

End-user Involvement Enhancing Innovativeness in Public Procurement. Evidence from a Healthcare Procurement

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Abstract. This paper examines public procuring, aiming to increase understanding of how the living lab approach and end-user involvement create innovativeness and enhance public procurement results, providing effectiveness and better solutions. The empirical findings are based on a real-life unique public procurement in the healthcare field where the living lab approach was used through the product testing phase, which was included in the procurement procedure. The selected group of users performed product testing in a real homecare environment. The quality of the product formed based on product testing played significant role for the first time in public healthcare-related procurement in the City of Oulu, Finland; the winning solution was not the most inexpensive but the one obtaining the highest quality scores by users. The findings suggest that product testing as a part of public procurement should be more widely adopted, while considering the proper balance of the price-quality ratio that ensures innovativeness. Based on the findings, we propose a framework for product testing as a part of public procurement through an open procedure.

Keywords. Public procurement, Living lab, Innovation, Healthcare

1 Introduction

Innovation is defined as novelty or reform with significant productivity, economic efficiency, or other value-adding effect on the organization's performance (Yliherva, 2006). Accordingly, innovation is seen as something original, new, and important that breaks in to, or obtains a foothold in a market or society (Frankelius, 2009). The roots of common Western innovation policies can be found from Schumpeter's theories: according to Schumpeter's early thoughts (1934), innovations that lead to economic growth can be new products, production methods, markets, material sources, or operation forms of the organization. Lee et al. (2012) see innovations necessary for improving public sector's productivity and new more cost-effective operations. One of the key drivers behind the utilization of new differentiated public procurement approaches is the desire to create new innovations (Edler and Georghiou, 2007). An extremely prominent source for innovations is customer interfaces propitious to the exchange of know-how, information, viewpoints, experiences, cultures and resources (Yliherva, 2006). The possibility to enhance the involvement of end-users in the

procurement process is partly the result of advanced technology, and partly citizens' increased willingness to participate in the co-production of the services (Bovaird and Loeffler, 2012). According to Uyarra and Flanagan (2010), public procurement has a potentially crucial role in enhancing the innovations in Europe, thus creating wellbeing. As a growing trend in public procurement is to try new methods to add innovativeness, e.g. through end-user involvement, a new opportunity has appeared for living labs to provide their expertise of user-driven methods and tools to be applied in public procurement. Thus far, the involvement of end-users in the procurement process has raised some interest and attempts in practice as well (Ng et al., 2013).

Innovative procurement is currently part of the everyday lives of skilled procuring entities alongside other procurement. However, innovative procurement - in which the best possible long-term solution needed by a procuring entity is being sought after in such a way that the supplier is able, through the implementation of the procurement, to improve their products and services - is not yet common. Thus, there is need to research a few existing cases to form an understanding. In this research, we address the innovative public procurement *by a thorough exploration of a public procurement case, to increase the understanding of how the living lab approach and end-user involvement can create innovativeness, and possibly enhance public procurement procedure*. The unit of analysis is a public procurement case in which the living lab approach was applied through product testing. It is commonly known that the development and enhancement of public procurement has several beneficial impacts on e.g. the economy, growth and commercialization of innovations (Manninen, 2015). Therefore, evidence from successful innovative public procurement can be seen as valuable for different stakeholders. Although the field of public procurement often appears as complex and multi-faceted, which limits the ability of an individual study to cover it in its entirety, this paper may bring novel insights for policy-makers to enhance public procurement. Accordingly, the paper contributes to the scientific discussion on public procuring but also living labs, increasing understanding of how living labs can be exploited in public procurement.

Through long-standing cooperation and several successful co-development projects with the city as a background, a local living lab OULLabs¹ was selected to participate in a public procurement of the City of Oulu. The aim of the "Keyless homecare" process was to implement public procurement of a keyless mobile door-opening service for homecare in a new, innovative way including *product testing* and user involvement. The aim of the city was to purchase a service that would allow homecare personnel to open patients' doors via a mobile device. The background for Keyless homecare procurement was needs-based and problem-based: homecare nurses used to carry a huge keychain which led to different inconveniences and security issues. Procurement was aimed to solve the problems related to nurses' daily homecare work in the city. The Keyless homecare product testing phase was implemented within an EU-funded, living lab ecosystem developing project. The project team planned and implemented the product testing phase of the procurement, led by usability specialists. A user involvement online tool was additionally used to collect feedback from homecare employees who tested the keyless door-opening

¹ www.oullabs.fi

service in a real environment. As a result, innovative public procurement of a mobile door-opening service in which product testing had a significant role for the first time, was successfully performed. Furthermore, as a result of the process, the winning mobile door-opening service, which was not the most inexpensive one but the one with the highest quality and highest scores given by end-users and usability specialists through product testing, was put to use.

2 Related Research

2.1 Innovative Public Procurement

The public procurement of infrastructure and services can be regarded as essential for maintaining society's economic and social structures (Lähdesmäki and Kilkki, 2008). Conventional competitive bidding procedures performed in public procurement have experienced an increasing pressure for change in recent years, including increased demand for services due to the aging population, challenging economic situation and new technology solutions (Jamali, 2007; Pekkarinen et al., 2011). According to Aho et al. (2006), innovative public procurement has emerged, alongside the changing procurement environment, as a central theme in the 19th century's demand-driven innovation policy both at the national and European levels. In particular, the new market-oriented public procurement models not only aimed at generating innovations, but also accelerating the spread of innovations by strengthening the demand for new solutions, have attracted attention. Public procurement has multitude of social goals to serve, and its use as an innovation tool entails various challenges (Uyarra and Flanagan, 2010).

The general benefits of innovative procurement have been considered, in addition to increased innovation, to produce increased higher overall efficiency of procurement, quality, efficiency, risk management and transparency (Yescombe, 2007; Majamaa et al., 2008), and enhanced dynamics of innovation (Edler and Georghiou, 2007). Public procurement is also seen as a demand-side-oriented tool for stimulating innovation (Aschhoff and Sofka, 2009). At best, public procurement can have a greater incentive effect on firms' innovation activities than conventional public sector-funded R&D activities. The greatest barrier for the implementation of innovative procurement is not the legal elements guiding procurement, but the procuring entities' ability to explore and apply procedures enabling the development of providing innovative solutions. In addition, innovative procurement often involves higher risks, the consequences of which should be identified in advance.

