Guest Contribution

Smart City, Technological Capacity and Public Procurement

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Abstract

The rise of smart city and the increasing use of digital technologies to govern cities and steer citizen behavior in form of big data, internet of things, and social media as participatory platform leads to incessant waves of innovations in public services. The impact of technology on public sector is almost always mediated by the institutional context that frames the ways public sector interacts with private providers as majority of technological solutions and products are provided by private firms. Using the case of Tallinn, the capital of a globally leading digital country of Estonia, the main focus of the chapter is to demonstrate how procurement is related to technology capacity development and how it shapes technology-driven innovation policy in the public sector.

Introduction[1]

The rise of smart city and the increasing use of digital technologies to govern cities and steer citizen behavior in form of big data, internet of things, and social media as participatory platform leads to incessant waves of innovations in public services (for general introduction see Batty et al. 2012; Townsend 2013). While some of these innovations may be radical and noticeable to many citizens, most innovations brought forward under the smart city label are in fact incremental in nature. Such innovations center around developing software and data analysis tools in city planning, waste management, transportation and other domains, often rather technical areas where expertise is an important feature of administrative capacity. However, smart city concept is often used in a normative sense (Hollands 2008 offers a critical overview of smart city as a concept). That is, it is too often simply assumed that technology by definition leads to better public services and increased public value. This is not always the case, but it is hardly (if ever) captured by the smart city governance scholarship.

While there is a relatively long-term tradition in researching how technological changes impact work organization in companies (see, e.g., Trist 1981, Barley 1990, Leonardi and Barley 2010), implications on public organizations have not been researched with such depth (Lember et al., 2018). In fact, based on the organizational theory literature one can hypothesize that the relationship between public organizations and technology is highly complex. In essence, the technological change emerging around concepts such as the smart city is a process how technological changes impact work organization and how technological capacity emerges as a central new core public administration capacity.

In this chapter we deal with one central element of the technological capacity, that is, public procurement and outsourcing, and its relationships with innovation effects. The role and impact of public procurement and outsourcing is key in understanding the development of technological capacities of public sector because, in the slipstream of the procurement of public services, social innovation takes place due to the involvement of a wide variety of public, semi-public and private organizations. The impact of technology on public sector is almost always mediated by the institutional context that frames the ways public sector interacts with private providers as majority of technological solutions and products are indeed provided by private firms.[2]

The main focus of the chapter is to demonstrate how procurement is related to technology capacity development and then on the innovation policy formulation itself. More specifically, we aim at demonstrating how different factors influencing the evolution of technological capacities of public organizations ranging from in-house technological skills to the role of public sector feedback mechanisms are shaped by the public procurement institutions and routines. Moreover, we aim to show that there is actually a co-evolutionary processes at play where not only the procurement routines constrain or enable certain organizational behavior, but also how existing technological capabilities influence which procurement processes are used. We hypothesize that rigid procurement rules and ICT insourcing creates path dependencies and lock-in in the public sector which make it difficult to switch to new technological solutions when these arrive. Thus, public organizations' ploy to control technological development coupled with the institutional structures of the sector and low level of internal ICT capacity, create an environment of innovation that is continuously behind the technological frontier and the possibilities it creates. While new public sector innovation projects are increasingly closer to the market, without internal ICT capacities, it is almost impossible to keep up with the changing technological environment. This also affects the possibility of the public sector to shape technological innovations through policy.

Conceptually, we will base ourselves on mixing four strands of relevant literatures: administrative and policy capacity, public procurement (of innovation and ICT), smart cities, and public sector innovation. As Estonia is globally seen as one of the leaders in e-government, the specific case study we have chosen is the procurement of three different ICT intensive public services in the capital city of Tallinn. All three services in essence build data infrastructure for further smart city type services. We selected cases that were carried out in cooperation between the public and private sectors and that potentially could influence innovation *in* as well as *through* public sector. With the three case-studies from Tallinn we aim to find out how technology impacts work organization in public sector and how procurement practices impact technological capacities.

The chapter is structured as follows. The first part gives an overview of the wider debate on public administration, technology, smart cities and public sector innovation. The second part introduces the relationships between technological capacity and public procurement. The third part outlines the results from three case studies from Tallinn,

Estonia. The final part concludes the chapter.

Ⅰ. Smart city: implications for technology governance and public administration

The emerging smart city perspective is perhaps the latest ambitious attempt in radically changing the foundations of public service provision. Although still being far from forming a coherent concept, smart cities can be broadly understood as "places where IT is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems" (Townsend 2013, 15, but see also Soe and Drechsler 2018). In short, smart city is a digital city. Following the theory of techno-economic paradigms that predicts that ICT based business models will become the best practice for doing anything in society (Perez 2002), we can pose certain postulates relating to the basics of smart city (see also Batty et al., 2012; Townsend 2013):

1. Information that can be digitalized, will be digitalized (both in the sense of how it is gathered and how it is generated);
2. Where there is big data in public sector, analytics will be developed to use it in policy analysis;
3. Service delivery will become generally particular, person-specific;
4. Where it is possible to use data from social media and similar sources, it will be linked to other data and used;
5. Where internet of things is possible, it will also be used in public service delivery.

