Edquist et al. 2016: 8-9)

Pre-commercial procurements are also often recognized in the academic discussion concerning innovative public procurement (Edler et al. 2007, Rolfstam 2013 & Edquist et al. 2016). Pre-commercial procurement is referring to the matter of public research and development investments, thus indicating more likely to the purchasing of research results. The difference with public procurement for innovation is that it is not about the actual product development that results with commercial-

ized solution. Although pre-commercial procurement is not defined as public procurement for innovation, it is not to say that research results from pre-commercial procurement could not be utilized later on in innovative public procurement. Pre-commercial procurement is often seen as one part of public procurement for innovation. (Edquist et al. 2016: 9-10)

2.2.2. Development of public procurement of innovation policies

The aforementioned introduction to the academic debate of innovation-oriented public procurement reveals the variety of policy goals innovative public procurement is seen to provide a useful tool for. In general, it is argued that rationales for public procurement of innovation are twofold (Valovirta 2015: 68).

Firstly, it is argued that public sector demand, in the form of public procurement, stimulates private sector research and development and innovation. As public agencies provide the initial demand and the first references for private companies, the commercialization of new products and generation of economic benefits, through diffusion of innovation, are advanced. (Valovirta 2015: 68; Zelenbabic 2015:264 & Rolfstam 2013: 14) According to Edler & Georghiou (2007: 954) this rationale relates to market and system failures, where these failures affect the translation of needs into a functioning market for innovative products.

Second rationale for the utilization of public procurement of innovation is that it is expected to contribute to solving societal challenges and improving public service delivery and infrastructure by purchasing better services and products from suppliers. Purchasing of innovation are seen to have strong potential for achieving variety of public goals and missions, such as sustainability, energy efficiency, environmental protection, social inclusion, regeneration and social inclusion. Also, investment needs, for instance for new systems or assets, can open up opportunity for public procurement of innovation. (Valovirta 2015: 68; Zelenbabic 2015: 264; Edquist & Zabala-Iturriagagoitia 2012: 1757; Edler & Georghiou 2007: 957)

The aforementioned rationales are, during the last years, widely adopted innovation policy measures by many Western countries including international actors such as the EU and the OECD. However, in practice there exist not a large number of successful projects of public procurement of innovation. This is considered to be caused by multiple factors. According to various studies, these factors relate to a lack of skills and capabilities of public procurement professionals, a lack of management skills and senior management support, the public sector's risk averse culture and obstacles related to different procurement organizational models, and also financial constraints and silo budgeting. (Zelenbabic 2015: 262; Yeow & Edler 2012: 477-478; Lember, Kalvet & Kattel 2011; Uyarra &Flanagan 2010)

Zelenbabic (2015: 263) points out that the insufficient use of public procurement to spur innovation suggests the prevailing uncertainty related to practice and procedures in making public procurement of innovation work in practice and how this practice is possible to be promoted. Literature on policy development and the implementation of public procurement of innovation, points out the existing disagreement regarding the implementation of the demand-side innovation policy measures in practice. Policy design is considered to be largely based on anecdotal evidence and without clear empirical and theoretical basis for comprehending how supplying to the public sector actually affects private companies' innovation performance and capabilities, and also in what ways wanted outcomes and behavior can be promoted. Examples of challenges here relate to the European Commission procurement rules; conflict between multiple policy goals; the policy design failure to take into account context specific differences; multi governance issues and the lack of evaluation and impact assessment of public procurement of innovation as a basis for policy learning. It is pointed out that successful development of innovative public procurement policies would require a comprehensive understanding of variety that establish public procurement of innovation. This means understanding of the types of products and services procured by the public sector, the nature of innovation and the multiple potential innovation effects and numerous ways public procurement may affect innovation. (Zelenbabic 2015: 265-267; Georghiou et al. 2013; Yeow & Edler 2012: 473 & Uyarra & Flanagan 2010: 127-128)

Policy development in Finnish context

The discussion of public procurement of innovation as a tool for Finnish national innovation policy, a relatively new phenomenon, has in principal followed the same topics as on the EU level. These include, for instance, the demand side perspective of the public procurement in promoting development of products and services in a variety of industry sectors. Discussion has also pointed to the focus on processes and structures of public procurement, and how these affect the creation of innovation. The potential of the Finnish public sector's demand that is based on the estimate that the total annual value of public procurement, including both the government and the municipalities, is approximately 35 billion euros. (Valovirta 2017 & Kajala 2015)

Finnish academic research and reports about the policy development has increased rapidly during the past ten years (e.g. Valovirta et al. 2017, Kajala 2015 & Tekes 2008). On the other hand, public procurement of innovation entered the political debate only during the latest parliamentary elections in 2015 (Kajala 2015: 1). That is to say, knowledge regarding the subject can be considered a call for new knowledge especially in the Finnish context.

In this thesis, the studied case considers public procurement of innovation in the hospital pharmacy sector. Thus, the focus of interest in general here is in the Finnish health care sector. The annual value of public procurement in the Finnish health care sector is approximately 11 billion euros, from which 5 billion euros of purchased products and services are from the open market. Majority of the public procurement in health care sector is service procurement. Because of the fact that health care in Finland is for the most part produced by the public sector, the demand for products and services, produced by the private sector, is predominately consisting of public procurements. Public sector organizations, thus, comprise a significant factor for the introduction of private sector innovations in health care. (Valovirta et al. 2017)

Current societal needs and challenges in the Finnish health care are related to multiple factors. These include, for instance, increasing health care expenses deriving from an ageing population, the increase of chronical illnesses and challenges of meeting customer needs and public resources. In addition, the increased expenditures of medicines are a recognized challenge. (Valovirta et al. 2017) Reflecting interviews, conducted in this thesis, the aforementioned aspects relating to increasing expenditures are also in some points relevant in the hospital pharmacy sector and its practices. One respondent pointed out digitalization and automation as solutions for the identified challenges, and it was considered to be a global trend, yet not so well established. This in turn could be considered to turn in favor for public procurement in providing the need for a new market.

2.3. Institutional approach

By making a connection between innovation theory and public procurement, Rolfstam (2013: 33) provides an institutional approach to study public procurement of innovation. According to Rolfstam (2013: 24 & 31), an institutional approach would provide a useful framework for understanding how public procurement of innovation is achieved, or how it is not always realized. This framework would also be useful for research implemented to inform public procurement of innovation policy discourse.

According to Rolfstam (2013: 3), an institutional approach in public procurement of innovation studies can be linked to the theoretical contribution of linking research of innovation theory and public procurement. This established link is essentially traced back to the research volume by Edquist, Hommen and Tsipouri (2000), where they introduced an institutional perspective as a new direction for what knowledge to collect and look for in public technology procurement studies. Espe-

cially, by identifying European Commission procurement rules as a significant barrier to the utilization of public procurement to promote innovation, they highlighted the importance of institutions as a crucial determinant for success and the failure of public procurement of innovation (Zelenbabic 2015: 266). Linking innovation theory and public procurement follows the idea that public procurement, as an act of innovation, becomes a special case of user-producer interaction where interactive learning takes place. Rolfstam (2013: 3) points out that: "*rather than being the result of anonymous market processes based on price information, public procurement of innovation (as distinct from procurement of regular goods and services) becomes a process where the social and collaborative aspects need to be stressed.*"

The volume by Edquist et al. (2000) has thus paved the way for the future studies of public procurement of innovation from an institutional perspective. By providing a well-established criticism to Edquist et al. (2000), Rolfstam (2007, 2009 & 2013) further develops the institutional perspective by developing a more holistic institutional approach to public procurement of innovation. In addition to formal framework of institutions, the importance of organization-specific institutions, in other words endogenous institutions, are highlighted.

2.3.1. Defining institutions

According to Rolfstam (2013: 34), the fundamental assertion underlying the institutional analysis here departs from a view of human collaboration as governed, supported, affected and/or regulated by institutions understood as at least effectually collectively agreed on *ex ante* structures. The term institution is widely used in a vast amount of literature, thus leaving little consensus regarding its meaning. For instance, variation may refer to different forms of organizations, transgress organizational borders and exist only in parts of an organization. (Rolfstam 2013: 34-35)

Institutions are ´the rules of the game in a society that shape interaction´or the ´sets of habits, routines, rules, human interaction´. Institutions can also be regarded as ´systems of established and prevalent social rules that structure social interactions´

or as ´the prescriptions that humans use to organize all forms of repetitive and structured interactions including those within families, neighbourhoods, markets, firms, sports leagues, churches, private associations, and governments at all scales´. (Rolfstam 2013: 35) Institutions, considered as virtue, relate to their function as assets or resources. Institutions enable a social system that enable to accumulate knowledge or enable communication, and thus sustain innovation. (Rolfstam 2013: 34-35)

2.3.2. Institutions and public procurement of innovation

By basing his argument on the institutional approach used in innovation studies, Rolfstam (3013: 37) points out the claim that public procurement of innovation should be regarded as a special empirical phenomenon in the field of innovation studies. The basic starting point for public procurement of innovation is set up by a public agency that needs to procure a solution to a particular need or a problem. As most often procurer provides knowledge regarding the problem, yet it often doesn't have exact knowledge regarding the solution. On the other hand, the supplier may have relevant knowledge, skills and resources for a solution, yet it is often not capable of knowing the needs of the procurer. In that sense, the primary goal for procurer with public procurement of innovation is to find a supplier that has the capability, as in tools and skills, to satisfy its needs with the exchange of money.

The interaction between the procurer, the supplier and other stakeholders is emphasized, where supplier eventually learns how to apply its skills and tools. The procured solution is considered to be at least partly created after the formal agreement between the procurer and the supplier, thus making it in some respects initially unknown. This would provide an example that separates public procurement of innovation from regular procurement. Public procurement of innovation can thus be considered as a complex and interactive process where the central activity is learning which involves interaction between the user and the producer. (Rolfstam 2013: 37) According to Rolfstam (2013: 38), by understanding public procurement of innovation as a special case of innovation, innovation research based on institutional

theory would make sense and also would have potential in providing knowledge that would inform policy development of public procurement of innovation.

In his study, Rolfstam (2013) provides a holistic approach to institutional analysis by discussing three modes useful for an institutional-based research. These are multilevel institutional analysis, institutions as rationales, and endogenous and exogenous institutions. In this study, I will concentrate more in detail to endogenous and exogenous institutional mode. The primary focus is put on endogenous institutions.

2.3.3. Endogenous institutions

According to Rolfstam (2013: 44-47), exogenous-endogenous institutions provide a useful perspective for an institutional approach to public procurement of innovation. Rolfstam bases this approach on the study of Coriat & Weinstein (2002), in which two separate trajectories, organizational and institutional, of innovation research are scrutinized. By recognizing the advantages and shortcomings both dimensions hold, Coriat & Weinstein developed a new innovation system analysis by bringing these two trajectories together through the development of a typology that distinguishes between universal and organization specific institutions, and between institutions concerned with long-run societal reproduction and those designed to operate on a fixed-term basis. (see Table 1.)

The distinguish between universal and organization-specific institutions are here referred to as exogenous and endogenous institutions, and these dimensions can be further scrutinized between institutions concerned with long-run societal production and those designed to operate on a fixed-term basis. The latter dimension concerns the duration of the institution. The long-term institutions refer to the ruling of a long run reproduction of a society and the fixed term, on the other hand, are fixed in time. (Rolfstam 2013: 44-45 & Corian & Weinstein 2002: 282-283)

Table 1. Institutional dimensions affecting innovative public procurement (Rolfstam 2013: 45)

	Long term	**Fixed term**
Exogenous	Law, mission of public agencies	Public policies, programmes
Endogenous	Organizational choices regarding modes of coordination	Contract

Exogenous institutions are based on an explicit "forcement" dimension and authority posed on all the agents. This dimension, guaranteed by a sanction system such as a formal law that applies to everyone, calls up complex social devices that make the imposed rules of the game operational and guarantee their respect by agents. Exogenous institutions, thus, affect organizations from outside and they are imposed on organizations with little or no control from the organization itself. From the point of durational dimension, long term exogenous institutions can refer to general rationale for the existence of a public agency. fixed term exogenous institutions, on the other hand, can be considered universal and fixed in time. (Rolfstam 2013: 45 & Corian & Weinstein 2002: 283)

By reflecting Corian & Weinstein (2002: 283), Rolfstam (2013: 44-445) defines endogenous institutions as the rules that individual agents decide to give themselves and they are private collective agreements between a collective of agents. Endogenous institutions typically evolve within organizations and may also change as a result of learning within the organization. It is also pointed out that change in endogenous institutions can affect how organizations react to exogenous institutions. Endogenous institutions, from the perspective of a long term dimension, reflect organizational choices regarding modes of coordination within an organization. Short term endogenous institutions also reflect organizational choices but from the local point of view within a limited time span.