Although public procurement has already been exploited as a tool to promote innovativeness in certain countries, innovative public procurement can be viewed as a rather new phenomenon. The most advanced countries in the development of innovative procurement have been the United Kingdom and the United States. Although Finland was recently ranked as the second most innovative country in the world in the World Economic Forum's report 2015-2016, the only category in which it did not score in the Top 10 was the public procurement of advanced tech products, where it was ranked 33rd (Schwab, 2015). In Finland, the promotion of innovation has generally not been the main goal of public procurement even in new procurement,

but rather a minor aim of the projects. The choice of an innovative procurement method in public procurement projects in Finland has been justified mostly based on achievable savings instead of innovativeness. As not only exclusively existing demand gives rise to innovation, essential for innovative purchase models is a dialogue between end-users and other key stakeholders considering the functionality of a procurement. Demand-driven public procurement can reach for higher customer orientation in procurement. The public procurement of infrastructure and services should not be judged according to mere decision-makers' interest, but based on end-users' desires. In the present research, the interaction between the actors in an innovative procurement is seen as a triad of the customer, the supplier and the value co-producer (Havila et al., 2004; Majamaa et al., 2008).

A major problem in public procurement is that the practitioners often lack a clear understanding of who the client of the public service is and, therefore, do not know whose needs they are supposed to satisfy (Bovaird, 2007). Although no generally agreed upon definition of public procurement partnerships is known to exist (e.g. Lawther and Martin, 2005; Yescombe, 2007), some market-based models like public-private partnership (PPP) and pre-commercial procurement (PCP) have gained vast interest from both the researchers and practitioners in the public procurement field. The most vital aspect of describing innovations within the PPP model is the added value the innovation creates for the end-users (Yliherva, 2006). If the PPP method were chosen more regularly based on the value gained by the end-users, the cooperation, commitment and networks would more often be considered the benefits of the model instead of the financial justification (Lähdesmäki and Kilkki, 2008).

2.2 Living Labs and Public Procurement

One solution for tackling problems related to public procurement is innovative public procurement practices that change the way suppliers are being invited to supply pre-existing solutions in an improved way (Knutsson and Thomasson, 2014) and allow for new actors such as living labs to be engaged in the purchasing process. The concept of collaborative innovation, presented by Hartley et al. (2013), emphasizes inter-organizational, multilevel, and cross-sector collaboration between a range of stakeholders from the public, for-profit, and non-profit sectors, as well as users and citizens.

The living lab approach emerges in between the concepts of open innovation (Chesbrough, 2006) and user innovation (von Hippel, 1986). Leminen et al. (2012) see living lab as a network that integrates both user-centred research and open innovation. Living labs are physical regions or virtual realities, interaction spaces, in which stakeholders form public-private-people partnerships (4Ps) of companies, public agencies, universities, institutes, users, and others that follow the philosophies of open and user innovation to collaborate for improving, developing, creating, prototyping, validating, and testing of current or new technologies, services, products, and systems in real-life contexts (Ballon, 2005; Westerlund and Leminen, 2011). A reform of open innovation, open innovation 2.0 (OI2) is based on principles of integrated collaboration, co-created shared value, sophisticated innovation ecosystems, open exponential technologies and rapid adoption. (European Commission, 2016; Quesado, 2016). Living labs are one example of the OI2

ecosystem development as they apply user-centric co-design process for the development and implementation of innovative ICT-based products and services (Quesado, 2016). Living labs are driven by two ideas: involving users as equal co-creators with other participants, and conducting experiments in real-world settings (Almirall et al., 2012). A high degree of realism and user involvement separate living labs from other innovation approaches (Schuurman and De Marez, 2012), for instance, in field trials or user testing in which a living lab involves users in all stages of R&D and the product development lifecycle (Ballon et al., 2005).

Edler and Georghiou (2007) and Georghiou et al. (2014) noted that demand alone is not enough to strengthen the innovation dynamics, but the interaction between demand and supply is also focal, and organizing interaction between users, consumers and other actors in innovation operations becomes significant. As a difference between public and private sector end-users, the public sector has both an operational incentive to pay attention to individual clients' needs and a need to serve the social goals of a wider public (Hartley, 2005).

From an innovative public procurement point of view, the planning phase of a procurement is most critical as interaction between the actors in that phase is important (Enbom et al., 2014). A user-driven approach, also the cornerstone of living labs, has been a growing trend in public procurement. Users' desires are increasingly taken into account, and procurement in which methods of user-driven development have been performed is seen as an excellent way to develop procuring procedures (Knutsson and Thomasson, 2014; Enbom et al., 2014.) Living labs' are needed in innovative public procurement, as implementing innovative procurement requires cooperation among all actors: customer, supplier and end-users (Mattila and Silander, 2015). Accordingly, an important element in living lab research is to study the interaction of end-users with a technology or prototype in a real-life environment (Ballon et al., 2005). Although cooperation with end-users and the surrounding community has been recognized essential for public procurement's success, the resources given to end-users' engagement in the public procurement processes are often slim (Bovaird and Loeffler, 2012). The desires of end-users often get neglected, which leads to solutions that are unusable or unsuitable, creating e.g. financial losses caused by the additional fixing costs and dissatisfaction's impacting the supplier's life cycle payments (Ng et al., 2013; Satish and Shah, 2009). The early detection of user requirements and needs guides the procurement towards better end results, efficiency and innovative solutions from the beginning (Laine and Junnonen, 2006; Majamaa et al., 2008; Satish and Shah, 2009).

In addition to new thoughts, users can also enhance the process for instance by positively influencing other users and lowering negative opinions (Bovaird and Loeffler, 2012). Thus, living lab user communities can be useful when involving end-users in innovative public procurement. The supplier and end-user share a common need to develop products or services, aiming to create added value e.g. through better quality, more efficient production processes, lower life cycle costs, environmental friendliness or usability (Mattila and Silander, 2015). By developing innovative procurement, end-users are able to participate in the process from the early planning to the implementation phase. Living labs' basic idea, the early involvement of end-users thus makes possible changes cost-effective in procurement cases.

2.3 Procurement Procedure

The EU legislation regulating public procurement has recently become more innovation-friendly. The earlier model in which the supplier with the most affordable price was chosen has been replaced with new “best price-quality ratio” model in which quality can play a significant role in bidding competition. The legislation sets certain thresholds to regulate public procurement. However, national regulation can be applied for tenders of lower value (EU, 2016). There are different models for procurement procedures, e.g. the *open procedure* model in which any supplier company can tender (Figure 1). Here, procurement is usually started by market research to identify existing solutions and required features for service to be procured. Potential suppliers can introduce their solutions and services in the technical dialogue phase, from the basis of which appropriate announcements are drawn up. After this, the bidding process starts with the below featured phases (Figure 1). Here, the minimum time limit for the submission of tenders is 52 days from the publication date of the contract notice, and if a prior information notice was published, this time limit can be reduced to 36 days (EU, 2016). According to the public procurement regulation in Finland, the bidding announcement also has to be published in an electronic service meant for public procurement announcements (JHS, 2013).