From these basic postulates, we can draw following implications of smart city for governance and public administration.

Emergent democracy: as feedback to public policies and political events will be instantaneous, it will be also measured instantaneously; most important impact of this is that policy goals will also be fast changing as various co-production practices will also be near-instantaneous. The question is, can people react to information effectively in an instantaneous setting? Much of this will not be rational political action (I am against or for it because…), but in the form of normative-emotional reaction (I like/do not like…) (Cooke 2017). This will have implications from the idea of representation (if our reactions are measured instantaneously, how many and what kind of representative institutions do we need?) to such issues as check-and-balances (will party-system survive?) and as auditing and evaluation (towards what goals should we evaluate public organizations?) (see discussion in Perl, Howlett and Ramesh 2018).

Predictive governance: availability of predictive capabilities will enable — notwithstanding ethical and legal challenges — predictive analytics to be used in measures and policies from health (from diet to free time activities) to policing and national security (Fitzpatrick, Gorr, and Neill 2019; Parikh, Obermeyer and Navathe 2019). In essence, the entire focus of governance will shift from predictability of services towards predictive

steering of behaviour (e.g., cost of mobility service will partially reflect dietary choices). Within complex, individualized steering systems it will become impossible for citizens to monitor the steering mechanisms applied to them and in some cases they have no possibility to do so as predictive algorithms are becoming protected proprietary secrets. This will also affect basic democratic principles (freedom, control and equality).

Self-learning and autonomous services: many if not most basic public services (transportation, utilities) will be essentially autonomous in the sense of technical set-up, service provision, maintenance, fees, etc. (e.g., Millard-Ball, 2018). Others will be semi-autonomous (public health, environmental protection) with computers talking to each other (including algorithms that measure satisfaction with autonomous services). This brings questions of data and software ownership to the center of service design and implementation (how to regulate cooperation with private data owners such as Google and Facebook, e.g. on issues from privacy to advertising) rather than costs and efficiency (since returns-to-scale come from intensity of use, i.e. cost of autonomous public services is dynamic).

At the same time, the theory of techno-economic paradigms also argues that technological development and diffusion and emergence of ICT-based business models is also a socio-economic process where different societal variables come to play. And these may, depending on the socio-economic context, be both constraining and enabling factors for a smart city. We can bring out some of the crucial issues here that should become also the crucial governance or public administration issues on the path towards smart cities:

1. The data have not been collected for smart city purposes. In other words, big data analytics need big data governance: cleaning, systemization, editing, legitimization (validation), coordinating, securing compatibility, interoperability, security, transparency, and other activities (see Kitchin et al., 2018 for a recent overview). Thus, the success or failure of smart city evolution is much dependent on how a specific city or state approaches big data and any kind of data, i.e. whether or not data will be treated as a public good and part of public infrastructure (such as roads, ICT infrastructure etc.) whose short term costs will be allowed for long-term public goods.

2. A smart city is a digital city within a social city. Digital city needs to be embedded in the democratic and social patterns of the city (although, it will also likely to change the latter, as argued above) and this will affect the speed, direction and depth of the digitalization of the city (see e.g. Green 2019). In other words, the early evolution and limits of the smart city will be determined by the cultural, political, institutional, financial and other characteristics of the city (either as top-down bureaucracy or as bottom-up community). Globally scalable technologies will always meet locally specific social processes and will be partly determined by them: just as democracy is always contextualized, or the set of current ICT solutions (from internet to its apps) is "consumed" differently in different context and cultures.

3. While it is very tempting to set up indicators of "smart governance" as preconditions for smart city evolution (and as necessary "absorptive capacities" for the application of best practices and solutions (see e.g., Nam and Pardo 2011)), it is in fact the other way around. The current characteristics of governance in different societies and cities will at least in the mid-term determine the pathways of smart city evolution and emergence of smart governance, i.e. some smart cities may evolve from hype and openness, others from conflicts and cynicism; and it is by no means certain, that the former will lead to "better" outcomes. As such, it is not surprising that variety of extremely heterogeneous smart city governance models have emerged, especially in connection to cities interacting with the private sector (Anthopoulos 2017).

4. It is almost impossible to predetermine if 'smartness' and increased use of ICT will actually lead to increase in productivity or public sector effectiveness beyond apps and niche products (BIS, 2013; Caird and Hallett, 2019). With Smart City initiatives foretelling a boom of IT man hours and labor costs inside the public sector or outsourced to the private sector, it remains to be seen if those gains will substantially cross over to also public sector services and their effects and outcomes. As mentioned above, this will depend much on the ability to change core human behavior — both in and outside the public sector — which has proven a difficult feat in prior efforts. Thus, investment into Smart City initiatives may be a 'grand challenge' unsolvable by many.

