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Enhancing Collaborative Innovation of Cities with Pre-Commercial Procurement: Empirical Findings on Opportunities and Approaches

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Abstract: - The purpose of this study is to increase knowledge of the opportunities and approaches of using pre-commercial procurement (PCP) in enhancing collaborative innovation of cities with external actors. The external actors refer to private companies, 3rd sector organizations, and research institutions such as universities. So far, the knowledge of this area is scarce and there is a clear need for research. The present findings stem from an empirical study on open innovation platforms in Smart Cities, and one of the aspects addressed in the study is pre-commercial procurement. The research method is qualitative and draws on extensive data from in-depth interviews and co-creative multi-actor workshops. As the result, this study identifies and describes a large number of opportunities and approaches of using pre-commercial procurement (PCP) in enhancing collaborative innovation of cities with external actors. These findings contribute to the scientific literature as well as provide guidelines to officials in city governments and urban policy makers.

Key-Words: Pre-commercial procurement PCP, Innovative public procurement, Public Procurement for Innovation PPI, Public sector innovation, Collaborative innovation, Open innovation, Service innovation, Urban development

1 Introduction

The potential for using public procurement as an instrument for innovation is considerable, since in many industries public procurement represents a key source of demand for private companies [1]. Construction, health care and transport are examples of such industries.

Some studies have found public procurement to more effective way to boost innovation than R&D subsidies. Based on their study, Rothwell and Zegveld [2] (see also Rothwell [3]) concluded that, over longer time periods, state procurement triggered greater innovation impulses in more areas than did R&D subsidies. Similarly, Geroski [4] argue that public procurement is a far more efficient instrument in stimulating innovation than any of a wide range of frequently used R&D subsidies. Indeed, since cities are responsible for a large share of public procurements in the society, they possess a substantial potential to enhance innovation through their procurement.

Pre-commercial procurement (PCP) is the procurement of research and development of new innovative solutions before they are commercially available [5]. It belongs to a larger strategic

approach of Public Procurement for Innovation (PPI) which includes several approaches, and PCP is one of them [6].

The literature includes very little empirical knowledge of opportunities and approaches of enhancing collaborative innovation of cities with pre-commercial procurement. This knowledge gap is addressed in the current study. It aims at increasing knowledge of the opportunities and approaches of using pre-commercial procurement (PCP) in enhancing collaborative innovation of cities with external actors. The external actors refer to private companies, 3rd sector organizations, and research institutions such as universities.

First, based on the earlier literature, this article discusses public procurement of innovation (PPI) and pre-commercial procurement (PCP). Then it explains the empirical method of the research. Next, it puts forward the results from the empirical study, and briefly describes various opportunities and approaches of using pre-commercial procurement (PCP) in enhancing collaborative innovation of cities with external actors. Then, it draws the final conclusions.

2 Public procurement in fostering innovation in society

2.1 Innovative public procurement

Edler and Georghiou (2007) [1] introduced a taxonomy of innovation policy tools. In their taxonomy, the public sector's measures to foster innovation are divided into two categories: supply-side and demand-side measures. Most of the traditional methods are oriented on the supply side. A major reason for the potential effectiveness of public procurement as an approach to foster innovation is the fact that procurement affects the demand rather than supply of new services and products. Public procurement is a major part of "local" demand, which constitutes a major factor in the location decision of multinational enterprises and in the inclination to generate innovations in a given location. Also, there is a number of market and system failures affecting the translation of needs into functioning markets for innovative products, and public procurement can prove effective in redressing this. Moreover, the purchase of innovative solutions offers a strong potential to improve public infrastructure and public services in general [1](*ibid.*).

Public Procurement for Innovation (PPI) occurs when a public organization places an order for the fulfillment of certain functions within a reasonable period of time, through a new product or service [6]. The fundamental objective of PPI is not primarily to enhance the development of new products, but to target functions that satisfy human needs or solve societal problems. However, innovation is needed in all PPI before such objectives can be met. Edquist and Zabala-Iturriagoitia [6] introduced the taxonomy to classify different categories of PPI (drawing on Edler [7], Edquist et al. [8], Hommen and Rolfstam [9], and Uyarra and Flanagan [10]). The taxonomy includes two dimensions. The first dimension refers to whom the user of the resulting product (good, service, system, etc.) is. Based on this dimension, two different categories of PPI can be identified: direct and catalytic.