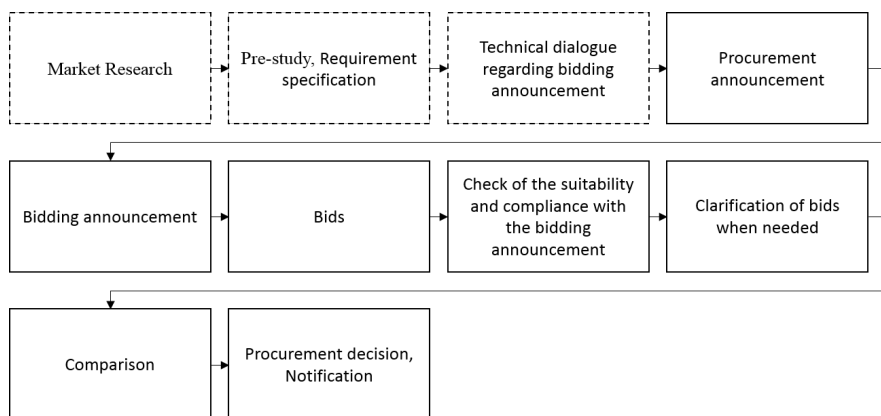


Fig. 1. Open procedure in public procurement (Adapted from JHS, 2013).

3 Research Design

3.1 Case Study Research

A case study is used as the primary research approach in this study. The case study approach to the data collection was chosen for the following reasons: According to Yin (2009), a case study design is considered suitable when the focus of the study is to answer “how” and “why” questions, or when the behaviour of those involved in the study cannot be manipulated, contextual conditions are thought to be relevant to the phenomenon under study or the boundaries are not clear between the phenomenon

and the context. Furthermore, a case study is beneficial because it facilitates the investigation of a phenomenon in its real-life context (Stake, 1995; Rowley, 2004; Baxter and Jack, 2008), bringing about new insights for stakeholders although the findings can not necessarily be widely generalized. The defining characteristics of the case study method according to Stake (1995) are the following: *holistic*, as the method considers interrelationship between the phenomenon and its contexts; *empirical*, as it builds on empirical data and observations; *interpretive*, as it rests upon intuition and views research as a researcher-subject interaction; and *emphatic*, as it reflects the vicarious experiences of the subjects in an emic perspective. Both Stake (1995) and Yin (2009) base their approach to case studies on a constructivist paradigm, where truth is seen as relative and dependent on one's perspective. The paradigm recognizes the importance of the subjectivity, but it does not reject outright some notion of objectivity either.

Despite some limitations and criticism towards the single case study method (Willis, 2014), here it is a justified choice for the research design due the *uniqueness* of the research subject as a whole (Yin, 2009). Moreover, the method produces empirically-rich, context-specific and holistic view of the research subject (Willis, 2014).

3.2 Data Collection and Analysis

Case studies typically combine data collection methods, e.g. archives, interviews, questionnaires and observations. In addition, multiple levels of analysis are characteristic (Eisenhardt, 1989). In this study, research data were collected via multiple sources of evidence. The primary data of the study are qualitative: the project team was informally interviewed and in-depth semi-structured interviews were conducted with identified key persons. These persons were closely involved in different roles during the case procurement, being likely to possess the most relevant information (Kumar et al., 1993), which was needed to develop a comprehensive and objective view of the case Keyless homecare procurement, which is the unit of analysis in this paper. All interviews were recorded and afterwards transcribed into text documents. The approximate duration of each interview was one hour. The interviewees were one technology specialist from the City of Oulu, who at the time of implementation of the Keyless homecare case, had the role of purchase planner in the City of Oulu's strategic procurement department; one project manager of an EU-funded project who was actively participating in planning and in charge of product testing as a part of purchase; one usability specialist who had a central role of product testing planning, implementation and reporting in the Keyless homecare case; one assistant usability specialist; one CEO of the supplier company and winner of bidding; one project salesperson of the supplier company; and one Dep. development manager for Strategic Procurement Operations of the City of Oulu (Table 1). Insights from the nine homecare employees who were involved in product testing were collected from an anonymized, private online discussion organized for the test group on a living lab user involvement platform. A report of the online discussion was used as additional source of data.

Table 1. Interview Informants

Role	Informant	Length	Date
procurer	technology specialist	70 min	Jan/15
living lab	project manager	110 min	Feb 2015
living lab	usability specialist 1	60 min	May 2015
living lab	usability specialist 2	60 min	May 2015
supplier	CEO	57 min	Sep 2015
supplier	salesperson	57 min	Sep 2015
procurer	Dep. development manager	40 min	Mar/16

In addition, the procurement related project reports, and documents such as the four test reports as well as public information available e.g. the bidding announcement (HILMA, 2013), the report of market dialogue for potential suppliers, legislation (EU, 2016) and several related articles were used as secondary archival data. There were also publicly available interviews with the Keyless homecare procurer (Tekes, 2014a) and supplier (Tekes 2014b) which were used as complimentary data sources. Furthermore, references from similar procurement cases were searched and retrieved from the literature and internet sources to form a view on the current state of innovative public procurement, e.g. Enbom et al.'s (2014) collection of practical experiments from healthcare and environmental business sectors.

All the data were connected and analysed, to form holistic understanding. As typical for qualitative studies, the data collection and analysis occur concurrently (Baxter and Jack, 2008; Yin, 2009). *Within-case analysis*, which is suitable for the single case study analysis method (Eisenhardt, 1989), was applied to explore the case thoroughly. Similarities, repetitions and differences were sought from the data, creating themes and typologies. The aforementioned primary and archival data were analysed to facilitate triangulation (Denzin, 1973), to ensure a comprehensive understanding of the case, and to answer the questions “how” and “why”. Moreover, the data were analysed, attempting to maintain objectiveness, by involving research team members (Baxter and Jack, 2008) through analytical discussions to agree on the interpretation.

4 Case Description

4.1 Empirical Context

The annual value of public procurement in Finland is 35 billion and the direct impact of municipal procurement on employment is estimated to be 80 000 person-years. Thus, it is important to develop and enhance public procurement at the strategic level. The City of Oulu seeks to reform public procurement to make it professional, expertise-based, centralized and controlled. For instance, the city's strategy for 2020 states that 20% of the purchases have been made using innovative procurement procedures, as innovative public procurement increases vitality, develops markets, creates possibilities for co-creation and partnerships and produces better services and products for city, references for suppliers, employment and tax incomes (Manninen,

2015). The needs-based search for solutions often produces new innovations whereas legislative or process-oriented competitive bidding may stifle innovativeness (Tekes, 2009). Involving end-users is a growing trend in public procurement, and may add innovativeness to traditional procurement.