5. The quest for Smart City is likely to radically shift the traditional public administration focus away from public sector organizations being primarily service delivery units towards public sector organizations as being mediators between different and often conflicting interests of smart city industry, public organizations and citizens (activists as well as service consumers). Smart city industry can bring to the table their ever-increasing technological capabilities and computational power to provide efficiency increasing solutions (see Porter and Heppelmann, 2015), yet the top-down IT developments, especially when aiming at greater productivity, tend to standardize processes, lead to technology lock-ins and suppress agility and spontaneity. Citizens, on the other hand, through being able to design new, bottom-up social technologies and new ways of interaction are best positioned to use the existing knowledge for articulating specific needs and novel ideas, and providing quickly effective solutions through either individual initiatives or collective ones (hackatons, app contests, living labs etc.; see Morabito 2015, pp. 23–45). Spontaneous and organic bottom-up approaches, on the other hand, are infamous for their unsustainability either because initiators lose their interest, they are regressive in its nature or because micro-solutions are often difficult to up-scale once they are expected to meet the universality standard in public sector (Townsend 2013). At the same time, IT solutions can to a considerable extent enable more interactive and inclusive participation in public affairs and consequently increase the legitimacy of public sector. Yet, participation, democracy and legitimacy are what communities constantly re-make and re-invent, being thus subject to continuous political conflicts, which is where IT solutions can not only change the nature of political deliberation but can hardly ever able to provide finite solutions. Thus, while smart city technologies bring

ample outside expertize into governance and public administration, cities need to be able to solve the trade-off between top-down, bottom-up and participatory approaches to smart city. The interests of smart city stakeholders are different and so are the technological consequences of their interests.

Analyzing, understanding, contextualizing and mediating (as the normative goals of governance and public administration research and practices) these different technology-determined and society-determined variables is the current and the future "grand challenges" of governance.

Ⅱ. On the importance of public-private interactions and innovation

The role of public sector can be seen as a mediator of these various interests and potential consequences emerging from new technologies. All this puts public-private interaction (from consultation to public procurement) in public service delivery at the very center of smart city/technology developments and the capacity of public sector to steer these processes. But for that to happen the public sector needs to have legitimacy as well as policy capacity to design technology-based solutions and administrative capacity to interact and use public resources efficiently to take risky decisions and select certain technological solutions from others (in general, see Painter and Pierre 2005; Wu et al., 2018). All this assumes that governments are not passive users of private sector technology, but active 'market makers' by formulating clear demand for societal problems and effectively managing partnerships (see general discussion in Mazzucato 2013). It has to be able to interlink efficiency-driven information architecture with spontaneous bottom-up solutions.

Thus, in addition to the productivity issues, one needs to take into account the potential of technology to radically change control, power and legitimacy relationships within and outside public sector (Kattel et al., 2018). From the one hand the potential of technology is difficult to ignore, however, little is still known what are the implications of increasing iniquitousness of technology on the capacity of public sector to radically change public service provision and how public sector competing logics make that radical change possible (Lember et al., 2018). Radical change assumes risk-taking and lot of experimentation from the public sector, which is due to political reasons challenging.

Ⅲ. The capacity to procure innovation and technology

Being a process that frames both formally as well as informally the ways public and private actors interact, outsourcing in general and public procurement specifically has direct bearings at what kind of technology is developed, how it is applied, what interests and aims get involved, and what consequences follow from new technologies. Importantly, public technology procurement can spur innovation both in public as well as private sector (Lember et al 2015). There are several categories that influence the capacity to induce innovation in case of public technology procurement.

The first category is related to the innovation strategy (aims) of public organizations.

More specifically, public organizations can associate public procurement to technology and innovation in three ways (Edquist et al. 2000; Edler and Georghiou 2007; Hommen and Rolfstam 2009). First, public sector can procure so-called off-the-shelf solutions, i.e., ordinary solutions that neither require nor lead to any innovation. Second, governments can facilitate radical innovation where as a result of public procurement private actors deliver new-to-the-world products or solutions. Here public sector explicitly contracts for non-existing solutions, thus creating incentives for the private sector to engage in not just exploitative, but truly exploratory innovation processes. In so doing, governments need to possess specific market and technological know-how, resources and competencies to pull off as well as use newly created innovations. Crucially, in addition to just developing innovative services, these services may also change the relationship, accountability and legitimacy structures between government, market and citizens (think only about the potential effects of emerging data-driven services on these relationships) (see Jayasuria 2005 for making a more general point). Third, governments opt for incremental innovations where the procured services are new only to the particular service area or user organization but not to the "world" or broader society as such. Here the innovation is adaptive or exploitive in its nature. Importantly, all the above-mentioned three types of public procurement involve, to varying degree, inter-organizational collaboration and learning, which is a key success factor of innovation processes (Edquist et al., 2015).