According to Rolfstam (2013: 46-47), this institutional perspective can provide a useful insight for a variety of analyses for public procurement of innovation, relating to for instance European Commission directives on public procurement in relation to the EU member states. The exogenous-endogenous mode is capable of providing an explanation for success of public procurement contracts in institutional terms. From this perspective, public procurement contracts can be seen as results of an institutional match between different exogenous institutions and endogenous institutions.

Rolfstam (2013: 47) highlights that this institutional mode is primarily an institutional model, despite its capability to correspond to organizational level analysis. Still, endogenous institutions can often be identified specific to an organization. In this thesis, I will focus on the endogenous side of institutions. Endogenous institutions can be considered a useful framework as it would provide a useful perspective for scrutinizing public procurement of innovation from organization-specific conditions.

Endogenous institutions as success factors

By comparing case studies about public procurement of innovation, Rolfstam (2013: 144) explores to what extent it is possible derive success factors for public procurement of innovation projects. By noting the simplistic nature of the term itself, Rolfstam identifies the success factor as conditions that if met in a particular case appear to work to contribute to the success of public procurement of innovation projects. The aforementioned conditions can be established by the procurer, by any other stakeholders beyond the control of the procurers, or, expressed in general, by the context. Success factors can be considered to have a dual role in a sense that, if met, they may increase the expectations of success for a procurement project. In conditions where some success factors are not met, the project may fail even if some other success factors are still met. Success factors can also vary in different context.

A set of eleven success factors were identified (see Table 2.). These concerned issues of expertise on public procurement procedures and relevant law; technical competence for the specification; coordinating competence for cooperative demand; managerial control; allocation of resources for public procurers; political support; commitment from other institutional actors; appreciation and understanding of public procurement procedures; institutional match; technology champions and choosing the universally best solution. (Rolfstam 2013: 144-170) I will next briefly introduce the aforementioned factors.

Expertise on public procurement procedures and relevant law

A successful implementation of public procurement innovation was identified to require access to knowledge of the underlying legal framework and the procurement procedures. In other words, it is to say that allocation of competent knowledge on EC directives and national public procurement law will affect the project in a positive manner. (Zelenbabic 2015: 268 & Rolfstam 2013: 158-159)

Technical competence for the specification

Innovative procurement project often requires application of functional specifications where desired functions and outcomes rather than technical details of the item to be procured are given. Here, the supplier is given the responsibility to find out a solution for the desired functions. Even though application of functional specifications is emphasized, the procurer must still have a clear understanding of the intended outcomes. This can be considered important essentially in collaborative projects where stakeholders different needs require sufficient coordination. (Zelenbabic 2015: 268 & Rolfstam 2013: 159-160)

Coordinating competence for cooperative demand

Continuing from the aforementioned, successful collaborative procurement project must arrive at specification that would work for all stakeholders instead of only

finding single best specification. Rolfstam emphasizes that public procurement of innovation is most often much more than just a tender process. Adoption and diffusion of procured item often require initiation of other changes in order to make innovation fit the intended context. These include, for example consultation of end-user needs, measures of budget reorganization to avoid silo-budgeting and evaluation studies for convincing stakeholders of the innovation's usefulness. (Zelenbabic 2015: 268 & Rolfstam 2013: 161-162)

Managerial control

Public procurement of innovation as a special case of innovation project, requires sufficient project management skills and resources. This means also the requirement of a situation that is possible to manage. Public procurement of innovation always includes risks, and thus capabilities of risk management is also required. Risks in innovative procurement projects relate to organizational and social risks, technological risks, financial risks, market risks and turbulence risks (Tsipouri et al. 2010). (Zelenbabic 2015: 268 & Rolfstam 2013: 162-163)

Allocation of resources for public procurers

Successful implementation of public procurement of innovation is related to the allocation of sufficient resources that often are not available within the regular operative routines and budgets. Here resources are primarily identified as money but also the extent to which the procuring organization creates conditions for the procurers to work with a project. The notion of the latter is essentially important in an innovative project that consists of non-routine tasks such as development of functional specifications and finding technologies. (Zelenbabic 2015: 268 & Rolfstam 2013: 163-164)

Political support

Political support and decisions are considered important for the public procurement of innovation carried on the operational level. It also increases the chances of sufficient resource allocation. PPI requires political support and decisions in order to enable procurers on the operational level to carry out the work. Political support can also increase the chances of sufficient resource allocation. (Zelenbabic 2015: 268 & Rolfstam 2013: 164-165)

Commitment from other institutional actors

In addition to the procurer and the supplier, as actors of the formal procurement transaction, other institutional actors may affect the success of an innovation project. These are, for example, the end-users of procured products or services or organizations with exogenous authority. Also, people or organizations who are not direct customers or who do not have any formal authority for the innovation were mentioned as one potential category of institutional actors. (Zelenbabic 2015: 268 & Rolfstam 2013: 165-166)

Appreciation and understanding of public procurement procedures

From the potential suppliers' point of view, the success of public procurement of innovation is determined by how well the public procurement procedures are understood. This means the sufficient comprehension of the European Commission directives and the national procurement law. Procurer's ability to provide clear information regarding intentions, requirements and administrative procedures would improve the possibility for the success of the innovative procurement project. (Zelenbabic 2015: 269 & Rolfstam 2013: 166-167)

Institutional match

As public procurement of innovation consists of interaction between at least two organizations, the procurer and the supplier, the success of a procurement project is dependent of how well the rationales of the participating organizations are met. The aforementioned factors, such as managerial control and coordination competence, can be considered as tools for negotiating the institutional mismatch. The institutional match occurs as a result of compatible rationalities among collaborating actors. In practice, it is finally manifested as a signed contract. (Zelenbabic 2015: 269 & Rolfstam 2013: 167-168)

Technology champions

Individuals and groups can act as a crucial factor for the success of public procurement of innovation. In other words, they are then functioning as technology champions. This means that they are "*key to the implementation of technologies, and their actions appear directly related to the success or failure of many innovation*" (Lawless and Price 1992). The importance of technology champions appears to be increasing especially in situations where the initial idea for innovation is not a result of an exogenous decision. (Zelenbabic 2015: 269 & Rolfstam 2013: 168-169)

Choosing the universally best solution

In accordance to general principles of public procurement, the selection of "best" solution, regardless of its origin, creates a prerequisite for a successful procurement project. This is most often in contrast with local political rationalities where regional or national industries are promoted. This suggests that the solution eventually chosen needs to be superior to any other solution offered, regardless of the political expectations that procurers should aim to retain a portion of procurement to promote local economy development. (Zelenbabic 2015: 269 & Rolfstam 2013: 169-170) In Table 2., a summary of all the aforementioned success factors for public procurement of innovation is provided.

Table 2. Success factors for public procurement of innovation (Zelenbabic 2015: 267-269 & Rolstam 2013: 144-170)

Success factors	**Description**
Expertise on public procurement procedures and relevant law	The requirement of knowledge of the underlying legal framework and the procurement process itself
Technical competences for the specification	The assessment of desired functions and outcomes rather than only technical details of the item to be procured
Coordinating competence for cooperative demand	A specification that satisfy all stakeholders in collaboration of public procurement of innovation
Managerial control	The provision of sufficient resources for project and risk management
Allocation of resources for public procurers	Providing of sufficient resources for finance and labor for non-routine project
Political support	The political support for operationalization and resource allocation of public procurement of innovation
Commitment from other institutional actors	End-user participation in technology development
Appreciation and understanding of public procurement procedures	Informing prospective suppliers of public procurement procedures
Institutional match	The provision of a solution that matches with the objectives of both the procurer and the supplier
Technology champions	The presence of individuals and/or a group are considered crucial for the successful implementation of procurement, and whose actions relate directly to the success of innovations
Choosing universally best solution	The selection of the best solution regardless of its origin

Endogenous institutions as barriers

As already mentioned earlier, endogenous institutions can also act as a barrier for implementing public procurement of innovation, and the adoption and diffusion of innovation. In their study, Rolfstam, Phillips & Bakker (2011) discuss how endogenous institutions act as barriers to diffusion of innovation in public organization.

Identified barriers related to, for instance, organized scepticism; absence of technology champion; decentralised decision structure; silo budgeting; price; problems with demonstrating the value of innovation; de-spending and existing agreements with supplier of current technology. (Rolfstam et al. 2010: 460)

Organized scepticism reflects the requirement for sufficient proof before innovation can be adopted. Problems with demonstrating the value of innovation is related to the justification for adopting an innovation that has never been tried out in a practical setting. Silo budgeting and price concerns the situations where an innovation may be more expensive per unit than the existing technology, and where spending and gains from the spending don't affect the same budget, which in turn decreases incentives for the spending. (Rolfstam et al. 2010: 460) These potential barriers were also identified in KUH's case by the interviewed persons. In general, it was found out that a functional multi-professional collaboration and coordination provided certain conditions to tackle these barriers.

3. RESEARCH STRATEGY AND METHOD

In this chapter, I will discuss more in-detail the research strategy and data collection constructed in this thesis. The following discussion will introduce the conduct of a case study strategy and the introduction of a scrutinized case study. This is followed by a discussion on the utilized data and the methods of data collection. Finally, I will discuss the content analysis as a chosen research method for the study.

3.1. Case study as research strategy

According to Zelenbabic (2015: 267), public procurement of innovation studies have pointed out the contrast between the identified potential of public procurement of innovation for policy development and practices regarding the implementation of public procurement of innovation. This is in some points considered as gap between theory and practice. The multifaceted nature of public procurement of innovation is considered as a challenge for research. This relates to, for instance, variety in the types of products and services procured by the public sector, the nature of innovation, the variety of potential innovation effects and the different ways how procurement may affect innovation. Paying attention to organization-specific endogenous institutions would help to understand the potential disparity between theory and practice. Paying attention to context specific factors and drawing on experiences of procurement practitioners would further the understanding of public procurement of innovation as an interactive learning process.

The aforementioned factors influenced the methodological choices of this study. This thesis is conducted as a case study with an explanatory perspective. Following Yin (2009: 19), the idea here is "*to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies.*" The research objectives of this thesis require description and understanding of the context in order to analyse the results and to discuss their relevance in regard to generalization. The formulation of the research objectives reflect the current needs in

public procurement of innovation research. Wesseling & Edquist (2016) point out that research regarding public procurement of innovation is still relatively new and it requires further development. Case studies with explanatory perspective were recognized beneficial in order to better establish this field of research.

Due to different translations case study is often understood both as a research method and as a research strategy. In this research, case study can be understood as research strategy. Scrutiny in a qualitative case study is focused on small amounts of cases, or a single case as it is done in this thesis. The object of scrutiny is based on a course of events or a contemporary phenomenon. Case study as a research strategy is typically suitable answering research questions "*how*" and "*why*" (Laine et al. 2007: 9 & Yin 1994). The objective of this study is to investigate contemporary phenomenon of public procurement of innovation and figure out how KUH procured a comprehensive solution for pharmacy automation, and how did endogenous institutions affect the outcome of the procurement project.

Relevant notion in the case study is to recognize the significant difference between a case and research units. Description of a case itself is not sufficient enough to be called as research, but it should include some sort of tension to which the research is focused on. It is also important to make a distinction between the case and the object of study. The case here refers to an example of something more general. In this study, KUH's procurement of comprehensive solution for pharmacy automation would provide an example of the operationalization of public procurement of innovation. (Laine et al. 2007: 10, 33)

Often debated issue regarding a case study is its capability for scientific generalization. In regard to this assumption, Yin (2009: 15) points out that, in general, case studies have potential to contribute to theoretical propositions of generalization rather than generalizations about populations and universes. Also, one way to discuss generalization of a case study is to identify the type of the case study. (Laine et al. 2008: 31-34) The case study of this research could be defined as unique case study, in a sense that there exists relatively minimum amount of established regularities

regarding the studied phenomenon. Also, case studies about a single public procurement of innovation and its practices in the Finnish context can be considered rare.

In this thesis, Kuopio University Hospital (KUH) was chosen as the case study organisation. The reason for choosing this case for this thesis originated from my internship in VTT Technical Research Centre in Finland Ltd, where I participated in a research project that was focusing on analysing public procurement of innovation in Finland. KUH's pharmacy automation project was one of approximately 70 cases, classified as public procurement of innovation, that were scrutinized in VTT's research project. KUH's case was firstly discovered case for the aforementioned research project, and furthermore it was chosen as my thesis case for the reason that it would resemble a unique case of developmental public procurement of innovation in Finland. Purchased automatization of KUHs pharmaceutical service was seen as unique case of innovative procurement Finland. KUH's case resembles a direct public procurement of innovation that is still considered rare in practices of public agencies operations. VTT's research project (Valovirta et al. 2017) indicates that that majority of public procurements in Finland, that have included elements of promoting innovation, have merely enhanced diffusion of new solutions to new markets rather than development and introduction of totally new solutions. The aforementioned notions provided motivation to further study KUH's case more in detail.