The Keyless homecare procurement which exceeded the EU threshold (HILMA, 2013), was implemented using the previously presented open procedure model in which any supplier company could tender. The procurement was implemented for approximately eight months in 2013-2014. The need for procurement arose from initiation of the social welfare and health services and specifically homecare services of the City of Oulu, which aims to search for cost-efficient services and tools for service production. During a shift, homecare employees visited more than 10 patients living at home, thus using at least as many different keys to open the patients' doors. Moreover, the keys were stored in the office of homecare employees, from where they had to pick them up individually between patient visits. Thus, the need for a keyless door-opening system arose mainly from practical reasons – the need to save time and make homecare work more effective, ease the work and improve safety by reducing the risk of e.g. losing the keys.

A few cities in Finland have already managed to make their homecare totally keyless. Reference cases were searched for and used as basis, in addition to the aforementioned practical needs of homecare in the City of Oulu, to start the procurement where product testing played a significant role for the first time as a part of public procurement in the city.

4.2 Product Testing within Procurement

The Keyless homecare mobile door-opening service was purchased partly (40%) based on the product testing of four door-opening products (lock module, mobile application and access control software). The product testing phase was planned and implemented by local living lab specialists. A two-month planning phase and the implementation phase including official decision making process (altogether six months), made overall duration eight months. A relatively long time was spent on planning, as product testing within public procurement of the City of Oulu was conducted for the first time in this scale: preliminary work including searching for references, minimizing the risks and considering the regulation, was time-consuming. In addition to the actual product testing, a living lab user involvement online platform PATIO2 was used for collecting feedback in a private online discussion area from homecare employees about the product testing process to develop the procedure of innovative procurement within the city.

Scoring Criteria. The selection criteria for purchase were based on the overall economical affordability. The criteria contained two main elements: price and quality. The supplier products were scored and points were given based on the formula described below. The maximum number of points was 100. The price had 60% and quality 40% weight. Scores given by the nurses and the usability specialists together formed the quality. User feedback questionnaire and homecare service manager (administrator user) questionnaire both had a 12.5% weight, product

² www.patiolla.fi

efficiency/opening the lock 7.5% weight, and time spent for software usage 7.5% weight, altogether 40% (Table 2).

Table 2. The scoring criteria

Criteria	Score %
price	60
quality	40
questionnaire for nurses	12,5
questionnaire for admin	12,5
efficiency: opening the lock	7,5
efficiency: use of the access software	7,5

The price of the product included all the costs of service provider. The most affordable product got 60 points. Other products were scored using the following formula (1):

$a / b * 60 = y .$	(1)
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a = the lowest price b = company's price.

Example 1: Company1's product has the lowest price e.g. €100. The result is $100/100 \times 60 = 60$ points.

Example 2: The price of the company2's product is e.g. €200. The result is $100/200 \times 60 = 30$ points.

The quality criteria were scored based on the product testing. The testing objectives/indicators were defined based on the usability definition in ISO 9241-11 standard³, which defines usability as follows:

"The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

The factors related to the usability are defined in the standard in the following way:

- *Effectiveness*: accuracy, completeness and lack of negative consequences with which users achieved specified goals
- *Efficiency*: relationship between the result achieved and the resources used
- *Satisfaction*: positive attitudes, emotions and/or comfort resulting from use of a system, product or service

Usability specialists used these average points to calculate the final points for quality. The best product could receive a maximum of 40 points. Formulas used for scoring the quality elements were the following:

³ <https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-1:v1:en>

a) To calculate the *user feedback* scores, the following formula was used:

$a / b * 12.5 = y .$	(2)
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a = company's score b = the best score

Example 1: The product gets the best score e.g. 25. The result is $25/25 \times 12.5 = 12.5$ points

Example 2: The score of the product is e.g. 18. The result is $18/25 \times 12.5 = 9$ points

b) To calculate the *efficiency* scores the following formula was used:

$x / z * 12.5 = y .$	(3)
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a = the fastest time b = company's time

Example 1: The lock opens the fastest e.g. 3 seconds. The result is $3/3 \times 7.5 = 7.5$ points.

Example 2: The opening time of the lock is e.g. 4 seconds. The result is $3/4 \times 7.5 = 5.625$ points

Product Testing Implementation. Product testing was carried out for two weeks in a sheltering house for elderly people in the City of Oulu. The four different products (a product refers here to an entity consisting of a lock module, a mobile application and access control software) delivered by four different suppliers were tested by seven homecare employees (nurses). Each product was tested for at least five days and 20 separate times during the test period. The nurses' more precise task was to test the opening of lock modules for each four products via mobile application and that of the service managers was to test the access control software (SW) for each four products. The products were anonymized and coded with colours. The access control software of each product, the meaning of which is to administrate and give access rights to users, was tested by four homecare service managers (administrators). The administrators used the SW for the whole duration of the test. All the users (nurses and administrators) were given a questionnaire to be completed by the end of the testing period. The questionnaire had five statements accompanied by five alternative answers and a field for justification. The statements were based on the effectiveness, efficiency and satisfaction objectives, which were identified by nurses and administrators. The criteria are described in the Table 3.

Table 3. The criteria for the locking device and access control SW

Locking device	Access control SW
The lock will close and open	The opening of the lock is recorded to the SW
Opening the locks via a mobile key is fast and easy. The lock shall open in less than 10 seconds.	The length of the client visit is saved correctly to the SW

Locking device	Access control SW
Nurses are satisfied with the mobile key and interaction with the system	The access right set by administrator will operate in the locks The administrator can effectively manage the data and access rights The administrators are satisfied with the SW

In addition to the user feedback collection, product efficiency was measured by two usability specialists. They measured the opening time of the lock/door and the time used to complete specific tasks. Each lock was opened ten times via a mobile key. In addition, the opening procedure was observed during the test. The usability specialists also performed the access control SW product testing. The predefined tasks were executed by one usability specialist, while another expert recorded the time. The procedure was carried out three times and the fastest time was selected. The predefined tasks were as follows:

1. Create a new profile for a nurse and give him/her access rights to the lock
2. Modify the access rights, so the nurse can open the lock only between 11 am and 1 pm
3. Remove the nurse's access rights (created in step one)
4. Remove the nurse's profile

5 Results

5.1 Product Testing Results

The selection criteria results are presented in Table 4 below. Company 2 (C2) had the lowest score in all elements. Companies 1 (C1) and 3 (C3) had the best quality scores. Companies' 4 (C4) and 2 (C2) software lacked the functionalities needed to perform the test properly, which affected the quality scores.

After the product testing, the sealed price envelopes from each supplier were opened and prices scored based on the formula presented earlier. Total scores were formed combining the total quality and price scores. As shown in Table 4, the winner was the product of Company 1 (C1), closely followed by the Company 2's product with the lowest price (C2) and Company 4 (C4).

Table 4. Selection criteria results

	Questionnaire: Nurses	Questionnaire: Admin	Efficiency: Opening the lock	Efficiency: Access control SW	Total Quality	Total Quality	Total
C1	12.5	12.5	2.7	7.5	35.2	32.8	67.99
C2	4.0	3.1	0*	0*	7.1	60.0	67.07
C3	9.3	11.6	7.1	7.2	35.2	30.6	65.78
C4	7.5	11.0	7.5	0*	26.1	41.0	67.07

* Efficiency tasks weren't able to carry out.