The second category is about technology contracting traditions that influence how ICT projects are developed (small and packaged projects vs system-level). Here one can distinguish between three state traditions (see e.g. Dunleavy et al 2006). First, there is the marketization strategy where ICT solutions are, as a rule, always outsourced. The emphasis is on spot contracts and maximum competition rather than long-term partnerships with proven contractors. Second, there are countries that prefer to balance the marketization strategy with strong in-house ICT capacity, where a considerable amount of ICT services are produced as well as delivered by public sector units. And third, public organizations balance spot contracts with long-term partnerships. The idea is to have trusted private partners as preferred providers that possess in-depth knowledge of the public sector needs and specificities. There is also an additional factor, which is the composition of specialized IT market sectors. Markets dominated by a handful of big players may lead to different dynamics compared to markets with many small and medium sized firms actively present.

The third category can be related to in-house capacity to procure technological solutions. Foremost it is about organizational ability to find out, obtain, understand and use new knowledge and/or technologies (i.e. absorptive capacity, see Cohen and Levinthal 1990). This capacity issue includes also "the extent to which government agencies retain the capacity to maintain or re-establish their own in-house IT service, and to design, coordinate, and implement substantial IT projects" (Dunleavy et al 2006). The technological capacity needs to be accompanied with sufficient contracting capacity in writing, tendering and monitoring procurement contracts (Brown et al 2006).

The fourth category covers the contracting practices and procedures relevant for innovation. The key issue here is how to facilitate interaction and learning with providers before, during and after contracting. There are several procurement practices that can facilitate and support innovation: the use of life-cost assessment (vs lowest costs), acceptance of variants and usage of functional specification rather than input specifications, risk sharing between public and private partners, allocation of intellectual property rights, use of incentive contracts such as profit-sharing arrangements that emerge from fulfilling the project, advanced communication of future needs that would enable private firms to specialize, early interaction with contractors to enhance learning, emphasis put on sustainability criteria, and use of innovation requirements in tenders (Uyarra et al 2014; Dunleavy et al 2006). The usage of competitive dialogue or other procedures enabling dialogue and joint learning is found to be especially useful here (Uyarra et al., 2014).

Table 1 summarizes the public procurement analytical categories.

Table 1: Factors Influencing Innovation in Public ICT Procurement

Category	Specific factors
1. Innovation strategy	- Off-the-shelf - Incremental - Radical
2. Contracting tradition/strategy	- Marketization (spot contracts) - Corporate (long-term relationships) - In-house centered - Dominance of SME vs large firms
3. In-house capacity	- Technology (absorption) capacity - Contracting capacity
4. Contracting practices relevant for innovation	- Life-cost assessment (vs lowest costs) - Acceptance of variants - Usage of functional specification - Risk sharing - Provisions related to intellectual property - Incentive contracts - Advanced communication of future needs - Early interaction with contractors - Emphasis on sustainability criteria - Innovation requirements in tenders - Tendering procedures enabling dialogue and learning

Source: Produced by the authors

In essence, the factors influencing public sector innovative procurement practices also influence the way given public sector organization conceptualizes technology, innovation and its potential impact, and that means also how this impact could and also should be measured.

Ⅳ. Introducing the empirical cases

In order to analyze the processes connected to the use of innovation indicators in public sector we used the city of Tallinn as a test case. More specifically we analyzed the use and influencing factors of innovation indicators through the dynamics of three largest e-service development projects of the city; all cases used public procurement as a way to acquire new solutions.

The cases were analyzed through a participatory action research design to identify how and why public sector uses innovation indicators, how it is related to public procurement institutions and how it influences the evolution of administrative capacities. Consequently, as part of the research (in addition to document analysis and over 25 interviews with public and private sector stakeholders), we have followed the activities of the city of Tallinn between December 2013 and June 2015: participated in their development meetings (among them the e-service working group) and followed the management meetings of the aforementioned and ongoing ICT developments. Most of the interviews were recorded depending on the preference of interviewee; for the internal meetings the authors rely on written notes.

Ⅴ. The case of the City of Tallinn

Estonia is globally seen as one of the leaders in e-government (Drechsler 2018; Kattel and Mergel 2018). On the municipal level, the city of Tallinn is at the forefront of implementing electronic services in Estonia. In the recent 5–7 years, the city has taken a service-specific focus in developing its ICT capabilities. By 2016, the city had categorized 581 different services in 20 different policy fields. Close to 200 of the former exist electronically only in the form of description (1st level e-services) while 21 are semi-automated and 58 are fully automated e-services. For the other electronic forms can be downloaded or requested for a service. Tallinn has also created a self-service portal for a one-stop access point to the offered e-services. As a rule, the city of Tallinn procures software developments and tries to license the former and not buy it for themselves to ensure that the IT developer has the interest to continue developing the former. The developments we look more specifically below — the spatial planning registry, the city's internal property registry and the operative information database for closing streets and planning road works — were the city's biggest development projects of 2014. All of the above have also a geographic component to them and can be described as geospatial web — GeoWeb — solutions (Cinnamon and Schuurman 2012). All cases can also be seen as key infrastructures for smart city services and data collection. The document trail showed that all of the developments can be traced back to the recommendations of internal audits to increase transparency, user-friendliness and accountability in the specific fields they were initiated in. The initiatives are briefly described below.