- **Direct PPI.** This occurs when the procuring organization is also the end user of the product resulting from the procurement. The buying agency uses its own demand or need to influence or induce innovation. This type of PPI includes the procurement undertaken to meet the ('mission') needs of the public agency in question. Yet, the resulting product is often also diffused to other users.

Thus, innovations resulting from PPI can be useful to the performing agencies, as well as for society as a whole.

- **Catalytic PPI** takes place when the procuring agency serves as a catalyst, coordinator and technical resource for the benefit of end-users. The needs are located 'outside' the buying public agency. The public agency aims to procure new products on behalf of other actors. It catalyzes the development of innovations for broader public use and not for directly supporting the mission of the agency.

The second dimension refers to the character of the result of the procurement process, i.e. the character of the innovation (if any) embedded in the resulting outcome. Based on this dimension, three alternatives of PPI can be distinguished: pre-commercial, adaptive and developmental procurement.

- **Pre-commercial procurement (PCP).** See the definition earlier in Introduction section and the discussion below.
- **Adaptive PPI.** This is the case when the product or system procured is incremental and new only to the country or region of procurement. Innovation is required in order to adapt the product to specific national or local conditions. This may also be labeled 'diffusion oriented' or 'absorption oriented' PPI.
- **Developmental PPI** implies that completely new-to-the-world products or systems are created as a result of the procurement process. This can be understood as 'creation oriented' PPI and involves radical innovation [6].

2.2 Pre-commercial procurement (PCP)

Pre-commercial procurement refers to the procurement of (expected) research results and is a matter of direct public R&D investments, but no actual product development. Moreover, it does not involve the purchase of a (non-existing) product, and no buyer of such a product is therefore involved. This type of procurement may also be labelled "contract" research, and may include development of a product prototype [6]. According to Edler and Georghiou [1], pre-commercial procurement is applicable for innovative products and services for which further R&D needs to be done. The risk related to innovation process is shared between the company and the city. Products and services are still in the pre-commercial phase, the products and services delivered are not "off the shelf". The procurement is actually an R&D service

contract, given to a future supplier in a multi-stage process, from exploration and feasibility to R&D up to prototyping, field tests with first batches and then, finally, commercialization. The justification for this approach stems from the argument that R&D-intensive procurement needs more intensive interaction and cannot be judged on the basis of written specifications and proposals (*ibid.*).

PCP is based on the process in which different suppliers compete through different developmental phases. The risks and benefits are shared between the procurers and the suppliers under market conditions. The risk-benefit sharing under market conditions is when procurers share the benefits and risks related to the IPRs resulting from the research and development (R&D) with suppliers at market price. Competitive development in phases is the competitive approach used in PCP by procurers to buy the R&D from several competing R&D providers in parallel. The procurer compares and identifies the best value for money solutions available to address the PCP challenges. R&D is divided into phases (solution design, prototyping, original development and validation/testing of the first products) with the number of competing R&D providers being reduced after each evaluation phase [5].

PCP is an approach for acquiring R&D services which enable public procurers to

- share the risks and benefits of designing, prototyping and testing of new products and services with the suppliers and other stakeholders such as the end-users,
- create the optimum conditions for wide commercialization and take-up of R&D results through standardization and/or publication, and
- pool the efforts of several procurers [11, 12].

PCP gives an opportunity to develop different ideas in parallel where one, or few of the initial ideas will eventually be selected for commercial public procurement in accordance with the Procurement Directives. It starts earlier in the innovation cycle of a product than a more conventional procurement project would do. It is a competitive process where solutions are step by step selected or abandoned. It is attempt to highlight existing possibilities for public agencies to procure innovation within existing legal frameworks. The First phase in PCP may involve a pre-study or 'solution exploration' where several different solutions are explored. The second phase may include prototype development of the solutions that are considered most promising. This can be followed by the development of a small

test-batch of some of the remaining solutions. Finally, one or few of the remaining solutions are selected for commercial roll-out (Decipher PCP Project, 2013) [11, 12].

