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Enhancing Public Sector Digital Service Design through Pre-Commercial Procurement

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ABSTRACT

This paper addresses the challenges in designing and provisioning digital services for public sector. The ongoing digitalization of public services calls for scalable models for ecosystem based collaborative service design. However, while digitalization of services has been studied extensively from technical and financial viewpoints, less focus has been devoted for the collaborative service design processes. In this paper, we present a critical analysis of an alternative approach to public sector driven ecosystem based service design. The analysis is based on a deductive review of earlier research on ecosystem based digital service design, and an inductive theory making based on a representative case study applying pre-commercial-procurement practices. The paper contributes to existing knowledgebase on ecosystem based digital service design. The managerial contribution is innovative approach to public sector service design process. The paper concludes with call for further research and practice on innovative digital service design models for public sector.

Keywords: Digital service design, Innovation ecosystem, Public-private-partnership, Pre-commercial procurement, Citizen engagement

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1. Introduction

The ongoing digital transformation in cities has highlighted the need for systematic end-to-end methodologies and management processes for public sector innovation. Innovations in smart city context are implemented in ecosystem based co-creation with a plethora of stakeholders with diverse motives, operating practices and objectives, which makes these projects cumbersome to manage. Cities typically have clear vision and strategy for digital transformation, but successful implementation of strategies is hindered by treating digital service creation as traditional software implementation projects rather than innovation initiatives. The lack of management practices and experience in innovative design approaches like citizen engagement, co-creation, challenge driven innovation and explorative research methods slow down the digital transformation journeys in the cities.

This submission addresses the identified challenges in public sector innovation, specifically in designing and innovating digital services in cities. The paper reviews the current best practices in publicly driven digital innovation, and presents a representative case study for validation and further elaboration of literature based classifications of public sector innovations. The paper's epistemic contribution is adding evidence to the body of research in public sector innovation and digital service design. The key managerial contribution is increased clarity on d transformation process with typologies of actors, motives and management practices for ecosystem based co-creation.

Public sector innovation landscape has been transforming rapidly during the past decade. Advanced technologies have enabled new means for service creation and citizen engagement in the design process, and services are increasingly created in ecosystem based co-creation. Public agents have transformed from service procures to active agents in service co-creation processes in emerging public-private innovation ecosystems [11].

The authors began the investigation with a review of the latest innovation ecosystem literature from Scopus, Google Scholar and EBSCOhost bases from 2010-2021, when the innovation ecosystem research took a significant increase. Focus was on innovation ecosystems, as platforms for the co-creation of new products and services.

Current innovation ecosystem literature mainly focuses on corporate or university driven innovation ecosystems [12]. This motivated the authors to focus on public sector driven ecosystem management methodologies, practices and challenges. The investigation was done through literature review for establishing and verifying the research gap, data collection and analysis of a representative case study, and conclusion of the findings to contribute to the existing knowledge base.

Cities as urban hubs are considered as contexts for implementing national innovation and technology strategies, and a places for experimenting with emerging digital transformation enabled opportunities [31].

We approach this process from managerial and service oriented view point. The process has been extensively studied from technical view point, but little attention has been devoted to the organizational and managerial questions.

This paper presents a real-life Smart City project that applies experimental service co-creation methodologies of pre-commercial procurement (PCP) and living labs. These citizen engagement focused approaches have been heavily supported and instrumented by the European Commission, and also the case study is funded by the Commission's PCP program.

Pre-commercial procurement is a method for challenge driven co-creation with private companies prior to official public tendering process. The process is based on competitive bidding and risk sharing among the parties in

real-life service design, development and testing. The role of citizen engagement is highlighted in every step of the process [21].

Living Lab methodology refers to an open, user-driven co-creation approach. It has been widely adopted globally since its inception with the European Network of Living Labs in 2006, and supported considerable by the European Commission. Living Lab approach has become an established practitioner approach to service creation, combining several theoretical approaches and methods [28].

The paper is structured as follows: first, it presents the theoretical background and contemporary research on innovation ecosystem management. Smart Cities are introduced as a representation of innovation ecosystems. Second, the named co-creation methodologies PCP and Living Labs are described as experimental modifications of classical service design models, adopted for Smart City contexts. The case study is used as a validation of the methodologies, and as an enquiry to discover best practices and challenges in public sector driven innovation.