3.2. Kuopio University Hospital as case organization

Kuopio university hospital (KUH) is one of the five university hospitals in Finland providing specialist medical care for approximately 248 000 citizens in its region. In addition, it provides specialist medical care for especially demanding cases for nearly one million people in Eastern and Central Finland. As university hospital, KUH consists also of research and medical training activities. KUH's annual statistics consist of 90 000 treated patients, 360 000 outpatient department visits, 2500

births and 22 000 surgeries. In total, KUH consists of approximately five thousand employees.

The case study in this thesis is limited between years 2010-2015, during which the pharmacy automatization procurement project was implemented. This includes phases of planning, the procurement process itself and the operationalization of the purchased products in different hospital units. During this time period, KUH has been carrying out the reform of its functions by redeveloping and renovating hospital facilities and organization. This went by the name MASTER PLAN-project, and the objective for modernizing hospital facilities are to enable new efficient processes and an increase in productivity. For instance, new pharmacy service, Kaari hospital and Säde hospital buildings were opened in 2015. Kaari hospital is functioning as a centralized facility for all the core clinical processes of KUH, including the surgery room; the recovery room; intensive care unit; the maternity ward; most of the surgical outpatient department; the dialysis ward; the teaching facilities; and the maintenance unit.

The KUH's operations were guided by the strategy of the Kuopio University Hospital Municipal Federation for 2009-2013, in which the business idea is to promote health. The strategy includes seven strategic targets: the effective and well-timed treatment, well-functioning service concepts, recognized research, the training and development activities, an evolving and capable staff, an attractive work environment, economic balance, and a strategy supporting management system. Worth of noting here is that KUH has not at least publicly indicated specific strategy for procurement. A Productivity Programme plan provided an update for 2013-2016 that still laid its foundation on the aforementioned strategy. The primary target of the Productivity Programme was to improve productivity and the effectiveness of health care in all health care units and their respective processes. The objectives of the Productivity Programme plan are connected to the discontinuing of the overuse of special health care and the reduction of growing municipal invoicing. The objective of the plan is to develop treatment paths and service logistics in a customer-

oriented manner without superficial barriers. Operational changes are targeted via partnerships, forming mutually agreed optimal service entities.

The Kuopio University Hospital Municipal Federation is managed by a board of directors comprised of representatives of the member municipalities. Highest decision-making power is held by a council that selects the board of directors. The Administrative Center, as one of the services areas in charge of the hospital operations, is operating under the board of directors, and it is led by the CEO of the hospital district. In addition to the administrative center, the service areas include clinical care services, comprising of all the core functions of patient work, clinical support services, providing services needed in patient care, and finally Kysteri that is a primary health care enterprise organizing the primary health care services in the municipalities of Vesanto, Leppävirta, Kaavi, Tervo, Keitele, Pielavesi and Rautavaara. These four service areas are divided further into service units.

In addition to the KUH's organizational units, KUH has outsourced its supportive services of patient care. The objective for outsourcing is to gain operational and financial benefit. The relevant outsourced functions, regarding this thesis, are procurement and ICT-services. The procurement service IS-Hankinta Oy is the responsible actor for all public procurements of the Kuopio University Hospital Municipal Federation. Istekki Oy is functioning as ICT and medical technology service provider for the Kuopio University Hospital Municipal Federation. Both units are publicly owned companies, owned by the city of Kuopio and Kuopio University Hospital Municipal Federation.

Pharmacy service in KUH

Main focus in this thesis is put on the pharmacy service unit. Pharmacy service in KUH operates under the clinical support services. In general, pharmacy service is part of national health care and its mission is to prevent and treat illnesses in a safe, exhaustive and economic manner. Hospital pharmacies and dispensaries are the responsible actors for pharmacy service in the public sector. The hospital pharmacy

service can be understood as a process of supporting patients' health and medical health care. The hospital pharmacy service tasks are based on Finnish medicines act and rules and regulation provided under the aforementioned law. In functional terms, the pharmacy service in hospital are responsible of the technical pharmacy logistics, storage, medical manufacturing, medicine purchasing and delivery to hospital patients. The hospital pharmacy in a broader sense means providing medicament to end-users that are the different hospital service units in KUH and the health care units such as health centres and hospitals in neighbouring municipalities. (Asikainen 2018: 50-51 & Medicines Act 395/1987)

The objectives for developing the pharmacy service, more generally but also in KUH, are related to improving safe and efficient processes to support health care. The focus of interest is in the perspective of process and development of processes that can be considered safe and efficient. This means minimal amount of medical errors in patient care, providing correct medical products in the correct time of treatment. For the hospital pharmacy, these indicate the indicate need for fluent pharmacy logistics and storage management, and also for safe production of medical products in the hospital pharmacy facilities. In KUH's case, the main challenges for developing the pharmacy service processes were related to their pharmacy service system and the facilities that were considered outdated and already fully optimized. At the time the facilities were not able to be modernized to answer the current regulations regarding medical manufacturing. (KUH Online Newspaper Henkreikä 2/2015)

3.3. Collection of data

The research method in this thesis is based on the qualitative research tradition. Reasons for the chosen methods are generally explained through the criteria of efficiency, economy, accuracy and reliability. Yin (1994: 84-86) considers the interview as one of the most important sources of case study as most case studies are

about human affairs that should be interpreted through the eyes of specific interviewees providing important insights into a situation.

In this thesis, empirical data consists primarily of conducted interviews with KUH's employees and an interview with the representative of a contract awarded supplier organization. The data consists a total of five individual interviews. The interviews were conducted during October and November in 2016. The first four interviews were held personally face to face in the premises of KUH in Kuopio, and these were complemented with one interview held via phone at a later stage. The length of the interviews varied from 40 minutes to two hours. Every interview was recorded with a digital recorder and transcribed in two weeks after every interview. All of the interviewees were ensured of anonymity. According to Hirsjärvi et al. (2000: 185) the quality of the interview is improved when it is transcribed in short time after the interview was held, especially if the researcher personally does both the interview and the transcription. Transcribed interviews of this study consist of 105 pages, yet two of the interviews also included sections connected to the research project of VTT, to which I conducted data collection also. Five interviews in general sense can be considered a relatively minimal amount and can thus be considered a limitation for the data collection. All interviewees, on the other hand, had breadth and in-depth knowledge about the whole procurement process. Two of the KUH's respondents also acted as representatives of relevant stakeholders, such as end-users of the procured products, in steering group meetings. This would highlight the responsible role in adopting a comprehensive perspective for the project. This could be considered to compensate for the small number of interviewees.

Regarding the process of conducting the interviews, I first approached the prospective interviewee via email, in which I introduced my research topic and the primary themes. After that I contacted the interviewee by phone to inquire the person's motivation to participate in the thesis research and also to suggest other persons, relevant to the respective public procurement process, to be interviewed. After that I further contacted other potential interviewees via email and afterwards by phone to

request and schedule suitable times for interviews. The first contact could be considered as essential, in a sense that there was no existing contact in advance, as the person proved to be the main responsible actor for the whole procurement process. The person was willing to suggest other interviewees that the person viewed crucial in providing a comprehensive understanding of the procurement project. This could thus be considered relevant regarding the limitations of the data.

All of the persons interviewed, from KUH and the supplier organization, were participating in the procurement process. Interviewees from KUH all represented different units of the hospital organization. The interviewee from the supplier's side attended the procurement process as a representative of the supplier team that worked in collaboration with KUH. As it was discussed with the first contact, the purpose of the interviews was to provide a comprehensive picture about the procurement from the perspectives of the relevant units, whose influence was considered crucial regarding the outcome of the procurement. The results of this thesis are based on the respondents' personal perception about the procurement process. It is thus necessary to recognize that the respondents might have had individual interests in emphasizing certain factors, and also in ignoring other issues. Thus, some issues regarding the procurement might have been prone to be offered minimal attention while others might have been over-emphasized. These challenges are not fully exceeded, although the benefit of having representation from all of the crucial units in interviews might in some points balance this disparity.

In addition to interviews, a variety of documentation material about the KUH's pharmacy automation project is utilized. The material consists of KUH's and the contract awarded supplier's own online publications, local and national news reporting about the issue, the KUH's annual reports and expert presentations about the procurement project. This material collected from the internet.

KUH provides an online publication, named as Henkreikä, where current and relevant issues regarding the hospital district are discussed. Publication includes three

issues annually. Topics related to reform of pharmacy supply service were discovered from five issues between 2012-2015. The KUH's annual reports are also published annually online. Annual reports from 2014 and 2015 were considered in this thesis as they included topics of pharmacy automation. Contract awarded company Newicon provides an online newspaper on their website. The procurement of comprehensive solution for pharmacy automation was discussed in one issue during 2015 and it was thus considered relevant in this thesis. As a result of internet search, two presentations about KUH's pharmacy supply service reform made by KUH's employees were found, and these are also utilized in this study. Found news reporting, used in this thesis, include one article from Savon Sanomat and one from Finnish Public Broadcaster YLE.

Documents and news are utilized in providing background for the case and also in the analysis of results, alongside data from interviews. The documentation was considered to provide supportive knowledge about the operationalization of the procurement project and developed products that gained a fair amount of local and national attention due to their level of novelty. The collected documentation and interviews are scrutinized through qualitative content analysis. This is further discussed in the following sub-chapter (see chapter 3.4.). The rest of this sub-chapter is about conducting of interviews.

Semi-structured interviews

The interviews were chosen as primary data for this thesis as there didn't exist relevant documentation about the implementation of KUH's comprehensive solution for pharmacy automation. In that sense, the study required a separate collection of data. Hirsjärvi & Hurme (2009: 34-35) note that the interview provides a flexible method for providing data, and it is thus suitable for many research purposes. The interview is regarded beneficial for instance when the objected phenomenon is relatively little studied, and it is difficult to predict the given answers, or when answers of the interviewee are aimed to be situated in a broader context. In this study, the main objective is to find out how KUH pharmacy service procured comprehensive

solution for pharmacy automation and how different endogenous institutions affected the results of the procurement. As there existed little information about the project, the interview would provide a useful tool to answer the questions by asking the relevant actors personally. In this sense, the interview could be regarded a more useful tool compared to, for instance, surveys or observation in this case.

The interviews, for the study, were conducted as semi-structured interviews. A semi-structured interview resembles an in-depth interview in its construction of openness. A semi-structured interview is constructed on around certain essential themes, chosen beforehand, and specified questions created within these themes. In methodological sense, a semi-structured interview highlights persons' interpretation on issues, given significances given for certain issues, and how significances are created through interaction. (Tuomi & Sarajärvi 2009: 75; Hirsjärvi & Hurme: 48)

According to Tuomi & Sarajärvi (2009: 75) there are no strict rules regarding the uniformity of the interview process in a semi-structured interview. It can be considered to be a matter of taste if questions, during the interviews, are asked strictly in the same manner and order, or asking the same questions from all respondents. The level of uniformity in semi-structured interviews are varying from one research to another. They still point out that the interviewer cannot form questions without any rules. The primary target is to find meaningful answers in accordance to the purpose of the research, the research problem setting and the objectives of the research. In regard to this study's research questions, it was important to gain a comprehensive view and perspective about the practical implementation of the procurement project.

The conducted interviews in this study can also be considered as elite interviews. According to Alastalo & Åkerman (2010: 373), Elite interview, in case study research, refers to a situation where the purpose is to collect information about the studied phenomenon or process from a respondent. The focus of interest, thus, is not in the person him- or herself, but in the information the person is supposed to

have. The choosing of respondents is based either on their institutional status or other implication in the studied process.

The semi-structured interview can be organized with certain themes that are derived from the theoretical discussion and the framework of the studied phenomenon (Tuomi & Sarajärvi 2009: 75). In order to provide a comprehensive understanding of the interviewees' perspectives of the public procurement process and enhance the quality of the interviews, I drafted two separate interview question forms. The first set of questions were pointed to the KUH employees as the procurers' representatives. The other set of questions was pointed to the awarded company as the supplier. For the procurer organisation the interview consisted of four themes: 1) the premise of procurement, 2) innovativeness in procurement and risk management, 3) collaboration and responsibilities between actors and 4) measurement and evaluation. For the supplier organisation the interview themes consisted of three themes: 1) transparency, 2) responsibility and learning and 3) risk management and evaluation.