4 Method

The present empirical findings are based on a larger study dealing with open innovation platforms in Smart Cities [13, 14, 15]. This larger research project addresses various aspects, and the central theme of this article -challenges in using PCP for enhancing innovation for cities- is one of them. The research method is qualitative based on in-depth interviews [16]. The data of this article include 65 in-depth interviews. The interviewees also had a chance to make drawings during the interviews. The drawings were photographed, collected, and interpreted in the analysis. The informants of the in-depth interview come from Finland (49), Spain (5), Netherlands (2), China (3), Italy (2), Denmark (1), Australia (1) and USA (2). The interviews were audio recorded and transcribed for later analysis. However, most of the findings of this paper are based on the data from the Finnish informants. The informants were selected based on their expertise or experience in innovation in the cities, public procurement, Living Labs, or other type of innovation intermediaries in the city context. The interviewees include persons from the city administration, private companies, 3rd sector organizations, innovation intermediaries, as well as researchers. Interviewees selected from the city administration have experience or expertise on innovation, urban development, and collaboration with private/3rd sector organizations. Interviewees selected from private sector have experience or expertise on collaboration with the cities. Interviewees selected from 3rd sector have experience or expertise on collaboration with the cities. Interviewees from innovation intermediaries have experience or expertise on Living Labs or facilitation of collaborative innovation networks. Researchers are academics who have examined innovation intermediaries or urban development. Interviews took around 1-3 hours. In addition to in-depth interviews, the data of this article include material from 4 co-creative workshop addressing innovation collaboration between the cities and external actors. The data of the workshops include transcriptions of selected parts of the workshops, notes, photos on written and drawn material during the workshops, as well as written summaries of the main conclusions of the workshops. The data were analyzed by open coding and selective coding, in terms of the grounded theory method [17].

4 Opportunities and Approaches for Using PCP in Collaborative Innovation of Cities

This empirical study identifies the following opportunities and approaches for using PCP for enhancing collaborative innovation in cities with external actors, such as companies, 3rd sector organizations, universities, and citizens. They are explained next.

1. R&D for specific needs of cities
2. Identifying and developing new markets
3. Pro-active market dialogue
4. Increase of co-creation and joint procurement
5. Boosting the business of external actors
6. Tool for developing the business sector, public services and communication
7. Support from R&D organizations and financiers
8. National expert organization for public procurement
9. Fostering national level PCP projects
10. PCP projects funded by the EU and the role of intermediary organizations
11. Fostering the innovation of SMEs
12. Enriching routinized procurement practices
13. Easing the procurement of R&D
14. Enhancing corporate social responsibility and profitable business
15. Lightening the PCP process
16. Lower risk method of procurement
17. Cities learn to understand better business organizations' motives and function in innovation
18. Encourages mapping and illustrating the city's service production system
19. Closer collaboration of city departments and procurement personnel
20. Support from political decision making in the city
21. Development of strategic procurement and contracting with external actors
22. The role of procurement knowledge increases
23. Understanding of international markets increases
24. Customer-oriented development of product and service concepts
25. Potential to exploit experiences from PCP and PPI
26. Authentic problems, challenges and interpersonal encounters foster innovation

27. Helps building up a long-term investment program of certain area

4.1 R&D for specific needs of cities

The research data shows that PCP can be an encouraging option for both the city and external actors because it commits the participants to target-oriented research and development. PCP creates opportunities to develop the service production of cities facing financial difficulties and implement PPI procurements. The city and external actors want to participate in concrete co-creation which, in the long term, will be beneficial to the activities of both. It is perceived as a reasonably safe procurement method to develop product and service concepts for gradual or even radical co-creation where more than one city participate in the procurement project and risks are shared among the cities and the external actors. The EU Commission's PCPs were seen as developing the ability to identify new areas and products as well as to bring cities and external actors closer together. The research data indicates that investors are interested in financing external actors involved in PCPs if the product and service concepts to be developed are innovative and customer-oriented.