The paper contributes to innovation ecosystem literature by proposing practice based recommendations for co-creation and citizen engagement in public innovation ecosystems. It addresses the identified research gap in public private ecosystem management. Managerial recommendations for Smart City context are given. The paper concludes with critical discussion on PCP and Living Lab methodologies, and suggestions for future research and appropriate application in these methodologies.

2. Literature Review

We approach this process from managerial and service oriented view point. The process has been extensively studied from technical view point, but little attention has been devoted to the organizational and managerial questions.

The term innovation ecosystem has been widely used in literature and practice since 2010 [27]. The use of the concept in different literature streams varies, depending authors' choice of policy and institutional focus, or business and strategy focus [14,15].

The authors here focus on the business and management oriented definitions, including "a community of interdependent heterogeneous actors coordinated through a co-alignment structure who collectively deliver an ecosystem-level output" [3], or "evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors" [15].

Although literature sometimes uses the concepts innovation ecosystem and business ecosystems as synonyms, recent developments have increasingly started to see them as different concepts [6,9]. As Gil-Gomes et al [14]state, the main difference between the business ecosystem and the innovation ecosystem is the focus on value capture for business ecosystems, and value creation for innovation ecosystems. We use the approach of Mazzucato and Robinson (2017) [24], treating innovation ecosystems as multi-actor perspective category, where a variety of actors interact to create socio-economic value through research, novelty creation, and market activities.

2.1 Approach

In an effort to define the research gap in innovation ecosystem literature, the author's completed a two-tier literature review on EBSCOhost databases (17 in total), the Scopus database and the Google Scholar in order to establish the current priority areas in innovation ecosystem literature. The search was focused on academic papers from year 2010, when innovation ecosystems started receiving growing attention in research[2,3].

Stage one involved EBSCOhost search with the keyword "innovation ecosystem". This resulted in 531 academic papers. This EBSCOhost search was narrowed with keyword

"management", which yielded 86 results. Similar search was completed with Scopus database, and it resulted in 69 publications.

Google Scholar was studied with keywords "innovation ecosystem" with 1540 results, and narrowed down by keywords "Managing innovation ecosystems" (102 results), and innovation ecosystem management (82 results). In the second phase, dublicated results were removed and 46 publications were selected for establishing the current research focus areas and gaps in literature.

The review suggested that contemporary research mainly focuses actor mapping and categorization[17]. Another recognized focus area was ecosystem origins, initiation, evolution and growth dynamics [5], [9,10].

The most apparent research gap was on value appropriation and lacking elaboration of practitioner implications for strategic management [4]. Many of the studies were descriptive in nature, and focused on ecosystem internal dynamics and management, rather than economic or societal impact.

Also public sector actor as an ecosystem leader received little attention [3], with apparent focus on university lead ecosystems and dynamics between private sector actors [26].

This motivated authors to focus on ecosystem based public-sector innovation through managerial and service oriented lens. The investigation focused on contributing to the apparent research gap in public-actor driven co-creation processes, methodologies and management practices, and the practical implications and advantages of citizen engagement in the co-creation process.

Public sector innovation challenges have been classified as organizational, interaction specific, type related and contextual challenges [7]. Overlap across the typologies exists, and further categorizations have been offered based on innovation actors, ecosystem maturity and openness of collaboration. Further identified challenges relate to policy alignment, citizen engagement and industry collaboration [1]. A good body of research has been devoted to public procurement processes and leadership aspects in innovation diffusion in intra-organizational context [22], but less focus has been given for holistic innovation management processes, research design and practical challenges for digital innovations in publicly driven innovation ecosystem context [25].

This paper focuses on digital innovation management by public actors. First, the paper presents a comprehensive literature review of public sector innovation challenges. This review is then complemented by review of digital innovation management and digital transformation literature.

The case study was a testimony of the earlier identified challenges in public sector innovation management. The investigation revealed interdependencies between the various innovation management challenges. The interaction specific challenges together with the contextual factors marked the major area for improvement. Traditionally, the city has sourced products and services from overseas, so local innovation ecosystem development is in very early stages. The lack of co-creation culture and consortium based development resulted in low levels of trust and interaction. Openness, risk sharing and role confusion were further typical signs of the immaturity of the innovation ecosystem.

The lack of management practices contributed to the second major category of challenges. Development was strongly driven by strong vision and shared agenda, along with clearly articulated innovation strategy and good instrumentation. The challenges laid in interaction between the ecosystem stakeholders and the lack of earlier reference cases and research architecture. The responsible government agency needed to define the concept for city wide experimentation for digitalization, the terms of engagement for co-creation, and even contractual templates to be used for collaboration agreements.