The themes in both of these two interview formats were primarily similar, yet due to different roles, the procurer and supplier represented in the procurement process, the questions were formed differently in order to fit better the perspective the interviewee had in the procurement process. The persons interviewed from the procurer's side were all asked the same questions, but difference is made regarding the interviewee representing the supplier. All in all, these themes were set to answer the research questions how KUH procured the comprehensive solutions for pharmacy automation and how did endogenous institutions affect the outcome of the procurement project.

Atmosphere in the interview situations appeared to be relaxed, and the interviews were attempted to be held in as much a conversational manner as possible. One essential limitation concerns the inexperience of the interviewer. The interviews, conducted here, were the first of their kind for research purposes. This have affected the interview situations, as due to excitement the ability of the interviewer to react

quickly to changing topics and notions was not ideal, and thus can be considered to have had a somewhat weakening effect on the data collection. The topic of the interviews, including the complex technical terminology of pharmacy processes and automation technology, was totally new at that moment. This affected the ability to conduct certain immediate follow-up questions during interviews.

3.4. Qualitative content analysis

In this thesis, qualitative content analysis is applied in order to scrutinize the primary data that consists of five interviews and collected documentation. Qualitative content analysis can be described as a method in analyzing documentation in a systematic and objective manner. The objective of this type of method is to provide a description on studied phenomenon in a condensed and general form. This would enable providing conclusions and finding meanings from the documentation. The clearer the form constructed from the data, the more sufficient conclusions are possible to provide. (Tuomi & Sarajärvi 2009:103-104, 108)

As the primary data is the main source of portrayal of the studied phenomenon, the objective of the analysis is to provide a clear verbal depiction of the phenomenon. With the content analysis, the aim is to organize the primary data into a clear and compact form without losing its essential information. Content analysis thus clarifies the used data, which then enables the formation of clear and reliable conclusion from the studied phenomenon. (Tuomi & Sarajärvi 2009: 108)

The analysis is operated on throughout the whole process of qualitative research. In qualitative content analysis the collected data is dismantled, newly conceptualized and collected to a new logical entity. This procedure is considered to face also critique. Qualitative content analysis is an instrument for providing data in a meaningful form. The incompleteness is highlighted here, as the procedure itself is not sufficient enough to be considered as conclusions of results. In other words, the reformulation and classification of information *per se* cannot be regarded as conclusions. (Tuomi & Sarajärvi 2009: 108)

Compared to other types of analysis, qualitative content analysis, as means to discover meanings from reorganized data, was considered the most suitable for this thesis. For instance, the discourse analysis differs from the qualitative content analysis by its purpose to focus on the meaning itself rather than figuring out how meanings are formulated. Also, in the breakdown of data, the emphasis is put on the quantitative perspective of data description. (Tuomi & Sarajärvi 2009: 104, 106) In this thesis, the purpose is to describe and understand a unique phenomenon that is the KUH pharmacy service's procurement of pharmacy automation solution. The purpose, thus, is not to concentrate on statistical generalizations or meanings themselves about the phenomenon.

Qualitative content analysis is a useful instrument in cases where data is consisting of large numbers of documentation that might be unstructured. The collected data from interviews comprised a total of 105 pages. The analysis of the results started off by constructing two classifications. The first classification related to the different phases of public procurement of innovation process, and the second related to the endogenous institutions. The data was looked through and relevant points were added to different classes. This was done manually, as in, that no appropriate software was used.

The first classification was comprised in a following manner: identifying the need for public procurement of innovation, the implementation of the procurement process, the results of the procurement and procurement effects for the procurer and the supplier. This classification was set up to answer the first research question, *how KUH pharmacy service implemented the procurement of automation solution.*

In order to answer the second research question, *how endogenous institutions affected the outcome of the procurement project*, another classification was constructed. This followed the theoretical discussion of endogenous institutions as success factors by Rolfstam (2013). The classification included expertise on public

procurement procedures and relevant law, the technical competence for the specification, the coordinating competence for cooperative demand, managerial control, allocation of resources for public procurers, political support, commitment from other institutional actors, the appreciation and understanding of public procurement procedures, institutional match, technology champions and choosing the universally best solution.

The aforementioned notions would fit in a theory-guided or an abductive approach of a qualitative content analysis (Tuomi & Sarajärvi 2009: 117). In theory-guided content analysis, units of analysis are chosen from the data and the existing theory is used as support in the analysis of results. In this approach, the data is firstly approached in terms of the collected material, and only afterwards, as the analysis has progressed, the data is linked with the existing theoretical discussion. In other words, the existing knowledge and its effects, about the phenomenon are recognized to have influence in the analysis. It is still not considered as theory testing but rather a tool for new ways of thought. (Tuomi & Sarajärvi 2009: 96-97, 117)

Some challenges were identified in the classification. The process itself wasn't considered to be straight-forward as it required a lot of interpretation. Some parts of the data could have been suitable to multiple classes similarly. This was especially relevant in the second classification of endogenous institutions. Endogenous success factors by Rolfstam (2013) in many ways describe the different aspects of collaboration and coordination in public procurement of innovation and these are in certain ways not fully distinct from each other. It can be said that the challenge here refers to the consistency of interpretation.

4. RESEARCH RESULTS AND ANALYSIS

In this chapter the research data is scrutinized from the basis of set research questions. The research results are analyzed from the perspective of an existing theoretical framework. The analysis is divided in two different thematic sub-chapters that are constructed on classifications derived from the theoretical framework. The objective here is to identify relevant meanings and observations about the operationalization of the procurement project and about how endogenous institutions affected the outcome of the project. These are in some points further supported by quotations. The quotations are translated from Finnish to English in a manner where the subject matters remain clear. All of the quotations are translated by the author.

The first sub-chapter discusses the operationalization of the KUH pharmacy service's procurement of comprehensive solution for pharmacy automation. The analysis, in this chapter, is set to answer the first research question: How the procurement of pharmacy service automation in Kuopio University Hospital was implemented? The second sub-chapter then focuses on the organization-specific factors that have had impact on operationalization of the procurement. Here, the analysis is set to answer the second research question: how did endogenous institutions affect the outcome of the procurement processes? The sub-chapters are constructed in a manner where the respondents' perceptions are brought up with regard to different classifications. At the end of this chapter, a short discussion is provided on the findings. The discussion is connected to the theoretical framework of the study.

4.1. Comprehensive solution for automatization of pharmacy service

4.1.1. Identifying needs and challenges

In 2013, the KUH's pharmaceutical service initiated a procurement process that aimed for modernizing hospital pharmacy processes. The procurement process was considered as a comprehensive solution for pharmacy service automatization. The

procurement was set up to answer different needs and challenges the hospital pharmacy was facing at the time.

The development of the pharmacy service was based on a process perspective. By focusing on the development of pharmacy service processes, the pharmaceutical service was set to enhancing patient safety and medicine supply. These include especially the minimizing of mistakes in the medicine supply chain, where patients are given right medicaments at right time and the production of drugs is completed safely. Effective pharmacy processes, on the other hand, refer to the medicament storage and storage management, where the logistics of processes are economically effective. The processes of hospital pharmacy service can be considered complex, and they are prone to human mistakes. These mistakes, on the other hand, can lead to severe harm for patients and also cause additional costs for the health care system.

The current pharmacy service processes were considered fully optimized, and thus were not able to answer the aforementioned challenges. The overall processes of drug storage, including the ordering and accounting, were primarily based on manual processes and handwork. The utilization of technology and automation were considered as a solution for reforming the whole pharmacy process in KUH to answer the needs.

The promotion of new technology was seen as a solution for a variety of reasons. Firstly, technology was considered to answer the need to minimize human mistakes in pharmacy service processes, by providing, for instance, automated control of medicine supply, brand name, active ingredient of drug, and form and strength of doses. The responsibility in pharmacy processes was highlighted on all levels of hospital operations. One interviewee noted that mistakes in these processes often lead to catastrophe.

On the other hand, technology was considered to improve the ergonomics of pharmacy work. The pharmacy processes, in its certain phases, are not only physically

demanding but also can cause static stress. Robots and automation were identified to help in removing the demanding work phases from employees, and thus improving overall well-being at work.

Finally, technology and digitalization of processes help to provide real time information and documentation of pharmacy service functions and management. In the old system, the documentation of medicine supply was done manually that would have led to inaccuracy and lag in pharmacy processes. New software, for pharmacy automation, and digitalization were identified to improve the documentation with standardized procedures. This, on the other hand, would improve the efficiency of the processes. The main objective here, with digitalization, is to integrate and manage the information of medicine supply, the treatment of patients and patient management. The respondents described that the integration of different data bases, with suitable software, robots and new products are placed under an umbrella to describe the comprehensive solution for pharmacy automation. One respondent pointed out the development of internet of things as a crucial element in the development of pharmacy automation:

> *" -- from that point on, this might be familiar term to you also, I mean, internet of things can be seen as a synonym. We ought to, or let's say our challenge is to utilize internet of things as good as possible. When you think it from the point of information governance, we ought to govern the information in order to provide some sort of digitalization. In that sense digitalization would enable us again manage these [pharmacy supply] processes --"*

The development of new technology, on the other hand, created a new intrinsic need related to the learning of new pharmacy supply processes. The interviewees pointed out the importance and the challenge of change management, in the adoption of completely new pharmacy supply processes. In order to operationalize the new system, the employees in the pharmacy unit and the hospitals wards ought to learn how the comprehensively automated pharmacy processes function in order to be able to develop the minor practical pharmacy supply processes and routines.

In addition to the objective of reforming hospital pharmacy processes, the respondents' notion of the need for the automated solution was also critical in the sense of general development of hospital modernization and reforms. Automation and digitalization were observed to be the direction hospitals, on the international level, are heading towards. This trend was also seen as a possibility for promoting the local health care technology cluster by providing the need for technology development.

The aforementioned notions provide information about the reasons for the public procurement of innovation project in KUH. The procurement of pharmacy automation can be seen to have derived from the intrinsic need to invest in a new pharmacy supply system in order to enhance patient safety and the efficiency of pharmacy supply processes. By noting the incapacities related to the old system, the development of new technology was considered as a solution. In this sense, KUH produced demand for a technological pharmacy supply solution that didn't exist at the time. In other words, this meant demand for an innovation. According to Edquist et al. (2015) reading on the typology of different public procurement of innovations, this case can be considered as a direct public procurement of innovation. This means that the procurer, responsible for the purchasing, is also the end-user of the new system.

Due to the identified needs for the procurement, it is evident that innovation was not considered as the primary goal of the procurement, but it was finally seen as the most profitable choice in order to improve patient safety and pharmacy supply efficiency. Identified reasons in this case support the discussion about policy goals of public procurement of innovation in a sense that procuring innovation often in practice is not regarded the primary goal per se, but is useful, and sometimes necessary like in the KUH's case, in improving the efficiency of public services or answering other societal challenges faced by public agencies (see e.g. Valovirta 2015; Zelenbabic 2015; Edquist & Zabala-Iturriagagoitia 2012; Edler & Georghiou 2007).

4.1.2. Implementation of procurement project

The idea and vision for the new system were initiated by the pharmacy service unit in cooperation with their clients. According to the respondents, the overall development of automation started by surveying the relevant journals of the pharmacy field and visiting other hospitals in order to create ideas of the desired technical products, their functions and processes. Market dialogue was also implemented to discover to markets' potential and capability in providing a solution that would satisfy the described needs. The conditions for the development of a new automated system was identified to be difficult. One interviewee pointed out the difficulties in a following manner:

> *" And we were sort of in a bad or good position, whatever, when we started to plan [pharmacy supply automation] there didn't exist any practical knowledge anywhere. This was very much in the margin. There were some in a sense that we could proceed with planning, but this was quite a bit of pioneer work --"*

In order to provide data of the current condition of the existing pharmacy system, measurements of efficiency and a survey regarding the challenges were made. The data thus provided information regarding the identified challenges and needs and was further utilized in drafting of functional specifications, and also in the process of granting finance for the project. Functional specifications were drawn up in collaboration with the relevant units from KUH and this took approximately six months. The description of specifications was done entirely internally without external consulting. The consolidation of different needs was highlighted, especially regarding issues related to different software and information systems.

The formal request to participate in negotiations pointed out the following functional specifications, challenges and needs: the utilization of automation was considered as a strategic objective, for both the hospital pharmacy and the Kaari hospital renovation, where patient safety and improvement of medicine supply and

treatment is emphasized. The specifications included the types of products and software and what type of functions they should have in regard to the pharmacy processes. The command for software integration between the procured system and different hospital information systems were addressed. The obligations also included commitment, from the supplier, to provide maintenance service and commitment to collaboration between the KUH's stakeholders regarding the development of a solution.