4.2 Identifying and developing new markets

The research data indicates that pre-commercial procurement allows for a new type of co-creation between cities and external actors where both parties significantly share and develop both their own know-how and the city. The identification of problems and the definition of the need require diverse expertise and forward thinking from the participants. R&D procurement allows a city to improve the cost-effectiveness of its current service offering when it is capable of customer, business and target-oriented co-creation with external actors. PCPs increase the knowledge of the market among city decision-makers and officials responsible for procurements and reduce the risks of innovative procurements.

4.3 Pro-active market dialogue

The research data shows that cities and external actors had not only the negative experiences—about market dialogues, but also positive experiences of market dialogues where new innovative product and service concepts for future challenges were sought through open discussion. Market dialogue practices and their more systematic use as an information-gathering and co-creation tool promote the development of the city. Successful market dialogues make it easier to determine a suitable procurement method. The research data indicates

that the city staff responsible for procurements is provided with procurement communication instructions and guidance so that the use of market dialogues become established and more effective in the future. Solving strategic problems and challenges of cities require more open innovation with external actors where significant PCPs and PPIs are identified.

4.4 Increase of co-creation and joint procurement

The research data showed that cities should be more engaged in co-creation and joint procurement and harmonize processes and operating models, as the needs of many cities and their residents are universal. Pre-commercial procurements allow to develop new customer-oriented product and service concepts more cost-effectively for the various needs of the organization and residents of the city, to share the development costs among several cities and to implement a joint procurement. Too city-centric a procurement policy and political decision making based on short-term benefits does not create the desired effectiveness of the service production of Finnish cities in the global operating environment. EU Commission-funded transnational PCPs teach cities to participate in international procurement, and this kind of knowledge will be required in the future. The research data indicates that the management and implementation of strategic and operational procurements could be concentrated at the regional level which would allow cities to save costs on larger procurement volumes also in the acquisition of traditional goods and services.

4.5 Boosting the business of external actors

The research data shows that PCP allows external actors to develop their own business together with city experts when a genuine future need for a new product or service concept is identified. In R&D collaboration, cities develop business- and customer-oriented thinking. Cities must dare to set high enough goals for PCP and PPI. PCPs must be aimed at utilizing innovative product and service concepts in the public sector and expanding external actors' markets in the domestic and/or international market. The integration of PCPs and their testing processes in the service production of a city is an important issue because these experiences will be beneficial to both the city and external actors. External actors can offer the service production of cities numerous ideas that will meet many societal and social challenges in a more effective and people-oriented way compared to the existing operating models.

4.6 Tool for developing the business sector, public services and communication

Based on the research data, cities have to shift from growth management to an active urban environment and the development of its services by creating a strategic business and innovation policy that will have a wide-ranging ripple effect on society. PCPs present the opportunity to create cost-effective and sustainability-promoting innovative procurements. Using PCPs and PPIs, the city has the opportunity to develop its own services and new business together with external actors. The research data shows that new innovative product and service solutions are required to develop the business sector and public services which also create an entrepreneurial ecosystem. The current procurement methods allow to undertake innovative public procurements and transform service structures to respond to the future needs as the skills to interpret procurement law are developed. The decision-makers responsible for the development and management of cities' product and service concepts should have better knowledge of the market and financial instruments and create an environment in which the participation in PCPs and PPIs is also promoted.

4.7 Support from R&D organizations and financiers

The research data indicates that cities need both research and development organizations and financiers as partners so that the cities are encouraged to begin a wider R&D collaboration with external actors. External actors also need their expertise and support as well as funding in both R&D projects and the possible commercialization of a product and service concept.

4.8 National expert organization for public procurement

The research data shows that there should be a national organization consisting of public procurement experts that would guide and service the public sector and other actors in both pre-commercial procurement projects and other public procurement as well as provide support for cities' procurement units and external actors, on a centralized basis. An organization consisting of experts could look for financing options and identify development targets as well as external actors who can provide innovative unbiased solutions to future problems of cities. A new kind of operating and guidance model would create opportunities to identify more such problems and challenges suitable

for PCP and simultaneously benefit several cities as well as external actors across the country.

4.9 Fostering national level PCP projects

The research data shows that future major challenges require national and strategically important pre-commercial procurement projects because the needs of cities are very much universal, although each city has its specific characteristics. Finland's small population and size speak in favor of national projects. Individual Finnish cities are too small and unwilling to invest in long-term PCP projects aimed at PPI. PCP is considered suitable for e.g. environment, energy, a circular economy, and health care where costs and resources can be effectively shared with external actors and external financing is obtained.