Table 1. Representative articles in innovation ecosystem research focus areas

Focus Area	Representative Articles
Ecosystem actor mapping	Mahmoud-Jouini, S. B. Charue-Duboc, F (2017): Experimentations in emerging innovation ecosystems: specificities and roles. The case of the hydrogen energy fuel cell. International Journal of Technology Management 75(1/2/3/4):28
	Dubina, I (2015): A Basic Formalization of the interaction of the key stakeholders of an innovation ecosystem. Mathematical Economics 2015 | 11(18) | 33-42
	Dedehayira, Ozgur; Mäkinen, Saku J. ; Ortt, J. Roland (2018): Roles during innovation ecosystem genesis: A literature review
	Pucci, Tommaso; Runfola, Andrea; Guercini, Simone; Zanni, Lorenzo (2018): The role of actors in interactions between "innovation ecosystems": drivers and implications.
	Dias Sant´Ana T., de Souza Bermejo P.H., Moreira M.F., de Souza W.V.B. The structure of an innovation ecosystem: foundations for future research
	Bacon E., Williams M.D., Davies G. Coopetition in innovation ecosystems: A comparative analysis of knowledge transfer configurations
	Núñez S.M.P., Serrano-Santoyo A. Multi-actor network perspective: CaliBaja an emergent binational innovation ecosystem
	Nepelski D., Van Roy V. Innovation and innovator assessment in R&I ecosystems: the case of the EU Framework Programme
	Aryan V., Bertling J., Liedtke C. Topology, typology, and dynamics of commons-based peer production: On platforms, actors, and innovation in the maker movement
	Yaghmaie P., Vanhaverbeke W. Identifying and describing constituents of innovation ecosystems: A systematic review of the literature
Ecosystem initiation and growth dynamics	Feng, N. Fu, C. Wei, F. Peng, Z., Zhang, Q. Zhang, K. (2019): The key role of dynamic capabilities in the evolutionary process for a startup to develop into an innovation ecosystem leader: An in depth case study. Journal of Engineering and Technology Management. Volume 54, October–December 2019, pp. 81-96
	Budden, P., Murray, F., & Initiative, M. I. (2019). MIT's Stakeholder Framework for Building & Accelerating Innovation Ecosystems.
	Mahmoud-Jouini, Sihem Ben; Charue-Duboc, Florence (2017): Experimentations in emerging innovation ecosystems: specificities and roles. The case of the hydrogen energy fuel cell. Int. J. Technology Management, Vol. 75, Nos. 1/2/3/4, 2017
	Fang T.P., Wu A., Clough D.R. Platform diffusion at temporary gatherings: Social coordination and ecosystem emergence
	Feng N., Fu C., Wei F., Peng Z., Zhang Q., Zhang K.H. The key role of dynamic capabilities in the evolutionary process for a startup to develop into an innovation ecosystem leader: An indepth case study
	Ferasso M., Wunsch Takahashi A.R., Prado Gimenez F.A. Innovation ecosystems: a meta-synthesis
	Gomes L.A.D.V., Facin A.L.F., Salerno M.S., Ikenami R.K. Unpacking the innovation ecosystem construct: Evolution, gaps and trends
	Benitez, G. B., Ayala, N. F., & Frank, A. G. (2020). Industry 4.0 innovation ecosystems: an evolutionary perspective on value co-creation. International Journal of Production Economics, 107735

Table 2. University as an Ecosystem Leader

University as a Leader	Representative Articles
	Leih S., Teece D. Campus leadership and the entrepreneurial university: A dynamic capabilities perspective
	Butler J., Gibson D. Research universities in the framework of regional innovation ecosystem: The case of Austin, Texas
	Heaton S., Siegel D.S., Teece D.J. Universities and innovation ecosystems A dynamic capabilities perspective
	Tejero A., Pau I., Leon G. Analysis of the Dynamism in University-Driven Innovation Ecosystems Through the Assessment of Entrepreneurship Role
	Gastaldi L., Appio F.P., Martini A., Corso M. Academics as orchestrators of continuous innovation ecosystems: Towards a fourth generation of CI initiatives

The paper supports city administrators and digital officers in designing and innovating digital services for cities. It gives practical guidance for project planning, stakeholder management and citizen engagement in Smart City context. The paper proposes clear terms of engagement for ecosystem based innovation together with step by step guide on implementing digital innovation projects following inclusive open innovation and co-creation practices in smart city context. As for the limitations, further research on contextual factors in digital innovation management will be needed by replicating the study in another smart city context. his story of a digital transformation journey has value as itself in advancing understanding of the practicalities of this process.