The tender procedure took place in 2013 and it went by the name of procurement of comprehensive solution for pharmacy automatization. The pharmacy service unit operated as the responsible procurer. According to one respondent, the new automation system was essentially targeted to be procured as one comprehensive solution from a single supplier. Multiple procurements of single products were also considered, but these were recognized as too laborious, and was considered to hold risks. In case where every product was purchased from separate suppliers was identified to lead to problems especially in the integration of different information systems. As one respondent indicated, it was a question having a single collaborative partner being able to develop a one solution for the automatization.

The tender procedure was implemented by utilizing competitive dialogue. Negotiations included meetings in two stages during the spring and summer of 2013. These negotiations were preceded with a market dialogue, where interested bidders were invited to discuss potential solutions and capabilities companies had and have discussion on what demands, and the ideas procurer had. According to one respondent, the market dialogue had an influence in the formulation of a functional criteria for the call for tenders.

Overall four bidders were invited to the competitive dialogue. According to one respondent, the bidders consisted of national and international companies. Every bidder was able to provide some sort of solution for the procurer's first set of formulated criteria. Accordingly, these varied significantly from each other, from a comprehensive fixed system to a single solution for certain parts of automatization,

yet without the capacity to provide a solution to every aspect presented. After the negotiations, the procurer further specified its functional criteria for the call for tenders. Finally, only one bid was received, thus leaving no room for choice.

One respondent noted that the technical requirements for the products were specified along the different stages of negotiations. Criteria for the solution were thus clarified and tightened from what started from loosely defined ideas to strict technical specifications. The technical specifications included for instance demand for bar code function for products and electronic medicine cabinets with a pass-through option. The comparison of prize was also playing a role in the procurement. At the end, mutual trust between KUH and potential supplier about the requirements was gained, and thus a signing of a contract was seen possible. Supplier gave promise for delivering the planned solutions, and also committed to collaboration with KUH in product development of new products and the comprehensive solution.

Respondents implied that competitive dialogue was considered as a good method, when dealing with purchase of a complex system, and where no one had an exact picture on how the new system would function in practice. Negotiations provided a platform for the procurer and the prospective suppliers to have a better understanding on the demands and capabilities the participants held. For the procurer, negotiations were necessary in order to be able to provide sufficient criteria for procurement. One respondent provided a sharp encapsulation:

> *"-- This competitive dialogue is good in a sense that you cannot form that sort of tender document like in regular tender procedure where you are aiming for as detailed criteria as possible in call for tenders, to my mind it is completely impossible, at least my imagination would not be enough to depict all [functional specifications] what it should include -- "*

The respondent from the supplier's side pointed out to similar reflection about the competitive dialogue:

> *"-- it was very transparent in a sense that we fairly well told certain things and limits regarding contract for instance prize of the procurement, and of*

course we told that this cannot be made in this prize, and if something was not defined in contract or their requirement specifications we would inform about additional costs or no additional costs at all regarding certain things or changes, so in that sense it was very fair game on both sides I think. "

Overall, the aforementioned issues highlight how the procurement project was implemented during the development phase and the tender procedure. The findings indicate the vast amount of work resources and time that preceded the tender procedure. With regard to the whole time line of the procurement project, the development phase covered the majority of the work and time resources. This, on the other hand, highlights the difference between regular procurement and public procurement of innovation. Also, the planning and development phases in this case highlights the theoretical discussion of procurement process where different phases are sometimes intertwined. In general, KUH's can be seen to primarily follow the public procurement of innovation process depicted by Edquist et al. (2015) and Edquist & Zabala-Iturriagagoitia (2012).

The procurement implementation, in the KUH's case, also highlights innovation-friendly public procurement practices (See e.g. Uyarra & Flanagan 2010). The development phase included for instance market dialogue and evaluations in order to survey possible solutions. The procurer was able to transform the identified challenges and needs into functional specifications. Theoretical discussion often highlights the difficulty of this procedure. This was also recognized in the KUH's case. Multi-professional collaboration and expertise, and the idea of having a common goal seemed to be relevant in order to come up with functional specifications. Issues regarding implementation and collaboration are further discussed in the endogenous institutions chapter.

4.1.3. Results of the procurement

The contract was awarded to a local pharmacy technology company Newicon Oy at the end of 2013. According to the respondents, the contract was signed for 8 years and it included a provision for the supplier to commit in collaboration with KUH in

developing targeted pharmacy automatization products and a software system. In addition to development, the contract included the production of guidance and maintenance for the new system. The overall value of the procurement was approximately 2 million euros.

As a result of the procurement, multiple products were developed and purchased. The procurement included a storage and retrieval robot, 45 automated dispensing cabinets, a robot for compounding intravenous medication, a robot for the infusion liquid package handling. In addition, the procurement included the development of software for an automated dispensing cabinet and integration of KUH's different information systems to support automation. Together these aforementioned products were considered to comprise an umbrella under which the new pharmacy supply system would operate (see Figure 1). An interviewee from the supplier's side depicted the novelty of the solution in the following manner:

> *" If we would consider it as consisting of subprojects, we already had this storage and retrieval robot, so to say an already commercialized product that two of those have been sold in Finland. And for KUH, we delivered a totally new [storage and retrieval robot] that included product development but compared to other [products] I could say it was almost like modification."*
>
> --
>
> *"All the other [products] that we delivered to KUH were started from zero."*

The storage and retrieval robot was situated in the new pharmacy facilities. As a part of the comprehensive solution, this robot was already a commercialized product, yet there were modifications regarding the size and scale compared to products directed to private pharmacy companies. Here the function is based on input automation where the drugs are stored via function of conveyors, robots and automated identification. The medicine identification is based on a barcode and camera sys-

tem. The barcode system is adopted as identification technology in the whole processes of pharmacy service. The storage and retrieval robot provides an automated functions of drug collection and packing. The robot's capacity in the KUH is between 70 000-80 000 medicine packages.

The automated dispensing cabinets that were developed as a result of procurement can be considered new to the world products. The cabinets were situated in new Kaari hospital facilities intensive care unit, the maternity wards, the emergency ward and the operating rooms. The development of the cabinets was conducted with the end-users, namely hospital workers in the wards. The cabinets consist of a module-based assemblage, meaning that refrigerators, warming cupboards and waste bins etc. can be installed differently according to different interior needs. Cabinets are, also, designed in a sense that they can be filled from outside maintenance corridors. In other words, they are installed in wall structures so that the filling of the cabinets can be done outside the clinical operation rooms. This was an idea and criteria that came from KUH, and the awarded supplier was the only prospective supplier that was interested and capable in developing this type of system. The cabinets include an information system that was also developed with the end-users during the procurement process. They inform and guide drug collection with led lights and every collection is automatically documented. The cabinets are connected with the storage management making new medicine orders automated. The filling and the usage of the cabinet is based on a barcode system, and identity management works with personal smart card and a password.

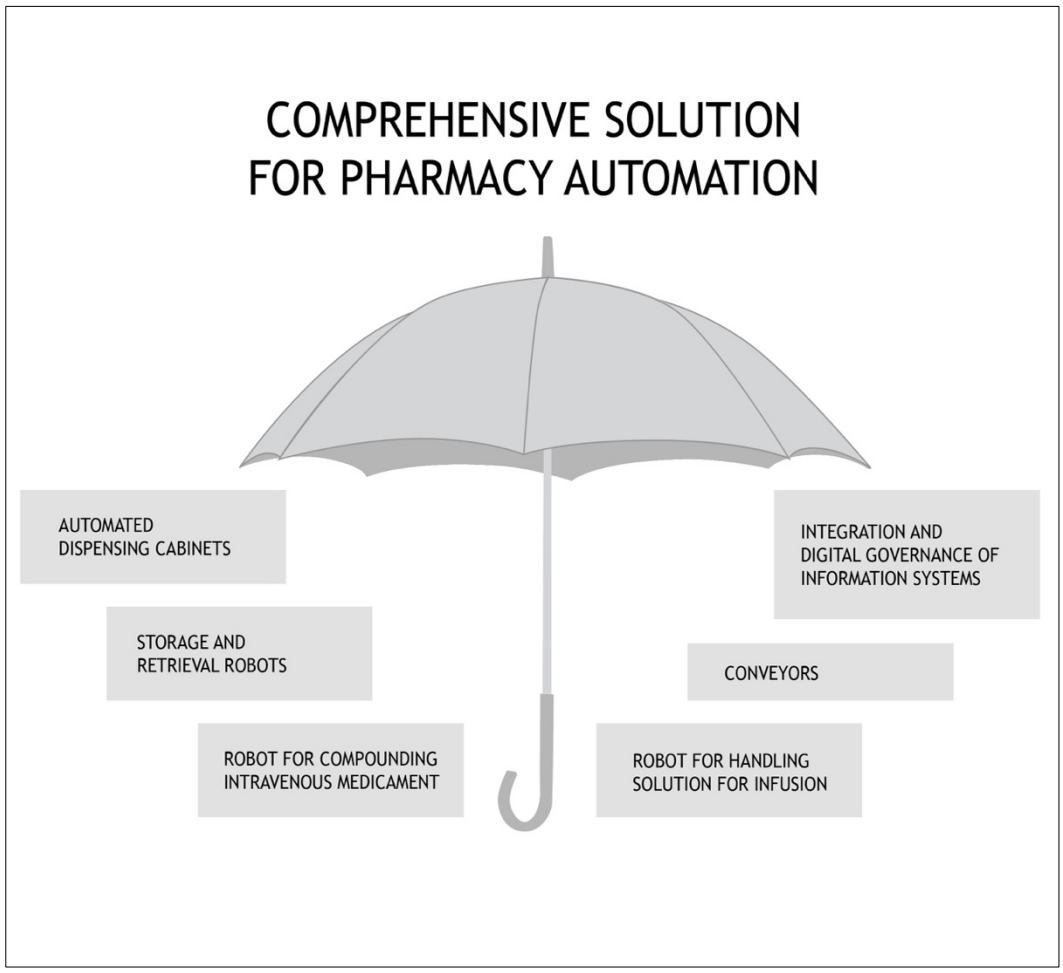
The robot for compounding intravenous medication was another new to the world product that was developed as a result of the procurement. The robot enables standardized mass production of intravenous medication of antibiotic and cytostatic doses. The robot operates in a laminar flow cabinet in a cleanroom and it is capable of producing approximately 60 doses per hour.

The robot for solution for the infusion package handling is also considered a new solution that was developed in collaboration between KUH and the supplier. The

system is integrated with many robotic solutions such as a lift system, a cardboard squeezer and machine vision and a robot arm. The idea for the system started from the objective of non-cardboard in the Kaari hospital. Responsibility for the infusion liquid boxes was pointed to the pharmacy service as the new Kaari hospital didn't have suitable storage space for those. Forwarding of the infusion liquid boxes was done in a decentralized manner before by many workers but now it is centralized in the hospital pharmacy. It is considered to decrease the cardboard waste in the wards and also to increase ergonomics.

The integration of different information systems, such as medicine supply and treatment information including patient management information, were playing an important part in the procurement. It was highlighted that in order to gain the full potential of the automation, in enhancing efficiency of the pharmacy supply processes, the governance of different information systems needs to be developed. Digitalization and the internet of things were emphasized in developing the governance and management of the comprehensive system. The aforementioned, alongside the robotizing of the pharmacy supply processes, have produced new work practices and processes, and job descriptions for the pharmacy service. In other words, new pharmacy supply service was created.

Figure 1. Comprehensive solution for pharmacy automation (Naaranlahti 2016)



The notions above encapsulate the developed and purchased products that together comprise the new automated pharmacy supply system. The results indicate the successful implementation of the procurement in a sense of that the procurer set an objective to purchase a single comprehensive solution from a single supplier. The results of the developed and purchased products also indicate, in general, the successful choices and operations made during the development phase and the tendering procedure. These are further discussed from the perspective of endogenous institutions later on.

In accordance to Edquist et al. (2015), the developed and purchased products reflect the character of innovation in a public procurement project. Overall, the procurement project has elements of both radical and incremental public procurement of innovation. With regard to the storage and retrieval robot, it can be considered to resemble both an incremental and a radical innovation. The product was already commercialized, and it has been in the markets for private pharmacies. On the other hand, it included completely new modifications regarding the size and scale of the structure and its functions, and it was especially targeted to hospital pharmacy environment. The KUH's case was the first reference for this new modified storage and retrieval robot. It can be regarded radical and adaptive in a sense that it was a completely new modification of a commercialized product, and it also required innovative elements in adapting it to the new conditions.