Moreover, feedback from the homecare employees regarding product testing was collected via online discussion on a moderated living lab user involvement platform PATIO. This feedback was not scored; thus, it did not directly affect the procurement, but was rather an additional tester feedback aiming to help develop the product testing process further. Anonymized logins for each test user were created and three open-ended questions about his/her personal experiences with the product testing, positive sides of the product testing and improvement ideas. Seven employees participated in the discussion and wrote a total of 24 posts varying in length.

Based on the scores formed by quality features (40%) and price (60%), the mobile door-opening system was procured. The overall size of the purchase was 500 lock modules and software, the total value of the procurement being 250 000 EUR. Compared to traditional public procurement in which the product with lowest price is typically selected, the result of the Keyless homecare procurement differed considerably: the selected mobile door-opening system was not the most inexpensive one but the one with the highest scores obtained from the overall price and quality together. This means that quality and user assessment played significant roles in the procurement. Interestingly, the product with the lowest price did not receive high scores on quality either.

5.2 Framework for Product Testing as a Part of Public Procurement

Figure 2 presents the process of the Keyless homecare procurement, forming *a framework of an innovative public procurement open procedure including product testing*. Added to the previously presented (Figure 1) open procedure model adapted from JHS (2013), the elements of the procedure in which the living lab and product testing were included are highlighted (Figure 2).

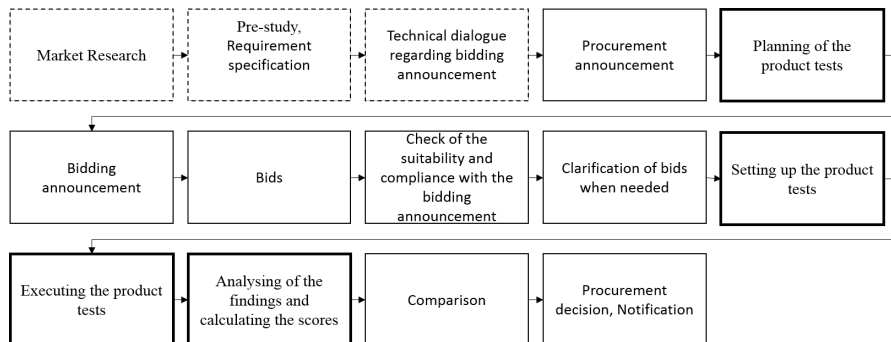


Fig. 2. Framework of the public procurement open procedure with product testing (Adapted from JHS, 2013).

The living lab had an important role in the early planning phase, as a detailed product testing description was attached in the bidding announcement. Based on the announcement, four bids from suppliers were received, and their solutions were installed to test in a real-life environment. The suppliers introduced their products to

the usability specialists to ensure efficient and smooth testing. A suitability check was done to ensure that the test users were not familiar with the products or there was not a conflict of interest. Living lab usability specialists organized the product testing and were also involved in the analysis of the results as a basis for decision making.

5.3 Stakeholders' Experiences

As several stakeholders were involved in the Keyless homecare project, the results can be viewed from different angles: *from the City of Oulu* point of view, first-hand experience conducting a successful procurement in which product testing was included and was valuable considering the further development of innovative procurement. From the *users/homecare employees'* point of view, the usability of a daily used product was ensured through comprehensive product testing: in addition to functionality testing, the users could provide overall feedback. From the winning supplier's point of view, the high quality of the product for once mattered.

From the *living lab's* point of view, valuable experience with the successful use of a living lab in an innovative public procurement was obtained, and conditions for using the living lab in future public procurement cases in the city were created. Moreover, the suitability of the living lab methodology for innovative public procurement in which i.e. legal aspects must be taken in account was piloted.

From the *winning supplier's* point of view, Keyless homecare procurement differs significantly from the earlier public procurement the supplier company had been involved. In this procurement, the company for the first time felt that they were participating in a "wise purchase", as the price was not the main indicator, but the usability and diversity of the service played significant role.

"As we are not selling cheap but aim to provide quality and sustainability, we saw this (bidding competition) as an opportunity and took it seriously. Wish all public procurement would be like this". (CEO, Company X)

"This is the only time we have experienced product testing as a part of bidding, unfortunately". (CEO, Company X)

According to the winning company, it was easy to participate in the bidding competition as it already had previous experience participating in public procurement.

"Good thing was that every supplier got an opportunity to discuss their offer/product with procurer, and the process was explained beforehand to enable investing in the case". (CEO, Company X)

Although the procurement procedure was quite successful according to the winning company, there is always room for improvement: according to it, what was missing in this process was comprehensive feedback regarding product testing. Therefore, a general feedback discussion could have been useful. A public summarized report regarding the product testing phase would have helped all the suppliers to improve their products. This would have required permission from the suppliers. In addition, the test group could have been larger, as the sample was quite small. The company would have been willing to lengthen the testing period if they had accordingly received a broader view of user experience.

“More extensive user feedback would have been worth gold for this type of organization...” (CEO, Company X)

The product testing phase schedule was too tight as there was only a short time between the bidding competition and product testing, considering that installations require time. At least three weeks would have been preferable over two. The schedule was tight for other parties as well; minor changes, such as test user’s illness could have led to failure. *Homecare employees’* attitude towards the product testing was mainly positive, and fortunately they were able to test the products as planned although most of them criticized the schedule as well:

“It (testing) was time-consuming and challenging to settle with other tasks as it occurred in a busy week”. (Test user 2)

“It took a lot of time...really a lot of variance in instructions but wish this would affect a good choice (product)...” (Test user 1)

Homecare employees also needed more time for the instructions and guidance. The scarcity of instructions (a paper sheet), however, came as a given in the bidding announcement, to maintain impartiality. Some of them also criticized the testing environment, the sheltered housing, as they saw it was not as authentic as possible:

“Testing should have been done outdoors as well...to see how the weather affected it”. (Test user 3)

Although the Keyless homecare public procurement process can be perceived as successful and to serve as a reference for future public procurement, there were several issues: even if a certain number of winning product have been procured, in practice less than half of the intended amount were supplied/installed when interviewing the winning supplier. The main reason for the delay was the rapid change in technology and choice of technologies to be used in the city.

“A technology breakthrough happened very rapidly (after the procurement)...proceeding has not been as smooth as thought”. (Dep. development manager)

According to the city representative, although the procurement results were satisfying, multiple challenges emerged: first, the *procedures of the city* were not mature enough for this type of operation model. Furthermore, there was *lack of resources*, as it was optimistically thought that existing resources would be sufficient to change the operation model, but in given timeframe it was not possible. Second, a *technological change* appeared: new solutions came to market making the existing mobile door-opening technology more comprehensive. A new *enterprise resource planning system* in which the purchased mobile door-opening service can be exploited as only one part of larger solution was adopted within the city, which to some extent slowed down the completion of the procurement. Moreover, there was also an issue with the *mobile phone operating system*: the city uses a specific mobile phone technology and the supplier was changed which also affected the completion of the procurement.