3.1 Pre-Commercial Procurement

With the objective of improving the external quality and affordability of public services, the incentives for implementing technologies in care processes are strong. Public procurers have the opportunity to drive innovation from the demand side by acting as technologically demanding customers that buy the development and testing of new solutions.

Pre-commercial procurement (PCP) is a concept developed by the European Commission in 2007. It enables the procurement of research and development of new innovative solutions before they are commercially available without violating public sector procurement regulations. It is an alternative to R&D subsidy programs for public private co-development [35]. The process is split into phases of solution design, prototyping, original development and validation/testing of the first products. The risks and benefits are shared between the procurers and the suppliers under market conditions.

Compared to R&D subsidy programs, pre-commercial procurement enables an earlier reality check of industry R&D against concrete public purchasing needs, which can help to maximize the effectiveness of the R&D process and optimize public R&D spending[5,8]. Development is split into phases and the number of competing R&D providers is reduced after each evaluation phase.

PCP applications are still limited and little has been written about the cases. The published cases follow traditional product development processes [5], which motivated the authors to develop a model for participatory design methodology for the PCP process. The authors propose application of Living Lab methodology for all phases of the PCP process.

Living Lab concept is an open innovation concept based on a systematic user co-creation approach integrating research and innovation processes. The term "living lab" or "living laboratory" is also used for real life product testing through user engagement. The methodology is well established among practitioners and broadly studies among scholars over the past decade [16].

3.2 Living Lab Approach

Citizen engagement in public decisions increases transparency and trust with public sector, and offer new opportunities for social value creation [29]. This was philosophy was the founding principle of the Living Lab concept development.

The concept was first introduced by William J. Mitchell, Kent Larson, and Alex (Sandy) Pentland at the Massachusetts Institute of Technology in 2005. The concept was soon adopted in Europe, where it resonated with the values and norms of the socially conscious societies. In 2006, the European Network of Living Labs, as a head organization for promoting Living Lab research was established, with strong support by the European Commission.

The concept seeks to understand human and social behaviour through observations and interventions. Living Lab approach proposes that users will be engaged from the beginning, the solution design phase. The experimentation

within LL has double value, on one hand it permits evaluation and testing of artefacts, and on the other it offers avenues for citizen engagement in co-creation

However, Living Lab research has been rightfully criticized for its' lack of scientific rigor [23]. While there is an increasing body of research on Living Labs, it is still best viewed as a portfolio of practical user engagement and service development tools, rather than an academic construct. (unless the title begins with such a word). Leave two 12-point blank lines after the title.

3. Methodology

The study followed the classical case study protocol [34] with an empirical inquiry on a representative case that represented the studied phenomenon within its real-life context, in with multiple sources of evidence were available for the study. Special efforts were made to make conclusions based on broad discussions and pattern-building among the research group and external stakeholders, making use of grounded theory approach (Strauss & Gorbin, 1994) [5].

The author participated in the case study as the project manager. Researcher prone bias was eliminated by following best practice case study procedures. Internal validity and clear causal relationships were ensured by detailed process design and planning. External validity was ensured by the selection of a representative case, and thorough analysis of the operating context for assessing the generalization of the findings. Inference typical to case studies was overcome by direct participatory observations of the case.

The study investigated a European Union funded research project Select4Cities (2017-2020). Select4Cities was a PCP project with an objective to create a data-driven, Internet-of-Everything (IoE) platform to stipulate and support large-scale urban experimentation and co-creation. Project partners involved representative of two European Cities, Helsinki and Antwerpen, that acted as the procurers. Other participants included PCP and Living Lab experts from academia, SMEs selected for device development through open calls, and dissemination and media partners for effective impact creation.

The project was implemented in two phases. In the first phase, the consortium released a challenge: 'develop an open, standardized, data-driven, service-oriented and user-centric platform for cities'. The participating cities selected air quality and mobility as specific application domains due to the severity of challenges in these areas in both cities. Five companies joined the consortium for Phase 2 and developed prototypes of the requested platforms with city operator interfaces and applications for citizen users.