Apart from the storage and retrieval robot, all of the products can be considered radical innovations in accordance to Edquist et al. (2015). These new products consisted of automated dispensing cabinets, a robot for compounding intravenous medicament and robot for solution for infusion package handling. The automated dispensing cabinets also included a new software that was developed during the procurement. These can be considered as entirely new to the world products and they are created as a result of the process. In order for the supplier to produce these products, research and development was required. In this sense, the KUH's case resembles a classic case of demand-driven innovation pointed out by for instance Rolfstam (2013). By using its demand for a completely new pharmacy system, KUH opened up the markets with new products and a stimulation of innovation.

The results of the case also imply to the creation of service innovation. Due to the new products and overall the digitalization of information systems, new-to-the-world pharmacy supply processes were created. This notion could be considered to highlight the fundamental change the radically new products often entail. In comparison to the old system, the pharmacy supply processes were entirely reformed in a sense that certain job descriptions were reformed, and new job descriptions were

created. The latter refers to, for instance, increasing the importance of technicians in supporting certain functions of the pharmacy supply processes.

4.1.4. Effects for procurer

Some already observable effects were noted. As a result of the automation, the pharmacy service has now real time information regarding the amounts, the users and the locations of medicament throughout the hospital. Related to the aforementioned, one identified economic benefit about the automated dispensing cabinets is the reforming of obligatory storage of drugs. In the old system, the pharmacy unit was forced to hold unsuitably big obligatory storage of medicament in its facilities due to usage management. In the new system, automated dispensing cabinets have made it possible to decentralize the obligatory storage in the wards. The drugs in the automated dispensing cabinets are property of the hospital pharmacy until employees from the wards log the acquired drugs into the medicine information system. This is considered to have economic benefits for the pharmacy service. It is also considered to have benefits regarding the optimization of space.

Improved ergonomics was also one of the desired effects of the procurement. According to the KUH's annual report (2015), the automation has decreased the amount of physically demanding workloads. Also, the desired effects regarding the automated dispensing cabinets related to the idea of removing pharmacy logistics processes from nurses. This means that ordering and filling of the cabinets is included in the services of the pharmacy workers. Regarding the robot for compounding intravenous medication, the ergonomical benefits are related to mass production of drug doses. The system also has helped in minimizing exposure for toxics and increasing product safety and centralization.

The measurement of effects was highlighted. Measuring the successfulness of the procurement was considered to be based on multiple factors. Primary focus is put on the productivity and efficiency measurements. All interviewees from KUH pointed out to challenges in measuring the productivity of the new system. The

optimal productivity of the new system is not revealed immediately after its installation, as learning and mastering new pharmacy service processes require time and resources. The results of productivity are revealed with delay and this was also considered as a risk for the public procurement of innovation. As one respondent indicated, patience was seen as crucial in distraining productivity effects:

> *" And on the other hand, it was considered important that [data for evaluation] was not collected immediately after operationalization of new system so that operations and processes would be stabilized a bit and learning of new processes improved, and as there was many other things simultaneously."*

As a part of the procurement process, comparative studies and measurements were initiated before the purchasing in order to provide data from the old system to which the information regarding the new automated system can be compared to. Analysis and surveys were done about the development of work profiles and processes in the wards, such as work time usage, health economic analysis and reports of ill-effects, and what kind of effect do these have on medicine costs. The realized advantage of the new digitalized system is that it automatically provides data measurements of its processes. The repayment period was considered to be between five to seven years. One interviewee also pointed out the importance of management in providing comprehensive measurements of effects:

> *"-- but there was that kind of an objective set that the repayment period [for automated pharmacy system] would be five to seven years and time will tell if this estimate is correct, but therefore it is largely a question of management that you get what you measure and maybe [automated pharmacy system] should be measured the whole time and evaluate. This is not necessarily realized by itself unless it is strongly managed."*

One interviewee pointed out discussions with the supplier about the completion of the technical requirement specifications:

> *" It also includes a certain perspective of evaluating the success of the procurement that we are still having discussions and dialogue with the supplier*

about how our requirement criteria have been realized. In other words, how much it is still left open regarding the criteria, and what have been our objectives of the procurement, meaning how those have been realized."

--

"That latter, the realization of technical specifications in a way shows how successful the procurement has been --"

Two interviewees also pointed out the effects of learning from public procurement of innovation processes as beneficial and also about learning from the development of new processes. The implementation of the pharmacy service automation project was considered an important experience and it gave a lot of knowledge about complex procurement processes for any future procurements.

The aforementioned notions highlight the different effects of the procurement for the procurer. An important consideration regarding the effects for the procurer is that how well the results have answered the identified needs and challenges. Overall the procurement can be considered successful as the pharmacy supply service in KUH is currently fully operational and it is delivering its obligatory functions of supportive services for the clinical functions of the hospital. Immediate effects were also recognized and these related to the efficiency and ergonomics of the pharmacy service.

One important notion regarding the effects of the procurement was related to the measurement of effects. In the KUH's case the measurement of effects related essentially to the productivity of the new system. The measurement of overall benefits and effects of the new system's productivity was considered challenging. First of all, the measurement of the new system was considered to require a variety of resources such as time and management.

The capability to recognize the overall productivity of the new system requires a long period of time and thus, patience and trust from the stakeholders. This was

also considered as a risk for the procurement itself as there would have not been evidence for the success available immediately after the awarding of the contract. This is in line with the public procurement of innovation literature (See e.g. Edler & Georghiou 2007) implying that implementing public procurement of innovation is often considered difficult because of its incapability to provide evidence of success immediately or sometimes not delivering success at all.

The measurement of productivity also requires sufficient resources of evaluation and change management. As it was pointed out in the interviews, the evaluation doesn't happen by itself but needs clear planning what type of information is needed and against what the information it is compared to. In the KUH's case, the measurements of productivity are primarily based on the comparison between the old and the new system. This can be considered to further highlight the importance of the development phase in the innovative procurement project. In addition to the management of evaluation, change management was emphasized. In order to gain full capacity of the new system, employees ought to be educated and adapted into the new system. This means the learning of new work processes and job descriptions. It is only after the employees have mastered the new processes the full productivity of the new system is able to be measured. Yet again it was highlighted that this requires time.

4.1.5. Effects for supplier

The procurement effected the supplier in many ways. First of all, the automation procurement in KUH enabled the company to develop and commercialize new products, the automated dispensing cabinet and the robot for intravenous medication. KUH, thus, worked as a first big reference for the supplier with regards to the developed products and the larger scale storage and retrieval robot. The company gained a first reference of a comprehensive solution of pharmacy automation for a hospital. the supplier interviewee reflected on the outcome of the procurement:

> *" It is of course, aside from the issue, we paid a lot more of the automated dispensing cabinets delivered to hospital than KUH. Meaning that it went*

very much negative for us. But on the other hand, this enabled us to provide a product that was a step forward for us in the process."

The company has expanded rapidly after the procurement regarding its staff size and company value. According to the respondent from the supplier, the procurement has increased the company's number of employees and thus enhanced its know-how capacity. During the procurement, the company consisted of 13 people and now it has grown to 57 workers. This is especially relevant in competence of the pharmacy, as they currently employ pharmacists and a head dispenser. The interviewee from the supplier's side pointed out that compared to the situation before the procurement in KUH, the company's know-how increased significantly, and it is now less dependent of outside knowledge in developing their products:

" Yes, let's say it [learning of new technology and processes] was a huge step for us overall, in regard to whatever subprojects that we delivered, it wasn't even increased tenfold but in fact it was created, I could say the growth was infinite, so very difficult to compare because earlier we didn't really have the know-how."

This has, in turn, opened up new health care technology markets for the company in both national and international levels. They have managed to sell developed products and provide investments to the company. The supplier's side respondent reflects on the benefits of having a big reference regarding the automated dispensing cabinets:

" Now with this reference it has turned out to be this way that as we visit other hospital districts, we know they would take this automated dispensing cabinet for a trial run, it is thus now that we have queue regarding the cabinet for next spring and all the way to the summer --"

"As their [new pharmacy products] development were started, it might have been a good that we didn't have or let's say KUH's own personnel was acting as experts here, which was very important and was playing a very important role, and as a matter of fact all these products, that we provided,

were to answer their needs and wishes, and these include certain things that are also similar to other hospital districts and how they see these things --"

The aforementioned quotation points out that standardized requirements and regulation pharmacy processes, especially in Finnish hospitals, can be now seen as a benefit for the company as the developed products were produced in the first place in line with these guidelines. This can also be considered to reduce the uncertainty related to the selling of new products. Collaboration with KUH has also benefited the company's marketing capabilities. Due to the close location and trustworthy collaboration between KUH and the supplier, KUH has been portrayed as a model environment for new potential buyers.

The aforementioned results point out different positive effects for the supplier. First of all, the procurement project had direct effects on innovation as the purchased products were developed and finally commercialized as a result of the procurement. As a result of the KUH's case, the company were able to open up to markets. Also, the utility of the newly commercialized products was strengthened as KUH now provides evidence that the products are functional. By being able to develop the products in collaboration with KUH, the products fit the demands of national standardized regulations from a day one, and thus would be suitable for other hospitals immediately. After KUH's case the other hospitals, nationally and internationally, have showed their interest towards the new products further highlighting the effects of the process.

4.2. Endogenous institutions as success factors

Following Rolfstam (2013: 144), ´Success factors´ in this context are understood as conditions that if met in a particular case appear to work to contribute to the success of public procurement of innovation projects. I will next discuss success factors identified to be relevant in the KUH's case in providing and furthering the conditions for executing the procurement in a successful manner.

4.2.1. Technical competence for the specification

The application of functional specifications, in expressing the desired outcomes of the procurement, are often stressed as a factor for the successful implementation of innovative procurement (Rolfstam 2013: 159). This was also relevant in the KUH's case, where the procurer was able to formulate functional specifications, for the automation system solution, during the tender negotiations. One interviewee pointed out:

> *" But here of course the cheapest [automated pharmacy supply solution] was sought, the price was indeed in the background, but other things also meant here much more in the procurement, that is to say what type of solutions this supplier could offer."*

Functional specifications were considered to play a much more important role than the price of the solution itself, even though the procurer was in search of the cheapest price. At the end of negotiations, the discussions on the functional aspects of the procurement were further developed with the technical criteria. This supports Rolfstam's (2013: 159) notion that despite the importance of functional specifications, the procurer must still have a clear understanding of the intended outcomes. As the solution was affecting a variety of stakeholders in hospital, the attendance of different units' representatives, in providing their perspective on the needs for functional specifications, were considered important. As one respondent noted:

> *"-- and then we had end-users from the wards, the intensive care unit,the surgery unit and the pediatric unit. We had [end-user] representation in the designing of the call for tender, but also during those negotiations, and there was a doctor, the representatives of the municipality, the representatives from anesthesia and nurses and so on. And those were, I don't even remember all, but mainly end-users, pharmacy, the KUH information management, the IT department ISTEKKI. I could say these were the most important actors that attended the tender procedure."*

This quotation provides an example of the problems identified in functional specifications during collaborative innovation projects. Even if the procurer is capable

of providing functional specifications, collaborative projects usually involves different rationalities with different needs that might prevent the application of the considered competence. The problem is thus related to the challenges of coordination. (Rolfstam 2013: 161)

4.2.2. Managerial control

The operationalization of the procurement was based on standardized project management structures. The project organization in the procurement process was structured in a sense that every organizational level in KUH were participating in the decision making. The project organization consisted of three groups: the project group, the management group and the steering group. The service unit operated in the project group; the service area, the representatives from the supplier, the pharmacy service, the project group and the procurement unit in the management group; and the hospital directors, the board of directors and the chairmen of council in the steering group. These notions are in line with observation by Rolfstam (2013:162) noting that the outcome of public procurement of innovation may be determined by the quality of the project management, requiring sufficient allocation of management resources in a situation that is possible to manage.

All interviewees highlighted the functional collaboration between different stakeholders as a crucial element in the project management. The collaboration was considered easy due to a feeling that everyone understood to have a common goal that was to develop the automation solution constituting to a shared high motivation. The project management process was never considered to be prone to crises.

One aspect of project management concerns the different risks associated with innovation (Rolfstam 2013: 163). A variety of risks were identified in this case. These included risks regarding the construction schedule, technological risk, resistance to change as risk and dysfunctional collaboration. These notions about of risk management can also be considered to be in accordance to endogenous institutions as barriers by Rolstam et al. (2010). As already identified as risks associated to the

procurement project, institutional barriers can be considered intertwined into risk management. For instance, endogenous institutional barriers such as organized skepticism relates to resistance to change and dysfunctional collaboration, and problems with demonstrating the value of innovation relates to technological risks.