5.4 Outcome of the Living Lab Approach

In the Keyless homecare procurement, the living lab entered a completely new area, public procurement. Thus, close cooperation between the representative of the

procurer and the living lab was essential for the successful implementation. However, *closer interaction* between the actual procurement decision-makers of the city and the living lab would have been needed as here product testing played a key role in the success of the procurement: the living lab had to define the quality metrics and test procedures universally without knowing the potential suppliers' precise solutions to be able to test all kinds of solutions equally and avoid appeals. Moreover, the living lab was consulted when setting the price-quality criteria and to understand how to measure the quality of products.

“Usually when planning product testing you know how the product will function. Here, it was unknown which made product testing planning challenging, especially when we had to keep in mind that if we do not treat the products as equal they might appeal to Court”. (Usability specialist 2)

“The role of the usability specialist was the most important”. (Project manager)

The living lab must gain familiarity with the procurement procedure and regulations to be able to integrate the living lab into the process. Although the planning phase was relatively long, the strict schedule regarding decision making given by the procurer limited to the implementation of the actual product testing phase. Normally, the living lab would have planned the schedule to be more flexible for all stakeholders. As the city lacked user involvement expertise and resources, the living lab's role was perceived as crucial:

“Living labs are absolutely needed to enable testing in authentic circumstances”. (Dep. development manager)

“If we consider it from the perspective that we should use public taxpayers' money to acquire products or solutions that meet the needs, so it (product testing) is absolutely needed, and of course in as natural and authentic conditions as possible to obtain an accurate view of the product. And, of course, it would be best to do it before the procurement decision”. (Dep. development manager)

5.5 Selection Criteria Outcome

Although subjective metrics can sometimes be appropriate in the procurement where subjectivity is closely related to the procurement, it was questioned whether the *selection criteria* in this case were too subjective and could be used as such. There was some internal debate as to whether the product testing could have been conducted with different criteria. Accordingly, the selection criteria results presented in the previous chapter show that *there is reason to question whether the criteria were discriminating enough*: the difference between the winning bidding (with the highest-quality scores) and the one with the lowest price was subtle. The price of one of the mobile door-opening services involved in the bidding competition was considerably lower compared to others, which led to these results. In the worst case, this product with the lowest price but the poorest quality would have won the competition and spoiled the whole idea of product testing and the innovative procedure. It is not clear, based on the research data, how the decision of the price-quality ratio in this case was

made, but the findings undoubtedly show that it is critical to consider this issue in depth.

“It is always challenging to find the balance: you cannot set a very low weight to price... well here the challenge was that an extremely cheap but extremely unusable product was close to winning. It was speculated that 50%-50% (price-quality ratio) would have been much safer, but this was the case, that luckily the most usable product won”.
(Technology specialist)

Moreover, maximizing the objectivity of selection criteria limits the possibilities to take user feedback in account. More specifically, user feedback here was collected through methods that enable measurement.

Effect on Procurement Regulation. Traditionally in public procurement, the winner is typically the company who dares to make the “dirtiest promises”. According to the experiences of the winning bidding company, in the case in which the weight of price counts for more than 50% of the purchase, nothing else matters. Moreover, the offer can be written so that it answers all the questions set by procurer despite the fact that, in practice, the products do not necessarily function in the manner in which the bidder has described in the offer. For this reason, the winning bidding company has supplied some products even when they have not won the bidding competition because the winning bidder has not been able to deliver the desired technology (but won the bidding competition due the lowest price) after all. Thus, there is a great deal of room for improvement in the implementation of public procurement according to the informant company:

“One reason for the poor economic situation (in Finland) is that there is a lack of professional, skilled procurers, especially in the public administration sector. Soon no one wants to bid because much is asked but less paid...there are smart thoughts and nice figures - but who will pay”? (CEO, Company X)

A common problem in public procurement is that when making a bid, a customer might visit five to six suppliers, after which a bidding announcement will be made. Possible suppliers can then be recognized among the bids. It would be beneficial not to identify the technology, but rather describe the usability and the desired advantage. Based on the earlier experiences, a technology-driven approach often results in a poor outcome.

“It’s a pity that in the public sector, a negotiated procedure is not commonly used within procurement legislation”. (CEO, Company X)

Although in public procurement, lost suppliers typically try to find issues to appeal to of, in the Keyless homecare procurement there were no appeals from suppliers. No one felt they had been treated wrongly in the bidding competition or that the criteria were not set right. In that sense, the procurement can also be seen as successful. The City of Oulu representative, however, reported not being afraid of appeals in procurement processes:

“We are open to trying new when there is justification for that. Even though there was chance to go to Market Court, I see it as a positive that new procedures become tested in case law. Sometimes I even hope

that we will go to the Court to test and develop the interpretation of the law. Certainly, it might slow the process down and require a lot of resources". (Dep. development manager)

Thus, the use of innovative methods within public procurement can be seen as a way to *affect improvements in procurement regulation* in case the procurement goes to Market Court.

What was innovative in the Keyless homecare procurement was that the product testing included in the public procurement for the first time ever in the city in this type of procurement. Considering the effect of product testing in procurement, it may also work as sparring suppliers to develop their products when included in the bidding competition phase. On the other hand, there are people who support keeping bidding as simple as possible, and conducting i.e. product testing in phases such as market research or after procurement, with contracting conditions. Overall, the case introduced unique knowledge on the implementation of product testing as a part of healthcare public procurement.

"This was an excellent example of a successful product testing as a part of public procurement. Despite sudden changes and challenges, the procurement process was successful: product testing clearly affected the winning bid, and price alone did not matter". (Dep. development manager)

"When thinking of this as a process and public administration procurement process, this is one of the best. Even if we had lost the bidding competition, this case was like a spark of light in the dark. Whenever there will be (a procurement) like this we will be involved". (CEO, Company X)

6 Conclusion

The study presented a public procurement case in which product testing service provided by a living lab was included for the first time in a public procurement in the City of Oulu. The Keyless homecare procurement case was unique and raised a great deal of interest among stakeholders. The successful implementation of the procurement process and the exceptional results obtained are an important reference for all stakeholders, particularly the City of Oulu and living labs. New means of shifting from traditional procurement towards innovative public procurement were identified and piloted in the process. The product testing within public procurement was carefully planned and documented; thus, the framework in this paper may serve as a reference for future public procurement cases in which product testing is included.