The platforms were rigorously evaluated by the procurers' panel, and two consortiums were selected for the Phase 3, system implementation phase. Our focus in this paper is Phase 3, where the real life experimentation in the two cities took place.

The selected companies designed backbone architecture for collecting air quality and traffic data across the cities. The data was accessed by professional city data operators for urban planning and city management purposes, as well as by citizen users through a mobile application. The project created two Smart City innovation ecosystems with actors representing the city, academia, technology suppliers and citizens, applying Living Lab methodologies for platform design, development and testing, as well as for the PCP and Living Lab concept validation as sound methodologies for broader use in the future.

4.1 Data Analysis

Data was collected in participatory observations simultaneously in the two participating cities. Data collection was done in three tiers, focusing on various target groups for the triangulation of the data for improved validity of the findings. In the first tier, the platform was tested by city

operators, who were the ultimate users of the platform, and feedback was collected by structured questionnaires and online surveys. Second, beta version of the app was tested by students and hobbyist developers in one-day campus hackathon. Data was again collected on structured questionnaires and open ended questions.

The last phase involved citizen engagement and interviews with 50 people at public places including a library, a harbour and a market place. People were given an ipad to experiment with the app, and two adequately trained students took observatory notes, and asked a set of structured questions for rating the usability, usefulness and experience in using the application. All data was stored in a secured database and the results were treated anonymously.

The collected data was analysed according to the case study protocol with both qualitative and quantitative methods of pattern finding, categorization, reflections to earlier knowledge and studied ecosystem management frameworks. The teams in both cities first conducted analysis in their respective cities, and then the results were compared across the board. In addition to the data analysis, also feedback and experiences on the applied Living Lab methodology for data collection were recorded.

4. Case Study

The featured case is a European Union's Horizon 2020 research and innovation programme under grant agreement No 688196 'Select 4 Cities'. The project involved six core partners representing the cities, and the Living Lab test coordinator IMEC. Technology suppliers and the Living Labs for testing were selected through an open call procedure. The articulated objective of the project was to 'design, research and develop cities as linked and large-scale IoE labs' by developing scalable digital platforms.

In the case study, two dashboards, NAME and LUCIDAT, and one application, Athletes In Helsinki, were developed to test the Digital Enabler platform. They went through an intensive testing process in Helsinki during July and August 2020. The apps displayed air quality, pollution, noise and traffic for users to see the best route for practicing outdoor activities. It calculates the cumulative exposure to pollutants at the chosen location for the activity, and along the path to reach such location.

NAME dashboard gives insight regarding the traffic level in the Helsinki area, starting from data coming from air quality and noise sensors. LUCIDAT dashboard allows users to be aware of new deducted information based on data coming from sensors and Open APIs. This information includes events, city bike stations, real-time weather monitoring, most recent public transport alerts and pollutants level in the Helsinki area. The dashboard is divided into 4 main sections, each of which covers a certain aspect: 1) POIs, events and transport information, 2) current weather and forecasts, 3) air quality and gas sources and 4) noise level. This dashboard can be utilized by both city officials and consumers.

During the testing process, researchers conducted 50 user interviews in two public destinations in Helsinki: The Helsinki Central Library Oodi, and in Helsinki University Main Library. The interviews were structured so that the user was familiarized comprehensively with the selected dashboard and then interviewed. The results were combined with the hackathon and workshop information from Helsinki and Antwerp for further development of the Digital Enabler platform and the related solutions.

Living Lab testing followed five steps of intake, preparation, benchmark, pilot and consolidate. Further, the general principles and approaches of openness, multi-method approach, inclusiveness, integrity and real-life setting, as associated with Living Lab methodology, are fully applied in each iteration. The first phase focused on technical readiness, including

clarification of expectations around the use case. The KPI's and the roadmap, actor engagement plans and data collection methods were agreed upon. In the second stge the team used social media and gamification for promotion for active users and recruitment of new users. Living Lab activities included: Innovatrix workshop and two co-creation workshops for promotion and community engagement for the open calls, weekly rankings of top contributors to some and websites, weekly feedback discussion on progress and new features, hackathon, focus groups with professional users and developers, interviews and a survey. Each method was used for different target audiences, which included various categories of local citizens, local business owners, special user groups and visitors.