Spatial planning registry

The new spatial planning registry is by far the biggest development of the three cases. It is built on the pre-existing electronic system for planning, building projects and archi-

tectural conditions created in 2005. The prior registry allowed for a semi-automated planning process, alphanumeric and spatial data were not integrated and they were not easy to change or configure to match internal processes nor to use the map interface. However, the civil servants were used to working with the system. It was also very well-known that the system was not user-friendly and very confusing for the average user; nevertheless, as frequent external users of the system — architects, developers etc. — had learnt to use the system, no concrete plans to change the registry were planned. In 2011 the internal audit reviewed the system and severely critiqued the lack of speed, control and transparency of special planning processes in the city and recommended that the process should be fully automated and a new registry for it developed. In effect this gave the Urban Planning Department (UPD) the justification to ask for additional funding to start planning the development. Thus, following the audit the city changed its building decree in November 2012 and started the procurement process for 4-step development process of the new registry which included the analysis of the process, legal framework, composition of the initial assignment and the software development process. Compared to the other two cases the role of the central IT department of the city was more consultative and the development process was led by the Urban Planning Department. The registry was supposed to be ready on April 30, 2014, but the delivery of the registry was postponed for more than a year to March 2015. The goal of the development was to make the planning process fully electronic and shorten the time processing spatial plans — both detailed and general plans — and make the information and access to the process more simple and intuitive by also increasing the user-friendliness of the new interface.

Property registry

The development of the property registry started already in 2009 and was finally finished in 2015. Following audit procedures, the central City Property Department was created in 2009 which generated a need to centralize city property information of the city. Data on Tallinn city property have been stored in various datasets in city departments and district offices and the city owns more than 17 thousands different objects. The latter did not follow a uniform structure (the most common form was to collect the data in excel worksheets) nor was it possible to link the data to other registries. The system was, thus, not very transparent and arguably could lead to corruptive practices. The property registry was meant to increase internal efficiency and create an overview of the land, real-estate and other city property management (incl. care, renting and other business processes etc. connected to said property). One can link this to a need to increase internal control as the registry creates a possibility for statistical analysis of the data and a digital audit trail for all the changes connected to city property management. The possibility to interface the registry with other data systems will decrease mistakes via centralization of all data. On the whole, this is an internal tool for control and management of city property centrally. It is also important to note that such digital central control and management system should, ideally, diminish opportunities for corruption and nepotism as well. As this development touched most of the city's organizational units there was a lot of internal uncertainty and resistance to the creation of the

system. The initial assignment for the procurement process was set only at the end of 2012 and the development process started in 2013. Finally, at the end of 2014 the pilot testing program started which discovered a multitude of mistakes in the functioning of the software.

Operative information database

There were three main city departments that were involved with the development: Municipal Engineering Department, Transport Department and the Urban Planning Department. The operative information database for closing down streets, excavation permits and operative information was finished at the end of 2013 and it's a fully automated e-service. This has been described by the city government as one of the fastest ICT development projects in the local municipality's history. The evaluation of the previous semi-automated system was held in mid-2012, when the prior contract with the software provider was finishing. Beginning of 2013 additional sources outside the city government was found and project funding was applied for. The initial assignment was compiled in January 2013, the work started in May and by December the database was ready to be tested. The goal was to cut down the time it took to process applications for permits and make the overall process more transparent, simple and accessible to involved stakeholders. This also meant that the information of closing down streets and municipal works was to become available online to all citizens with also the possibility for citizens to follow the processes online on the map-interface in real time. The new database was functional since the beginning of 2014 and it considerably cut down the time to apply for permits in the connected policy area from two weeks to two days. As it is mostly used by field specialists and usually different water, electricity works companies, the database was quickly adopted by its users.

Measuring success

Although we suggested that there exist ample ways to measure innovation in public sector context (Table 3), we did not find evidence of systemic use of success measures for the innovations in the city of Tallinn. In fact, most of the potential public sector innovation indicators are never used and the applied ones are used in an unsystematic manner.

> "*Normally there are no general indicators connected to procurement tenders. Usually they say that the system or the service has to become 'better'. That is not measurable to an engineer. This means that there is no indicator. There should be one dominating indicator for ICT developments that allows to be flexible: process becomes quicker, more effective, or transparent to the service user.... If that is achieved then we shouldn't argue about the details. What in reality happens in scope disputes is that there is no main goal, public servants take the lower level process indicators and start to nit-pick, although the main goal may be fulfilled long before.*" (Private IT contractor)

When it comes to the specific three cases, the city did aim at increased productivity

(mostly in terms of time saved for internal as well as external stakeholders) and general performance (from better functionality to paperless communication) prior to launching the developments of the new service platforms. Yet, achievement of these aims was never formally measured during or after the implementation of the developments. Although, in all cases at least some productivity and performance increase was achieved.