The risks about schedule related to the uncertainty of the strict renovation project timetables of the Kaari hospital and how the developed pharmacy service technology would fit in these schedules. As automated dispensing cabinets were integrated in the structures of the Kaari hospital operation rooms, it was essential to coordinate the installations in line with other projects. With regard to the new hospital pharmacy facilities, the risk of schedule was not such a relevant issue than in Kaari hospital. Overall the installation of products was scheduled successfully before the operations of the hospital were scheduled to commence.

The technological risks are related to the novelty of a new solution and the products included in the solution. The interviewees pointed out the major risk in purchasing of products that didn't exist at the time, and that there were no certainties that the products finally will work as planned. This was especially relevant during the development and tendering phase. There was no earlier user experience regarding the automated dispending cabinets, robot for compounding intravenous medication and the robot for solution for infusion package handling. One respondent noted that it is also a risk being the first user of new products as it not possible to predict how far the developments would continue in the future. The technological risk can also be considered as endogenous institutional barrier implying to problems with demonstrating value of innovation (Rolfstam et al. 2010). The KUH's case shows that there would be problems of showing the value and hence justifying the adoption of new the products.

The resistance to change by the end users was also considered as a risk concerning the operationalization of the procurement, and also in bringing forward new processes and operation models. As a university hospital is a large-scale organization consisting of a variety of units, it is not evident that all employees warmly welcome

changes in the operational processes. Making participation in the piloting and development of new products possible for the end-users, the resistance to change was considered possible to consider. These notions relate to organized skepticism as an endogenous institutional barrier. It was identified that making all relevant stakeholders of the new system participate in the procurement, this would help to provide proof about the utility of the new system. One respondent pointed out the challenges of large hospital organization in the adoption of new processes:

> *" And that is something that needs to be taken into account, that is probably natural feature of workplaces in good and bad. I would say usually it is in bad, but sometimes it can also be in good, I mean resistance to change. In other words, it is necessary to prepare to situations where some people are not eager to come along. We didn't have this in pharmacy unit, our workers came along rather well, as we have, our workplace consists of 80 employees, so it is relatively small unit, so if people here would somehow become inspired, it would still stay together. But then you realize that those end-users in the wards, there are much more of those who oppose [change in pharmacy supply processes] and it is there more divided that some people like innovations and the new system and some people don't. Some people say directly that yet again these new systems are for our headache, and that doesn't this ever end, there is no sense in this."*

One respondent also brought up the dysfunctional collaboration between different stakeholders as a potential risk. With the possibility of dysfunctional collaboration turning into arguing, it was critically considered to decrease creativity that is considered essential in innovation. Good interaction between relevant stakeholders was considered to reduce the risks. The respondent emphasized the importance of combining different competences of one another and being able provide an environment for open ideas. Two respondents pointed out the importance of collaboration and trust in risk management:

> *" We don't have any sort of infernal skills, nobody has those, yet of course I have recognized that some individuals from the supplier's side have capabilities to be innovative, but in any case, the creativity is still created in a way where we together start to think sincerely and through simple stupid*

questions, writing things down on paper and so on thinking about that solution. And then in order to create that sort of situation, it is necessary that are no squabbles. There cannot be any, you can have disagreements and sometimes a group can disagree on things, but not that type of great fighting, that is to say it is necessary to have trust. If there is no trust and therefore the partnership would not be natural and fluent, then this type of public procurement of innovation can turn into a nightmare. In other words, products are poor and they are not useful."

"And in this case as we talked about quite an innovative project and risks that it involved, good interaction and sort of direct collaborative attitude would provide tools to tackle challenges and therefore prevent those to be refined as risks even though we probably don't have skills doing it smoothly --"

4.2.3. Allocation of resources for public procurers

The allocation of resources had greatly contributed to the success of the procurement. Before implementing the procurement process, a group of KUH representatives from different units, with the lead of the pharmacy service, provided a variety of estimates about the condition of the old pharmacy system, and a mapping of what challenges it contains. For the given results estimates were made how the automation could provide answers for the occurring challenges. The aforementioned estimates worked as ground for the acceptance of the budget pointed to the project by the line organization of KUH and finally also the board of directors and the council.

The finances reserved for the comprehensive automation system was primarily based on a separate budget pointed specifically for the procurement project. The financing of the automated dispensing cabinets was an exception as they were budgeted from the Kaari hospital project's hospital device budget. The reason for this was that the estimated budget for the automated dispensing cabinets was discovered to be insufficient. The decision to cover the process through two different project budgets were decided through successful negotiations.

Providing a sufficient budget for the project was considered to support the risk management aspect of the process. One interviewee noted:

> *" Well we didn't really, we only prepared then in a way that we provided the funding and tried to draft the plans, what we would start to do, in a sort of strict manner that we would try to stick to realism so to say it is certainly some sort of continuous preparedness."*

The acceptance of the budget was based on throughout estimates regarding reform pharmacy service processes, and it was backed by political support of the KUH's board of directors. During the tender negotiations, the budget frame of the project played an important criterion to be discussed with the potential supplier. The awarded supplier was the only one capable to commit to the set budget frame.

The aforementioned notions are in line with Rolfsltam's (2013: 163-164) observations about public procurement of innovation often requiring resources that are not typically included within operative routines and budgets. In addition to money, as an essential form of resource in an innovative procurement project, the provision of meaningful conditions for the procurers to work with the project can also be understood as a crucial resource.

4.2.4. Political support

According to Rolfstam (2013: 164-165), PPI as an exceptional activity, requires political support and decisions in order to enable the procurers on the operational level to carry out the work. This is in line with the KUH's case, as political support contributed strongly to the success of the automation system project. Political support was highly relevant in the aspects regarding the issues of funding and the hospital's strategic objectives. In general, political support was considered to be the presupposition for every new project in general in KUH, as one interviewee pointed out:

" Our every project what we are implementing are checked that they are supporting KUH's strategy and the whole policy statement of the hospital, and that there are LEAN-principles included and also many other benefits of course."

Regarding the construction of new facilities for clinical functions of KUH, the aim of the hospital was to minimize the usage of paper and cardboard. This strategy considered also the pharmacy service and the automation system procurement that was developed to be in line with the hospital's strategy of decreasing the use of cardboard.

One respondent pointed out that the political support in the KUH's projects ought to be in line with the productivity programme that consists of the strategic principles for economic productivity improvements. This was considered to be a highly relevant issue for the KUH's board of director's that would be show interest towards how initiated projects in KUH would improve productivity. Related to the principles of the productivity programme, the repayment period for the new automation system was considered to be five to seven years, and this estimate was considered to be satisfactory for the board of directors.

Political support for pharmacy service reform can be seen to have connection to other strategic reform projects operated in KUH simultaneously. It was noted that large organizational development, renovation and construction projects tend to provide more successful opportunities in implementing reforms such as an automation system solution than, for instance, regular development of operations. In the KUH's case, the renovation and construction of hospital pharmacy and clinical operation facilities of the Kaari hospital opened up the opportunity for developing pharmacy automation. This trend is also visible in other current development projects in Finnish hospital pharmacies (Metsämuuronen et al. 2018: 114).

4.2.5. Commitment from other institutional actors

According to Rolfstam (2013: 165-166), in public procurement innovation that involves development of new technology, the success might be co-determined by other institutional actors such as users and consumers of futures products alongside the procurer and the supplier. Multiple units in KUH participated in the development and implementation of the automation system during different phases of the procurement process. These included personnel from the pharmacy, the wards, the ICT-unit and the hospital administration. The aforementioned actors were participating, for instance, in the tender negotiations and formulating needs for the procurement and functional specifications during the tender process. They also represented an important role in the development of new pharmacy service processes and the piloting of new products. One interviewee highlighted the importance of multi-professional collaboration and learning as a success factor for the implementation:

> *" It is based on learning and always to a combination of multi-professional skills, as there are many, there are information specialists and governance employees and then there are workers from the wards, medical staff and pharmacy workers and technical engineers, so it is also based on knowledge from multiple professions --"*

As for the purchased products that didn't exist at the time of signing the contract, the significance of piloting was important. The procurement included piloting of the automated dispensing cabinets and the robot for compounding intravenous medication, into which the end-users of the products participated. The end-user participation in the development of automation system was essentially crucial in the piloting of the automated dispensing cabinets.

As a part of the KUH's reform of clinical hospital facilities, a simulation room was built to test and evaluate functional and technical qualities of the future facilities including space planning. Regarding the automated dispensing cabinets, multiple

prototypes were delivered to the hospital's simulation facilities, where end-users were able to test and give feedback for the supplier about the functionality and usability of the cabinet functions and the software it included. The supplier then further developed the cabinet and the software on the basis of the feedback. One respondent reflected on the collaboration between the supplier and the end-users in a positive manner:

" -- and on the other hand, it is to say here that the supplier was very receptive and all these pilots and other things, they listened very carefully to the feedback from the end-users and I also think they reacted to the feedback, meaning that was not only about listening but they also acted, and in that sense there was agility in the process, --"

The piloting of new products played a positive role in creating trust between the procurer and the supplier. As the contract included commitment for collaboration in developing the comprehensive solution, the possibility to influence the development of products in practice was considered to increase the confidence for successful implementation of the procurement. One interviewee indicated that it decreased the feeling of uncertainty regarding the operationalization of the project. A respondent from the supplier's side ended up in similar conclusions, highlighting the high motivation of nurses in developing their work description and improving medical safety by committing to providing feedback.

4.2.6. Institutional match

The success of the procurement was also due to an institutional match between the procurer and the supplier (Rolfstam 2013: 167). In general, the overall needs and objectives of the procurer and the supplier, for the project, were fulfilled. For the procurer, the objective was to provide a comprehensive solution for pharmacy automation, delivered by a single supplier. The KUH's pharmacy service had a vision and a strategy for automation solution, yet they needed a technology partner capable of providing solutions for the needs of improving patient safety and efficiency of

pharmacy processes, and also for the functional needs the new solution would demand.

On the other hand, the supplier was able satisfy its needs of expanding their competence and markets by developing new health care technology products and solutions for private and public pharmacy actors. One respondent pointed out that the supplier's aim was to expand their business, especially with the automated dispensing cabinets, their primary objective was to develop and commercialize new products and solutions:

> *" It is like that, and the supplier's own research and development again, they have had a certain vision. They have been pioneers in pharmacy robotics and they have sold those much before. Now they wanted to expand their business to automated dispensing cabinets and other pharmacy automation products. And their need was then, they knew that KUH is a reliable hospital district partner, so they dared to go for [product development] and take business risk about being able to develop a certain kind of a product that would apply to other places also. It was good that they were convinced as we benefitted it also in a way that we would get products that answer our needs as much as possible, but also benefit it financially as it included product development."*

In order for the development process, the supplier, at the time, was dependent on the knowledge of the hospital pharmacy regarding the pharmacy service processes and the needs and challenges they were facing. In other words, the supplier didn't have the necessary information in-house, which in turn has changed following the project.

Due to the awarding of the contract, the supplier gained access to the hospital facilities and processes, where they were able implement research and development necessary for the products that would be standardized with demands of the general Finnish hospital requirements. By providing products immediately with the necessary standards, required in Finnish hospitals, they would be more qualified in future

purchasing processes. In addition, through the successful implementation and commercialization of new products, the company gained a critical reference for their future business.

4.2.7. Technology champions

The success of the procurement, in general, was also identified to be dependent on individual actors. All interviewees indicated towards the pharmacy service unit, and especially the pharmacist as the manager of the unit, as a crucial and innovative actor in the development and initiation of a comprehensive solution for the automated system. The pharmacist played an important role throughout the process by being able to vision the future pharmacy service processes, but also being able to coordinate relevant information from experts. This is in line with Lawless & Price (1992) indicating technology champions as a key to the implementation of technologies. For instance, a respondent from the supplier's side noted:

> *" This [procurement] is indeed personalized very much during the initial phase and still really is very much to the pharmacist, who was, and this my personal opinion, he is a kind of a visionary, who has seen many other things that is important, and his sort of a support, and I assume this support also is extended to directors of KUH and -- "*

According to the supplier's side respondent, the relationship between the pharmacist and the CEO of supplier company was relevant. Being able work directly with the hospital pharmacy, they were able to gather information about the hospital pharmacy processes and needs that they would from other ways never have gotten. This was essentially crucial for the pharmacy technology company that wanted to expand their pharmacy technology markets from the private pharmacy markets towards the public sector health care.