What was different in this procurement compared to the earlier procurements with which the winning company had been involved, was that it was open and consultative. Overall, the feedback from all companies participating in the Keyless homecare bidding competition was encouraging. The results of the study show that a living lab's role in strategic procurement is significant and reflecting earlier research (Havila et al., 2004; Majamaa et al., 2008; Almirall and Wareham, 2012; Schuurman,

2015), through end-user involvement increases innovativeness in public procurement. Furthermore, circulating the view that user-driven development method trials are an effective way to develop procuring procedures (Bovaird and Loeffler, 2012; Enbom et al., 2014), the results indicate that product testing included in public procurement may also help to develop the regulation regarding public procurement as the regulation has been recognized partly as inappropriate. The findings can be seen to influence the development and enhancement of public procurement thus obtaining several beneficial impacts (Manninen, 2015).

“...to not get a feeling of “buying a pig in in a poke” due to the Procurement Law...I think it can't and mustn't be that way”. (Dep. development manager)

For instance, in cases in which citizens would be involved in a public procurement, the role of a living lab could be even more significant, as user engagement tools and methods for facilitating users are among the strengths of living labs. Initial experiences such as Keyless homecare provide an opportunity to practice co-operation and build trust between operators in multi-stakeholder projects. To spread good practices and enhance public procurement it is important to document and disseminate the results of new experiments like this.

“Several cities have been interested to try same kind of procedure in their procurement”. (Project manager)

There is a considerable amount of discussion regarding what makes procurement innovative. The case of Keyless homecare contributes this discussion (e.g. Aschhoff and Sofka, 2009; Knutsson and Thomasson, 2014; Georghiou et al., 2014) through exceptional results: end-users genuinely, through a unique procedure, were able to influence the procurement decision. Thus, end-user involvement prevented the procurement of an unsuitable or unusable product (Ng et al., 2013; Satish and Shah, 2009) which could have led to severe problems. In the literature, there are many definitions of innovation and (Schumpeter, 1934; Yliherva, 2006; Frankelius, 2009) innovativeness and based on the study, academic discussion and definition works as a good basis for procuring in practice. Innovativeness can be seen not only as a procurement of an entirely new innovation, a solution that did not exist before, but an innovative element can also appear in any phase of procurement process or planning:

“Innovativeness may arise from the application of knowledge or expertise in a way that clearly differs from the old. That is, I would say, genuinely innovative”. (Dep. development manager)

It can be even thought that anything that changes something in the unusable or ineffective old method, is innovative enough from the point of view of public sector procurement effectiveness.

“If you even stop and consider whether this could be done in other way to obtain better effectiveness or better value for customer is innovative for me. Even if a definition would state that it must be something unique”. (Dep. development manager)

“I wish product testing would be used also in the future whenever it is suitable. It has to be well thought out and planned, though”. (Dep. development manager)

The empirical findings suggest increasing innovativeness in public procurement can be done in different ways, trying something unique. Modern-age tools, for example *online user involvement tools*, can be seen useful not only for the engagement of end-users but also to ensure a modern way interacting between actors, which is an important part of procuring (Edler and Georghiou, 2007; Georghieu et al., 2014). Virtual tools, such as the user involvement platform provided by a living lab, could be, according to the findings, applicable for the public procurement market research phase for instance as a “virtual discussion board” for all stakeholders involved. Based on the findings, technology suppliers are not afraid of using virtual tools, which could be a flexible and easy way to involve stakeholders, working as a tool of interaction and collecting insights.

Relying on the empirical findings, and confirming earlier findings (Enbom et al., 2014), the product testing phase is important to plan thoroughly, considering sufficient resourcing (Bovaird and Loeffler, 2012), scheduling and objectiveness. To summarize, at least the following features should be carefully considered when forming criteria and processes for innovative public procurement in which product testing is included:

- determining the price-quality ratio carefully
- planning the product testing phase thoroughly
- resourcing a sufficient amount of working hours
- detailed documenting
- communicating the process to suppliers
- disseminating the results

6.1 Limitations and Future Research

Here, the uniqueness of the research subject led to several limitations, as the single case study method has limitations regarding the interpretation of the results. It is commonly accepted that findings of a case study cannot be generalized but taken as such, merely evoking discussion and raising questions (Eisenhardt, 1989; Stake, 1995). Due to the single case being the unit of analysis, the sample in this study is relatively small. However, it is important to examine novel cases to contribute to the scientific discussion in the field as well as to share knowledge to the relevant audience. To maintain the reliability and validity of the study, research data was comprehensively collected from multiple sources, and from the identified key informants.

Future research could focus on combining similar cases and finding consistencies. In Keyless homecare product testing, the assessment criteria were set as thoroughly and as objectively as possible to avoid any misinterpretations and maintain impartiality between all suppliers. However, this affects the possibility of taking into account end-users’ voice, as end-user feedback is always subjective. From the living lab point of view, this is a pity, as end-user engagement methods is the strength of living labs and their expertise plays major role here. Thus, we recommend further research and development to determine the most suitable methods for user involvement to be exploited in public procurement. Accordingly, the smooth implementation of living lab methods in the processes of public procurers should be further studied. Finally,

further research is required to obtain the right price-quality ratio balance in product testing.

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7 References

- Aho, E., Cornu, J., Georghiou, L. & Subira, A. (2006). Creating an innovative Europe. Report of the independent expert group on R&D and innovation appointed following the Hampton Court Summit.
- Almirall, E., M. Lee, & Wareham, J. (2012). Mapping Living Labs in the landscape of innovation methodologies, *Technology Innovation Management Review* 2(9), 12-18.
- Aschhoff, B., & Sofka, W. (2009). Innovation on demand—Can public procurement drive market success of innovations?. *Research Policy*, 38(8), 1235-1247.
- Ballon, P., J. Pierson, & Delaere, S. (2005). Open innovation platforms for broadband innovation: Examining European practice, Proceedings of 16th European Regional Conference, Porto, Portugal, September 4-6, 2005.
- Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers, *The Qualitative Report*, 13(4), 544-559. <http://www.nova.edu/ssss/QR/QR13-4/baxter.pdf>.
- Bovaird, T., & Loeffler, E. (2012). From engagement to co-production: The contribution of users and communities to outcomes and public value, *Voluntas* 23(4), 1119-1138.
- Chesbrough, H. (2006). Open Innovation: Researching a new paradigm, In Chesbrough, Vanhaverbeke & West (Eds.), *Oxford University Press*.
- Denzin, N.K. (1973). The research act: A theoretical introduction to sociological methods, *Transaction publishers*.
- Edler, J., & Georghiou, L. (2007). Public procurement and innovation-Resurrecting the demand side, *Research Policy*, 36(7), 949-963.
- Eisenhardt, K.M.. (1989). Building theories from case study research, *The Academy of Management Review*, 14(4), 532-550.
- Enbom et al. (2014). *Innovatiiviset julkiset hankinnat*, M-L. Niinikoski, J. Sorsimo, & T. Suursalmi (Eds.). Helsinki: Culminatium Innovation Oy.
- European Commission (2016). *The Open Innovation yearbook 2016*. European Union 2016, Luxembourg.
- European Union (2016). *Rules & Procedures: Public contracts*. Accessed 10th April 2016. http://europa.eu/youreurope/business/public-tenders/rules-procedures/index_fi.htm.
- Frankelius, P. (2009). Questioning two myths in innovation literature. *Journal of*

High Technology Management Research, 20, 40–51.