Discussion on the productivity and efficiency of e-services — return of investment — rises usually during the budget discussions when investments into ICT developments have to be approved. While the city is horizontally managed (with different departments and offices having relatively high autonomy from the central Tallinn City Office), financial services are centralized which gives the financial department the most power in the city to question and direct developments. The central IT department, in comparison, is at a much weaker position as the IT investment is part of different departments' and districts' own budget, making the IT department a consultative rather than development unit. Hence, prior to procurement procedures can be started, the city department has to justify spending money on e-services and in doing so the efficiency/productivity gains should also be monetarily evaluated. In reality, most departments fail to provide substantial information as they cannot foretell possible savings or performance gains from ICT developments. In other words, innovation indicators are not effectively used and make almost no impact in guiding or influencing the city development processes.

Importantly, for city officials innovation was mostly associated with internal improvements, i.e. how innovation inside public sector (internal work processes) would lead to higher productivity and enhanced citizen's satisfaction and trust (although the latter remains vague).

Ⅵ. Changes in power, control and accountability

All three developments are at their core managerial in nature and mostly meant for specialist use, although, the operational information database and the spatial planning registry also introduce functionalities to the general public (e.g. the possibility to follow in real time road-blockages, road maintenance etc. work in the city and be warned of the latter beforehand; or in the case of the urban planning registry follow planning procedures in your neighborhood or the city at large and also give online feedback to the former). The latter two are both working tools, information channels and archives of processes, and both are important channels for government-private sector interactions. The property registry is the most administrative and internal control oriented in nature. The core task of the new registry is to provide a transparent overview of management of municipality's real-estate to the central city office.

As mentioned above, the ability to evaluate renting, sale contracts and other property oriented information uniformly is also a deterrent for corruption. As different city departments and district offices have been historically rather independent of the central city government, it is not surprising that the development has been difficult and differ-

ent offices have tried to postpone the system. The control function of the database is clear and the new system does not offer a lot of value added to specific city departments. Even though the system is meant for internal use there are almost no feedback functions built into the system. One of the IT personnel of the city described it as a "more elaborate excel table". The potential to use the database also to increase transparency of city's property use was left undeveloped. Because the development has taken a lot of time, it is partially also the case that the functionalities of technologies have grown beyond the initial assessment and need, while it is very difficult to change the official procurement process after it had already started. Thus, also the GeoWeb solutions of the development were not interfaced with the official interactive city maps that the Urban Planning Department uses. Consequently, with this development mainly the power of the central city office has increased with making the property management more transparent. Although it would have been possible to make most of the registry information also accessible to the general public, the city government and the City Property Department see it as an internal tool meant for increasing administrative efficiency and accountability.

The operative information database and the spatial planning registry introduce more complex patterns of relationships. It is important to note here that compared to the spatial planning registry, operative information database is of much more smaller scale and the processes in general are much simpler than processing detailed or general urban plans. However, in both cases the idea was to control work-flow electronically and make it possible for different city departments to approve permits or plans parallel to each other. With these kind of case-management software solutions the capacity to delay processes by government decreases as citizens are able to follow government decision making and ask for justification for delays (Garcia-Murillo 2013). This makes both areas more transparent and up for public scrutiny, which has also been the case for implemented operative information system as timelines of roadworks has become much easier to follow to the GeoWeb application for the general public and the media. Also the time saved on evaluating permit applications in the case of the operative information system was rather drastic. It is also important that with the new solution responsibilities of various city offices and private companies applying for permits became clearer and thus also easier to control.

In the case of the spatial planning registry, it is possible for citizens to follow the processes online and see which city department is holding up the process. At the same there are opportunities to develop apps for public use that increase transparency of applying for permits and for other purposes, but these options have not been used nor have they played important role in developing the new registry. As debates and review of general urban plans can stretch to years, in the initial assessment phase of the registry development the specialists involved advised for a radical solution: if city departments are unable to approve urban plans in the set timeframe, they will be automatically approved. This did not reach the final phases of the development. As the development started with the analysis of the process itself, there was also possibility to

redesign the urban planning process more thoroughly. While changes were in the end made (e.g. initial planning procedures were simplified for the users), the civil servants in the city opposed more drastic changes in the process itself. There was still a high level of uncertainty connected to the new registry inside the city as various city departments had to use it during the planning process. Thus, as the spatial planning registry is by its nature much more complex system than operative info system, here we can see how administrative power issues intertwined strongly with technological developments.

During the process of development, public servants in different city departments were well aware of the control function these new web-based solutions created and those involved with the development process tried to minimize the pressure landing on specific public officials. For example, in the more complex urban planning registry specific information of who specifically is looking over spatial plans from a specific department is not given in the public view. This information is of course available in the system itself for administrative personnel as tasks are assigned and completed within the registry itself. Consequently, the statistical information that is given to the general user is less specific than is available for the municipal government itself.