4.10 PCP projects funded by the EU and the role of intermediary organizations

The research data shows that officials and those responsible for strategic procurements should become more familiar with EU Commission-funded PCP projects and actively participate in them in order to develop services and industry. Finland would need an institution to promote active implementation of PCP and PPI projects. Cities do not have adequate knowledge and resources to file PCP applications nor the ability to form consortia. Officials have too little experience in defining the needs and opening the chain of needs as well as in business understanding and market knowledge. This requires intermediary organizations, strong expertise and service design skills as well as a business-oriented mindset where the interest and objectives of the city and the external actors are met on a financially sustainable basis. Based on the research data, more active interest of cities and their decision-makers as well as external actors in PCP projects will be desirable in the future because they will be used to transform the cities' service production and create new business in Finland and the international market.

4.11 Fostering the innovation of SMEs

On the basis of the research data, pre-commercial procurements are used to genuinely promote the development of product and service concepts of SMEs because they are most in need of testing platforms and testers, as well as references. Companies and third-sector actors who are developing their own product or service concepts are interested in specific development projects such as PCPs. Experience gained from PCPs will help SMEs and the third sector develop when they

receive extensive feedback from experts and users regarding the solutions they have developed. Cities must create a suitable and actor-friendly operating and development environment for SMEs and the third sector so that in the future they can take care of a part of the services currently provided by the public sector. SMEs are mostly attracted by the commercialization of R&D results. The challenge for newly created SMEs in the high-technology sector is to convince cities of the importance of new services. Often the obstacle is the lack of convincing references or insufficient understanding by cities of the industry in question, even though the companies are familiar with and confident in the success of their own product or service concept and service production.

4.12 Enriching routinized procurement practices

The research data shows that a city should try different procurement methods with other cities more boldly as well as share knowledge and experiences and systematically improve their usability. Both small procurement and direct procurement were seen as innovative acquisition under the right circumstances. Large and small cities and their procurement expertise are in various stages of development and therefore some of them are able to expand the use of procurement methods more quickly than others.

4.13 Easing the procurement of R&D

Based on the research data, cities should be encouraged to invest in the purchase of research and development by allocating funding to PCP and PPI procurements. In addition, there is a need for an entity or actor that would promote and increase their chances of being realized between external actors and cities and provide concrete support to the parties in their execution. Opportunities for developing new product and service concepts exist because external actors are interested in research and development aimed at procurement and business. The better the city knows the opportunities provided by public procurement law and create an innovative operating environment the more external actors are able to integrate into its research and development.

4.14 Enhancing corporate social responsibility and profitable business

The research data indicate that cities have good experiences of developing services with external actors. This requires that both the city official and the other actors develop new attitudes towards each other. Those responsible for city procurements have

to understand that external actors need a profitable business in order to develop customer-oriented service concepts. Cities expect from companies socially responsible corporate citizenship where basic public services are transformed into more efficient and customer-oriented ones through partnerships and R&D projects. Both commercial and third-sector actors are eager to develop public services and an operating environment where officials will work flexibly and understand the objectives of their activities.

4.15 Lightening the PCP process

According to the research data, the 3-phase PCP process developed by the EU Commission should be streamlined so that cities are encouraged to participate in projects when appropriate. This will allow external actors to more quickly commercialize product and service concepts they have developed. The research data contains a proposal for combining Living Lab phase with field testing. The research data also showed that cities should implement lighter strategic national projects in the near future. A structured PCP process can contribute to solving major societal and social problems when cities anticipate them in good time for the market. The PCP process was seen as a common tool of the cities and external actors to share risks and create future service concepts in a proactive, long-term and forward-looking manner for cities' growing universal problems that global megatrends will inevitably create. The research data revealed that the public sector in the Netherlands and the United Kingdom has modified and successfully used PCP for several years.