- Georgiou, L., Edler, J., Uyarra, E., & Yeow, J. (2014). Policy instruments for public procurement of innovation: Choice, design and assessment, *Technological Forecasting and Social Change*, 86, 1-12.
- Hartley, J., Sørensen, E., & Torfing, J. (2013). Collaborative innovation: A viable alternative to market competition and organizational entrepreneurship, *Public Administration Review*, 73(6), 821-830.
- Hartley, J. (2005). Innovation in governance and public services: Past and present, *Public Money and Management*, 25(1), 27-34.
- Havila, V., Johanson, J. & Thilenius, P. (2004). International Business-Relationship Triads, *International Marketing Review*, 21(2), 172-186.
- HILMA Bidding Announcement (2013). *Keyless homecare – Mobile door-opening service bidding*. Accessed 14th March 2014. <http://www.hankintailmoitukset.fi/>.
- ISO 9241-11 (1998). Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability.
- Jamali, D. (2007). A study of customer satisfaction in the context of a public private partnership, *International Journal Quality & Reliability Management*, 24(4), 370-385.
- JHS-suositukset (2013). *JHS 167, Neuvottelumenettelyjen käyttö ICT-hankinnoissa*. Accessed 15th March 2016. <http://docs.jhs-suositukset.fi/jhs-suositukset/JHS167/JHS167.html>.
- Knutsson, H. & Thomasson, A. (2014). Innovation in the Public Procurement Process: A study of the creation of innovation-friendly public procurement, *Public Management Review*, 16(2), 242-255.
- Kumar, N., Stern, L.W. & Anderson, J.C. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal*, 36(6), 1633-1651.
- Laine, V., & Junnonen J. (2006), Julkisen elinkaarihankkeen hankintaprosessi. Vammala: *Rakennusteollisuus RT Oy*
- Lawther, W.C., & Martin, L.L. (2005). Innovative practices in public procurement partnerships: the case of the United States, *Journal of Purchasing and Supply Management*, 11(5), 212-220.
- Lee, S.M., Olson, D.L. & Trimi, S. (2012). Co-innovation: convergenomics, collaboration, and co-creation for organizational values, *Management Decision*, 50(5), 817-831.
- Leminen, S, Westerlund, M. & Nyström, A-G. (2012). Living labs as open-innovation networks, *Technology Innovation Management Review*, 6–12, 2012.
- Lähdesmäki, K., & Kilkki, S. (2008). New public management principles and practices in producing public utilities and services. *Administratie si Management Public*, 10, 114.
- Majamaa, W., Junnila, S, Doloid, H. & Niemistö, E. (2008). End-user oriented public-private partnerships in real estate industry, *International Journal of Strategic*

- Property Management*, 12(1), 1-17.
- Manninen, M. (2015). *Hankintojen strateginen kehittäminen ja innovatiiviset hankinnat*. Accessed 8th April 2016. <http://www.pohjois-pohjanmaa.fi/file.php?3377>.
- Mattila, P., & Silander, P. (2015). (Eds.), *How to create the School of the Future – Revolutionary thinking and design from Finland*, Oulu: Multiprint.
- Ng, S.T., Wong, J.M.W. & Wong, K.K.W. (2013). A public private people partnerships (P4) process framework for infrastructure development in Hong Kong, *Cities*, 31, 370-381.
- Pekkarinen, S., Hennala, L., Harmaakorpi, V. & Tura, T. (2011). Clashes as potential for innovation in public service sector reform. *International Journal of Public Sector Management*, 24(6), 507-532.
- Quesado, F.J. (2016). *Living labs and Open Innovation 2.0*. Accessed 29th October 2016. <https://www.neweurope.eu/article/living-labs-and-open-innovation-2-0/>.
- Rowley, J. (2004). Researching people and organizations. *Library Management*, 25(4), 208–214.
- Satish, D. & Shah, P. (2009). A study of Public Private Partnership models. *IUP Journal of Infrastructure*, 7(1), 22-38.
- Schumpeter, J.A. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
- Schuurman, D. & De Marez, L. (2012). Structuring user involvement in panel-based Living Labs. *Technology Innovation Management Review*, 2(9), 31–39.
- Schuurman, D. (2015). *Bridging the gap between Open and User Innovation?: exploring the value of Living Labs as a means to structure user contribution and manage distributed innovation*, Ph.D.diss., Ghent University.
- Schwab, K. (2015)(Eds.), *The Global Competitiveness Report 2015-2016*, *World Economic Forum*.
- Stake, R. E. (1995). *The art of case study research*, Thousand Oaks, CA: SAGE.
- Tekes Reports (2008), *Innovatiiviset julkiset hankinnat*, 225. Helsinki.
- Tekes Reports (2009), *Työkirja kilpailullisen neuvottelumenettelyn toteuttamiselle*. Helsinki.
- Tekes (2014a). *Lokakuun huippuostajaja*. Accessed 3rd December 2014. <http://www.tekes.fi/nyt/uutiset-2014/huippuostajat-uutiset>.
- Tekes (2014b), *Lokakuun huippuostaja*. Accessed 3rd December 2014. <http://www.tekes.fi/nyt/uutiset-2014/huippuostajat-uutiset>.
- Uyarra, E. & Flanagan, K. (2010). Understanding the innovation impacts of public procurement, *European Planning Studies*, 18(1), 123-143.
- von Hippel, E. (1986). Lead Users: A Source of Novel Product Concepts. *Management Science*, 32(7), 791-805.
- Westerlund, M., & Leminen, S. (2011). Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. *Technology Innovation Management Review*, 1(1), 19-25.

- Willis, B. (2014). *The Advantages and Limitations of Single Case Study Analysis*. Accessed 13th March 2016. <http://www.e-ir.info/2014/07/05/the-advantages-and-limitations-of-single-case-study-analysis/>.
- Yescombe, E.R. (2007). *Public-private Partnerships: Principles of Policy and Finance*, Amsterdam: Elsevier.
- Yin, R. K. (2009). *Case study research: Design and methods (4th ed.)*, Thousand Oaks, CA: Sage
- Yliherva, J. (2006). *Tuottavuus, innovaatiokyky ja innovatiiviset hankinnat*, Sitra's reports. Helsinki: Edita Prima