To some extent the city aimed at making use also of co-creation practices, but this tendency manifested itself though forcing external stakeholders to participate in service provision. The most significant change we found in the externally oriented operative information database and the urban planning registry was connected to the 'responsibilization' of citizens that was enacted through the development process of these new web-systems. First and foremost in both cases the external users become explicitly responsible for the spatial information they add to the database and the registry. Thus, the mistakes made in the entry are the faults of users alone, and these mistakes are machine-controlled. This is a powerful shift in responsibility and, accordingly, in accountability; we can argue that this represents a case of contracting out accountability via technological solutions (if files, data, etc., do not fit, applicant cannot move on to the next phase). In the case of the operative information database the exactness of data entry (for example drawing on the map the extent of the road blockage needed for specific works) will also determine the fees that would be imposed for the service.

Thus, the service becomes to a degree dependent on also the skill level of the user. This also applies for the urban planning registry where personalized accounts and digital signatures are imposed to increase personal responsibility. Each user gets a digital work table in the registry and depending on the role (UPD's worker, City Office specialist, external stakeholder and the general user), also access to various information and tasks. Furthermore, in the more complex urban planning registry the goal of the Urban Planning Department with the digitalization process was also to make the developers more responsible for getting agreements from different city departments and also citizens from the specific neighborhoods prior to different steps in the registry work flow. The registry also gives the opportunity to give direct tasks to developers especially

connected to mistakes made in incorrect data import.

Here also a case for the digital/democratic divide can be made. In the operative information database the move to the electronic service was very smooth and the big companies were able to almost instantaneously start applying for permits online and use the GeoWeb interface to map out the works. While the main users of both the operative information database and the urban planning registry are specialists in nature, the urban planning process is much more conflictual and also political in nature, thus, public interest of these processes is much higher. However, urban planning process is considered complicated and overly technical already by average users and also neighborhood associations who were interviewed as part of the study. In the new registry the process is online and while there are public debates held in case of specific urban plans, the opinions and specific data are only accessible online. In the urban planning registry case it is also clear that the local government prefers to primarily use electronic channels for the process. With some notification tasks compulsory by law in the urban planning process, the municipality has built an interface with the official state government e-service portal (eesti.ee) that gives maintains official e-mail addresses for citizens. If this cannot be used, then the paper-based notifications are seen as the last resort.

While in none of the case we can see effective two way interactions, the urban planning registry creates opportunity for identified citizens to give opinions and express views on different detailed and urban plans. The city municipality can also answer through the system. As the new system has not been in use for a long time, it is difficult to foresee how much these channels are actually going to be used and if this will speed up communication between government and citizens.

What is perhaps most noticeable is almost a complete lack of discussion around how to use data that are created in the new solutions for evaluation purposes or how to create some social features (feedback, discussion forums) to these databases. It also noticeable that in none of the cases City officials differentiated between evaluating impact within public sector and through public sector.

Ⅶ. Public procurement and smart city development

As all the main ICT solutions in Tallinn are insourced, we expected public procurement to play a significant role in shaping innovation processes of the public sector as well as in addressing innovation opportunities and challenges through the use of indicators. Several observations can be made in this regard.

First, the city of Tallinn had no explicit strategy for procuring innovations per se. Although ICT platforms are to an extent always innovative — that is, these are usually tailor-made solutions — the ways the city carries out public procurements assumes, according to contractors, routine work for private developers. This was echoed by a city official:

"*How to procure innovation with public procurement rules? Even after 25 years of experience, I don't know how to do that.*" (Public sector IT manager)

Second, the city's public procurement is heavily based on spot contracting strategy, meaning that the city contracts out single, packaged tasks rather than relying on internal development capabilities or long-term partnerships. Also, usually no system-level contracting takes place.

"*Long-term partnerships are more effective. When you need to think about the whole life cycle costs of the ICT system — for example 10 years — then you start to think about what you initially invest in the development. Also these things would not happen (authors: as in spatial planning registry) that you have some analytics who have done the previous system engaged with another project, because it is more profitable to the firm.*"
"*We try to act as partners to the public sector and finish the spatial planning registry. But will it help us in the next procurement? No.*" (IT developer)

Still, many of the contracts are won by companies with proven track record.

"*ICT companies do a better job if you value their work and also hype their developments — you did a good thing, we go to conferences, present it, give you some free publicity.*" (Public sector IT manager)

Third, although the city has a dedicated IT department whose responsibility is to assist city structures with IT projects, the technological capabilities play no central role in the city administration decision-making structures. The IT department has no direct power over technology development in the city nor figures the IT department or any other technology unit high in the administrative structure.