4.16 Lower risk method of procurement

The research data showed that the EU Commission's structured pre-commercial procurement is a safe and clear phased tender procedure for purchasing R&D services because the parties to the contract share risks among themselves, with the driving factor being business-orientation. A company participating in a tender based on the EU Commission's PCP model may withdraw if it so wishes, if not eliminated in different evaluation phases. According to the research data, some companies wish to participate in only one phase of the PCP process because they feel they learn and develop during the process with the procurers and other actors. The research data showed that PCP must be learned to be seen as part of PPI in which the customer and business focus is the starting points. The research data confirms that the use of PCP will, in the long term, transform the public procurement practices

and culture as well as the procurements into more innovative ones.

4.17 Cities learn to understand better business organizations' motives and function in innovation

The research data shows that in PCP and PPI process the city learns to purchase effectiveness and results rather than just goods and services from external actors, and understand them and the motivation of their activities. Also, the city has the opportunity to develop its contracting expertise and partnership skills, and to better understand the importance of a functioning ecosystem. The determination of effectiveness and its indicators will develop the ability of a city and external actors to understand the needs of customers so that customer-oriented cost-reducing solutions can be put in place.

4.18 Encourages mapping and illustrating the city's service production system

The research data shows that undertaking pre-commercial procurement and public procurement of innovation forces cities to illustrate their service. The illustration of service production helps to question and reform one's own processes and makes it easier to define the content of the procurement documents, leaving external actors the possibility to offer a different product and service concept. This operating model will encourage more external actors to participate in research and development projects, market dialogues and tenders which are perceived as more meaningful than the current rigid and formal tendering procedure.

4.19 Closer collaboration of city departments and procurement personnel

According to the research data, the emphasis on the planning and preparation phase and research and development during the contract period will strengthen the collaboration between city departments and procurement experts. The current emphasis on the tendering phase has reduced city departments' expertise in strategic management of procurement, and co-creation efforts with external actors during the contract period. The PCP and PPI operating models require that city departments become more familiar with the procurements and supplier market using a new approach and taking overall responsibility for the procurement process together with procurement experts at as early stage as possible in order to reach the strategic goals of the city in each case. Similarly, procurement experts are also required to have more than just technical tendering skills.

4.20 Support from political decision making in the city

The research data confirms that in order to succeed pre-commercial procurement requires extensive study, expertise and reasons as well as support and an understanding of a profound ongoing change in the public acquisition culture from political decision-makers before the process begins. The procurement of R&D in the public sector also provides an opportunity to better prepare for future complex competitive tenders when the procurement clearly identifies the object of procurement and a suitable method of strategic procurement during the process. It must be possible to clearly communicate the city's strategic procurement objectives to the market which will give an opportunity to transform services and improve the efficiency of procurements in a goal-oriented manner over electoral periods. The planning and implementation of PCP and PPI procurements require support from the city's political decision-makers, management and organization, as well as resources and financing so that it can be realized more systematically and target-oriented in collaboration with external actors.

4.21 Development of strategic procurement and contracting with external actors

The research data indicates that the importance of strategic procurement and contracting skills is seen as an ever more important part of professional competence for everyone involved in procurement. In the future, the public sector will purchase more and more complex service concepts and undertake different contracts and R&D projects with external actors. The study revealed that, in the future, the role of procurement planners will be strengthened as cities participate in development collaboration and procure more services from external actors as well as monitor the implementation of contracts and measure the quality of external actors' services. The importance of R&D procurement expertise will grow in the future. For this reason, the active use of PCP will transform cities' procurement culture into a more innovative one and strengthen the expertise as well as a customer- and business-oriented approach and thinking that will be required in the future.

4.22 The role of procurement knowledge increases

The research data confirmed that public procurements, along with the knowledge of procurement legislation, require a strong, in-depth, diverse commercial and contract law expertise because the operating environment and procurement

processes are much more demanding than those in the private sector. In the future, those responsible for city procurements will have to be able to sell and market the city as a contracting partner to different external actors. Residents are also consumers who are now more demanding and disapprove the weak service quality. They require high-quality, transparent and ethical services which add value to their everyday life. Persons responsible for procurements have to develop the ability to better identify new external actors and to be able to open market dialogues and implement necessary research and development projects in good time before competitive tendering. The research data confirms that cities will need more business, procurement and contracting expertise in the future as the production of public services changes and effectiveness requirements increase.