4.2.8. Choosing the universally best solution

The supplier as a local and already known actor was also considered to be an important factor for the success of the procurement. According to one respondent, there would have been more suspicions if the potential supplier would have come from abroad. This suspicion related especially to the fact that the set functional specifications would require development of new products as markets in international level weren't recognized to have the required competence at the time. Reflecting on this, one respondent indicated the suspicion in a following manner:

> *" These big international companies, they are not, they are not so agile for this type of, to come here in the periphery of Kuopio to develop new products, they are more interested about many other things."*

The benefits of the supplier's local position related essentially to collaboration in the product development phase, and also in the organization of the maintenance of the system. Meetings between the procurer and the supplier were easy and fast to organize due to the close distance between the two organizations. Yet, it was still noted that these benefits didn't have a significant meaning in the tender call and the following negotiations. The KUH's case can thus be seen to be in line with the notion of choosing the universally best solution regardless of its origin (Rolfstam 2013: 169). The local political rationale, of promoting local companies, could evidently be an essential contrast to the rationality of universally best solution. As the aforementioned quotation reveals, this contradiction was not evident in the case as the awarded supplier was the only capable actor to answer the functional specifications. That is to say, in this case, the local supplier ended up providing the universally best solution.

4.3. Summary of findings

the results of the analysis and the observations identified have been discussed previously in this chapter. In this sub-chapter, the aforementioned findings are shortly

summarized and discussed in the context of the research questions and the theoretical framework.

In order to answer the first research question, *how the procurement of pharmacy service automation in Kuopio University Hospital was implemented*, it was considered important to identify the need for the procurement; how the procurement was implemented; what type of products were produced; and how the procurement effected the procurer and the supplier. Overall, the procurement of pharmacy automation in KUH derived from an intrinsic need to invest in a new pharmacy supply system in order to enhance patient safety and the efficiency of pharmacy supply processes. Development of new technological products and their integration was considered as the most suitable solution as the old pharmacy supply system wasn't able to provide answers for the identified future needs. As a result of this, the KUH pharmacy service was able to introduce demand for a technological pharmacy supply solution that didn't exist at the time. The KUH's case thus reflects direct public procurement of innovation (see Edquist et at. 2015), in which the responsible procurer is also the end-user of the solution. The KUH's case also indicates the theoretical discussion of different policy goals, often associated to public procurement of innovation (see e.g. Valovirta 2015; Zelenbabic 2015; Edquist & Zabala-Iturriagagoitia 2012; Edler & Georghiou 2007). The primary goal of the procurement was to improve the pharmacy supply services. Innovation per se was not the goal, but it was consequiently considered necessary in order to satisfy the aforementioned need.

The implementation of the procurement project followed the basic principles of public procurement of innovation process by Edquist et al. (2015) and Edquist & Zabala-Iturriagagoitia (2012). The project included many different phases that at certain points were intertwined. This includes, for instance, the planning and development of the solution during the whole life cycle of the project. The KUH's case emphasizes the importance of the planning phase that required a vast amount of work resources and time before the tender procedure. This highlights the difference

between regular procurement and public procurement of innovation. The procurement project included innovation-friendly procurement practices as pointed out by for instance Uyarra & Flanagan 2010. The development phase included for instance market dialogue and evaluations in order to survey possible solutions and formulate functional specifications.

The implementation of the procurement also highlights innovation-friendly public procurement practices (See e.g. Uyarra & Flanagan 2010). The development phase included for instance market dialog and evaluations in order to survey possible solutions. The procurer was able to transform the identified challenges and needs into functional specifications. Being able to introduce functional specifications required multi-professional collaboration and expertise between the KUH employees. Also, an idea of having a common goal seemed to be relevant in order to come up with functional specifications.

As a result of the procurement, a comprehensive automation solution for pharmacy supply service was developed and produced. The solution included multiple products and a software. Overall, the developed and purchased solution can be characterized as both a radical and an incremental innovation as earlier pointed out by Edquist et al. (2015). The characteristics of both incremental and radical public procurement of innovation relates to the storage and retrieval robot that was an already commercialized product, yet it consists of modifications regarding size and scale. It was first product of its kind in a hospital environment. All the other products reflect the characteristics of radical innovation. These new to the world products consisted of the automated dispensing cabinets, the robot for compounding intravenous medicament and the robot for solution for infusion package handling. The automated dispensing cabinets also included a new software that was developed during the procurement. This comprehensive solution would resemble a classic case of a demand-driven public procurement of innovation (see e.g. Rolfstam 2013), in which public agency uses its demand to stimulate innovation and open up markets for new products. the KUH's case also resembles a service innovation in a sense that the pharmacy supply processes were entirely changed due to the new

technological products and digitalization. That is to say this case was able to stimulate multiple innovations even though it was not the fundamental purpose of the process.

Overall the procurement can be considered successful as the pharmacy supply service in KUH is fully operational and it is delivering its obligatory functions of supportive service for the clinical functions of the hospital. Some immediate effects were also recognized and these related to the efficiency and ergonomics of the pharmacy service. The measurement of the desired effects was still considered challenging, especially when it comes to measuring the full productivity of the new system. The measurement was considered to need both time and management resources. The evaluation of productivity requires a long period of time and thus the patience and trust from the stakeholders. The uncertainties related to the productivity evaluation was considered as a risk in the KUH's case. This is in line with the public procurement of innovation literature (See e.g. Edler & Georghiou 2007) implying that implementing public procurement of innovation is often considered difficult because of its incapability to provide evidence of success immediately or sometimes not delivering success at all. The results also indicate that the measurement of productivity also requires sufficient resources of evaluation and change management from the procurer organization. It was considered important to have clear plans regarding the information collected and in addition to educate and adapt employees into the new system.

The results also indicate multiple effects for the supplier. Overall, the procurement enabled the supplier to commercialize multiple products. The procurement thus had direct effects on innovation. The KUH's new pharmacy system would provide a practical example of the utility and functionality of the products for other potential buyers. Collaboration with KUH enabled the supplier to develop products that would fit immediately the set national standard requirements in Finland. The procurement can thus be seen to establish new markets for the supplier. After the KUH's case the other hospitals, nationally and internationally, have showed interest towards the new products which would highlight the effects.

This thesis was also set to discover endogenous institutions and how these have affected the outcome of the procurement. Multiple endogenous institutional success factors were identified. These related to the technical competence for the specifications; managerial control; allocation of resources for public procurers; political support; commitment from other institutional actors; institutional match; technology champion and choosing the universally best solution. These endogenous success factors are in line with Rolfstam's (2013) study, where similar types of factors were identified. The KUH's case thus would indicate the usefulness of endogenous institutions in describing successful practices related to public procurement of innovation.

In the KUH's case, the successful implementation of the procurement project related to multi-professional collaboration, the expertise of various units and trust. The earlier analysis indicates, for instance, that the procurer was able to introduce functional specifications in the tender procedure, where proposed solutions were playing an important role alongside the price. The procurement project was constructed by standards of project management that consisted of different groups. As Rolfstam (2013) points out, risks management is also associated to successful management of public procurement of innovation. In the KUH's case different risks were identified and coordinated. Some risks, such as technological risk and resistance to change, could also be considered as endogenous institutional barriers as pointed out by Rolfstam et al. (2010).

A sufficient allocation of resources contributed greatly to the success of the procurement. Here, the interesting notions relate to the fact that the procurement project was financed by two different and separate budgets. This is in line with Rolfstam's study (2013), in which it was pointed out that public procurement of innovation often requires resources that are typically not included in routine operations. The financial resources for the procurement were allocated by a political decision. Political will and support thus played an important role in the successful

operationalization of the procurement project. Rolfstam (2013) observes that political support is required due to the exceptional nature of public procurement of innovation. The pharmacy automation procurement was generally also considered to support the existing strategic programme of the KUH.

The commitment of other institutional actors played an important role in the procurement project. This is especially relevant in piloting processes of product development. For instance, the end-users, from different wards, participated in the piloting of the automated dispensing cabinets by testing the prototypes and providing feedback. This is in line with Rolfstam's (2013) study, where it was indicated that in a public procurement innovation that involves development of new technology, the success might be co-determined by other institutional actors such as the users and consumers of the future products alongside the procurer and the supplier. The piloting also further enhanced trust between the procurer and the supplier. KUH and the supplier awarded the contract created an institutional match, where both actors were able to satisfy their respective needs, thus providing a so-called win-win situation.

Finally, the findings indicate that the pharmacist of the KUH can be considered as a technology champion that played a crucial role for the development and implementation of the procurement. In line with a study by Lawless & Price (1992) the pharmacist can be considered a key actor to the implementation of new technologies in this particular case. The findings also suggest that the universally best solution was chosen. This is based on the notion that the awarded supplier was the only one capable of providing a desired solution. The supplier being a local company would evidently be in contrast to the rationale of the universally best solution as pointed out by Rolfstam (2013). In the KUH's case, the local company also proved to be the universally best.

5. CONCLUSION

This thesis focused on scrutinizing a current trending phenomenon in many countries' public sectors namely the public procurement of innovation. By identifying the topic's relative novelty, the lack of an established field of research and the current political interest, the general objective of this thesis is to contribute to the research of public procurement of innovation. In other words, the primary objective of this thesis was to add knowledge about the public procurement of innovation practices and potentially provide advice on how implementation of public procurement of innovation could be improved in the future. In order to do so, this thesis provided a single case study of public procurement of innovation, in the context of a Finnish hospital pharmacy service. The chosen case related to recent implementation of public procurement where the Kuopio University Hospital's pharmacy service unit reformed its pharmacy supply processes by procuring a comprehensive solution for pharmacy automation.

The objective of this study was to answer two research questions: *How the procurement of pharmacy service automation in Kuopio University Hospital was implemented* and *how did endogenous institutions affect the outcome of the procurement processes?* In order to answer these questions, interviews were conducted during autumn 2016. Additional documentation, regarding the procurement, were also collected to support the views received from the interviews. A theoretical framework about public procurement of innovation and institutional approach in public procurement of innovation was constructed. This theoretical framework was utilized to form classifications for the analysis of results. Qualitative content analysis was utilized in analyzing the results.

The identified results, for the first question, indicate that the KUH pharmacy service unit initiated a public procurement of innovation due to an intrinsic need to improve its patient safety and the efficiency of its pharmacy supply processes. The pharmacy service unit in KUH is part of the clinical support area, and it is responsible for the

organizing and management of medicine supply processes. This is related to the logistics, storage and purchasing of drugs, and also to the supply of medicaments to patients. The identified need was based on the fact that the existing pharmacy supply system and its processes were fully optimized and could not provide further solutions for the identified challenges. New technology, automation and digitalization of processes were identified as potential solutions. This provided a demand for the development of new technology and processes, and thus innovation. The procurement project included innovation-friendly procurement practices such as market dialogue and functional specifications for the solution. The tender procedure was organized as a competitive dialogue. As a result of the procurement, multiple products were developed and commercialized. For the procurer, the new system can be considered to have improved efficiency of the pharmacy supply. Yet, the measurement of final productivity was considered challenging due to long term process of the evaluation. For the supplier, the procurement affected its functions directly by providing an opportunity to create and commercialize new products. Procurement with KUH was the first big reference for their products and it also opened up new markets for their products developed in the process. In a general sense the procurement was a win-win situation for both actors. Overall, the studied case supports the existing idea comprised by many researchers that public procurement can influence innovation even when innovation was not considered as the primary goal of the public procurement.

The second research question reveals several endogenous institutions that have affected the outcome of the procurement project. The endogenous institutions, identified as success factors of the procurement, related to the technical competence for the specifications; managerial control; the allocation of resources for public procurers; political support; commitment from other institutional actors; institutional match; technology champion and choosing the universally best solution. Also, some endogenous institutions as were identified that required sufficient coordination in order to tackle them. These notions can be seen to link with and support Rolfstam's (2013) categorization of endogenous institutions. The KUH's case indicates the rel-

evance of endogenous institutions in successful implementation of public procurement of innovation. In general sense these were related to multi-professional collaboration and trust. The results of the analysis would thus indicate that endogenous institutions could provide a useful perspective in describing organization-specific factors that are crucial in operationalization of public procurement of innovation. Also, institutional approach would provide a perspective to be considered in developing further practices and policies for public procurement of innovation.

The aforementioned notions would provide some potential directions for future studies. One aspect could be to provide more systematic research about public procurement of innovation from the perspective of an institutional approach. As it is indicated in this study that success factors and obstacles for the operationalization seem to be located in the organizational level, an institutional approach could provide a useful tool in adding more knowledge on the public procurement of innovation policy development. These notions are also evidently connected to individual behavior in public agencies' work environment and culture that are guided by variety of responsibilities and accountabilities associated to civil service. Thus, it would be interesting to further discuss how the promotion of strategic perspective of public procurement and innovation are shaping the changing roles of public procurers in the context of public governance.

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