The Living Lab experimentation results were used for benchmarking between the experiments and definition of intended and delivered value for various user groups and Innovatrix. There were regular knowledge exchange workshops between the pilot cities and voting for the best new features on social media. In the end of the three Living Lab cycles and prototype iterations, the assumptions were verified and results consolidated into final reports for the various stakeholder groups. In addition to the review of the product and service related results, also the process related aspects were analyzed for learning and communication purposes for further application of Living Lab and Pre-commercial Procurement methods.

5. Results

The objectives of the project were twofold; to study the applicability of Living Lab methodology in Pre-Commercial Procurement process, as well as the PCP method itself, and the actual project results for the UX design of the city enabler application.

The Living Lab testing was considered as success in terms of both product and process outcomes. The testing followed the best practices for the Living Lab testing, as stated in the European Network of Living Labs state of the art handbook. The project concluded that Living Lab testing works well in the context of Smart City, as well as with pre-commercial procurement process. The benefits of Living Lab research included the deep involvement of the users and systemic data collection from the subjects.

Pre-profiling of targeted user groups and ad hoc interventions ensured authentic and representative set of data. The use of two-person teams for user engagement provided efficient, and yet not intimidating for the users. The results were recorded online on webropol tool, which reduced the need for further data handling. The formulation of questions together with the city representatives ensured the relevancy of the data.

Living lab approach provided a platform for the cities to operationalize their philosophy of citizen engagement and activation in designing public services. The methodology has been actively developed since its inception in 2003, and thus available tools and procedures are professional and easy to use. Also, the both cities had been actively applying Living Lab methodology in other projects, so previous experience and favorable attitudes towards the approach supported the implementation.

The validation of PCP process was considered sufficient. City representatives commented on the length of the process and the heavy resource and reporting demand in the process. Thus it was considered best suited for early stage concept design rather than applied, close to market research. One specific recommendation was to use PCP for defining requirement specifications for public procurement process. Technology providers agreed on the challenges with documenting requirements and the inefficiency of the process from technical development viewpoint.

In terms of the product, the developed application and platform were considered technically robust and filling the functional requirements. The shortcomings were identified

in the fit for operating context and linkages to other systems for scalability and future growth of functionalities. The development required a lot of close interaction with the user and management, and not all actors were used to this kind of process, which slowed down the development. The application is publicly available and in use at the time of this publication.

From scholarly perspective, the collected data and experience enabled a reflection of the methodological approaches to the identified public sector innovation challenges, namely organizational, interaction specific, type related and contextual challenges. The Living Lab approach as a collaborative development model could be applied to overcome interaction specific and contextual challenges. The organizational challenges including communication and collaboration processes could be partly solved by the application of Pre-Commercial Procurement as a means to equally serve all stakeholders' needs and initiate discussion and exchange.

6. Limitations

The paper presented a case study for understanding and validating the key success factors for successful adaptation of Living Lab approach to Pre-commercial procurement process, and supported the concept of community building as presented in earlier literature. This is a first of its' kind case study on this new emerging procurement and R&D method. With this the paper supports the advancement of pre-commercial procurement process in public sector. It further presents Living Lab concept as an alternative to traditional participatory research methods in the process.

With the applied nature of the topic, the paper has its' limitations in terms of theoretical contribution. Pre-commercial procurement and Living Lab concept are both still contested and much debated in terms of methodologies and theoretical foundations. Tighter grounding to major technical, behavioral and management theories would be a logical continuation for the paper. The paper is best viewed as a best practice case study in the application of these emerging methodological approaches in public sector context.

7. Conclusion

The paper contributes to the less published area of practical case studies in public sector service development, and particularly in managerial recommendations based on case study analysis. The results of the case study further verified the challenges in public sector driven innovation, as identified in the earlier research. The application of Living Lab concept as a representation of user driven development methodology and means for citizen engagement was considered to work well for digital service development. The authors' recommendation is to use applied versions of the methodology in public sector service processes. In terms of the Pre-commercial Procurement the results were two-fold.

On one hand, the process enabled deep dive into the details of the use context and thus have potential to lead to better design outcomes. This aspect can be likened to broadly applied design thinking process, and could be considered as a special application of the concept. However, the process was deemed somewhat too cumbersome and time consuming to be applied to regular procurement and development activities. This unfortunately easily leads to the application of traditional models of procuring off the shelf solutions with public sector acting as a buyer rather than a co-developer.

The paper's main scientific contribution is the application of alternative approaches to public sector innovation. The implications to the most commonly reported public sector challenges are listed in order to increase understanding of the underpinnings of these challenges and presentation of alternative means to overcome the challenges.

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