4.23 Understanding of international markets increases

The research data shows that the participation in the EU Commission's transnational PCPs develops the ability of external actors to operate in the global operating environment. The role, responsibility, power and operating culture of the Finnish public sector are different from those in many other European countries and thus the exchange of experiences and views is beneficial to the participants. Participants will learn to understand the procurement culture of other countries and to modify Finnish product and service concepts for the international market.

4.24 Customer-oriented development of product and service concepts

The research data indicates that cities can use PCPs and PPIs to challenge a wider range of external actors to develop customer-oriented product and service concepts. By exposing R&D services to competition, cities encourage external actors to develop and compete with each other. Hence, cities are not dependent on individual actors but help, using their own active innovative procurement management, external actors to develop and compete in both domestic and international markets.

4.25 Potential to exploit experiences from PCP and PPI

The research data confirms the idea that cities and their decision makers should become familiar with ongoing and completed procurements both nationally and internationally. There is a need for both the development of expertise and experience in the PCP and PPI so that more those who participate

in procurement processes have the ability to identify their opportunities in different situations. The expertise and experience of persons who have worked in current or completed projects should be utilized through more extensive networking with them. The courage, risk-taking ability, open-mindedness and attitudes of the procurement leaders as well as the identification of the problems determine how and in what situations the PCP method will be used in the future.

4.26 Authentic problems, challenges and interpersonal encounters foster innovation

The research data shows that the implementation of PCP and PPI projects becomes possible when encounters between city officials and external actors are arranged involving real problems and challenges. Then the traditional roles of the seller and the buyer are forgotten and the services are considered from the customer's, citizen's or/and taxpayer's point of view. The city and external actors need to build confidence and understanding of each other's activities and to create customer-oriented product and service concepts. Support from political decision makers allows for a goal-oriented co-creation. Encounters create a common understanding of new service concepts, extend thinking and reduce confrontation between the public sector and other stakeholders when various joint research and development projects are implemented by sharing the risks. External actors also see more opportunities for more dynamic co-creation than cities that are bound by their current hierarchical operating models and are afraid of making mistakes and of weakening their position unlike external actors who are aware of the strengths of their own activities. Both the city and external actors must know their own strengths and have a strong vision to be able to compete with each other and participate in multi-professional strategic collaboration in which each actor complements each other's expertise and adds value to the management of the whole process.

4.27 Helps building up a long-term investment program of certain area

According to the research data, cities need a comprehensive service investment program which sets the guidelines for research and development. In this context, cities should use PCP for developing future service investments. City service procurements have grown year by year. The city's service procurements can be higher than the city's annual personnel costs and therefore the development of services requires systematic and

long-term development in order to avoid bad investments.

4 Conclusions

The purpose of this study was to increase knowledge of the opportunities and approaches of using pre-commercial procurement (PCP) in enhancing collaborative innovation of cities with external actors. It was based on an empirical study on open innovation platforms in Smart Cities. The method was qualitative, and based on extensive data from in-depth interviews and co-creative multi-actor workshops. This study identified and described a large number of opportunities and approaches of using pre-commercial procurement (PCP) in enhancing collaborative innovation of cities with external actors.

The following suggestions emerge from the present study to officials in city governments and urban policy makers. Firstly, the PCP process should be developed to be lighter and easier for all stakeholders. Case specific applications could be developed so that all stakeholders would have lower threshold to participate in PCP projects. Projects allow the cities and external actors to test and refine the products and business models to correspond the market demand in real conditions before choice of final procurement method or commercializing the results. Pilots are needed for this. Secondly, cities should develop long-term procurement strategies that aim at enhancing the development and diffusion of innovations, as well as industries, and regional development –not just minimizing costs in the short term. Thirdly, the citizen and end-user involvement should be addressed more in the public innovation. PCP projects have potential for this. Fourthly, since PCP projects require much more expertise and effort than regular public procurement, national PCP experts should be trained and collaboration with cities is required. Fifthly, PCP projects with international consortiums and actor networks have the potential to boost the internationalization of services [18, 19, 20]. Sixthly, joint research and development projects in the area of PCP and PPI are required between city administration and research institutions.

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