"*It was a bit frustrating to deal with the city. I do not know if it was the project team or it is how they do things in the public sector, but it seemed that the operations manager did not make any decisions. Nobody wanted to take responsibility. So, everything had to be taken to the higher-ups, so, while we had already moved on with the development, it was not uncommon that the project team came back to us and said: no, actually we cannot do it this way.*"
"*I regret that we did not hold our ground and draw the new process as it should have been and stuck with the reality. This probably cements the processes even further in the organization. I have learnt from that for the future.*"
„*It is very difficult to automatize processes. While technically you can close a process before you start another process, but in practise it is not so easy. The city is centrally managed and the City Council says what you can or cannot do.*" (IT systems architect)

The city's capacity to understand the technological trends and emerging possibilities

as well as the capacity to absorb the new emerging technological solutions is probably the best ones among Estonian local governments, but as the city itself invests into no long-term exploratory development projects, the absorptive capabilities can be regarded as somewhat limited.

> "*The honest answer is that neither us nor the City of Tallinn understood how complicated the development was. There were professionals working on both sides — we have a lot of technical capability and they know the process — , but we couldn't foresee all the interlinkages.*" (Private sector IT developer)

At the same time the overall legal as well as procurement context seems not to have made this particular task easier:

> "*There have been occasions that in a friendly collaboration with the IT-developer we find out that we could do things differently or we cannot do something at all (for example if we are dependent on another public sector organization and they don't fulfil their part). We should do things differently, but we cannot. The public procurement unit tells us that we don't have grounds to change the procurement contract mid-process, we would be breaking the law.*"
> "*It is difficult to draw new IT systems and their different outlooks if you don't know for sure what the legal system is going to look like. Public sector is still in the process of changing laws while we have to prototype new solutions and fulfil our procurement contract in time. In the case of the Spatial Planning Registry we didn't know if the state was going to take over part of the building planning process or when they were planning to do that. In the end we had to go with the solution that the model that described the then-current system.*" (IT systems architect)

The city itself regards its contracting capabilities to be on a very good level. This assessment is further supported by the fact that on average the city has a very small number of challenged procurements. Yet, this does not resonate directly in public opinions about the city. Also, private providers do not necessarily share this perspective.

> "*Public sector is not a good procurer from the perspective of Auntie Maali (Authors: ordinary citizen).*" (City official)
> "*In these procurement documents almost everything is described, as if you are solving all the world's problems. The client should know what is important, what is the main functionality. When resources are limited then you have to know what to let go. However, in the public sector the tendency is to do everything at least somehow — that is the worst. It is pointless.*"
> "*It seems that in the public sector they want to keep the deadlines to the last second. The time frames in the procurement process were absolutely unreal. It seemed that if we analyzed something and came up with new ideas that seemed to be better, we were so busy that we couldn't develop them and had to move on. Then everything was left as it was already in the initial project documents.*"

Fourth, the city of Tallinn makes a limited use of innovation enabling contracting practices such as the use of life-cost assessment, acceptance of variants and usage of functional specification, risk sharing between public and private partners, effective allocation of intellectual property rights, use of incentive contracts such as profit-sharing arrangements or advanced communication of future needs. In similar vein, the city seldom makes use of competitive dialogue and similar procedures that would enable more interaction and learning prior as well as during public procurement. From the one hand the city encourages functional rather than input-based thinking:

> "*My ideology is to propose tasks, not solutions, in procurement tenders. It gives some room to think for the developer. There is nothing I dislike more than an IT-developer who comes to me and says that this thing wasn't in the procurement document.*" (Public sector IT manager)

Yet, this is limited due to time and cost constraints:

> "*The patterns in the public sector are very similar: contract conditions are concrete, funds for additional activities are low and this does not bode well for managing projects' scope flexibility. Not in terms of time, money or tasks. The only thing that the public sector is slightly flexible on is time, but for a developer this means working hours — that is money.*"
> "*In the system where the cheapest offer rules, it is difficult to develop IT systems. The reality is that IT systems are so interlinked and should be interoperable that it is difficult to do just one single part that was ordered. Another city department sees the development and finds the results, the created data interesting for them and ask to link it to their databases. This wasn't in the official offer, but then we are told that we 'promised to make the system whole'.*" (Private sector IT developer)

For city officials as well as for some private contractors this is the direct consequence of the public procurement law.

> "*People are generally nice and hard-working in the public sector, thus, it is not public servants personally that don't allow for innovation in public procurement, it is the structure in which public procurements are organized.*" (Private sector IT developer)
> "*I don't think that agile development is possible in the public sector in the near future, but the meantime solution might be to divide the process into different parts. First to procure the pre-analysis that ends with a system prototype and then go into the main development process. Then it is more clear for the developer as well. . . if they want a castle or a small hut. . . and the procurement offers will be more realistic as well.*" (Public sector IT manager)

In terms of indicators and evaluation frameworks, it is noticeable how fundamental is the impact of procurement capacities on what kind of indicators are used in new technological solutions. In essence, existing procurement rules significantly narrow

choice of indicators used as the city officials struggle to adapt the new IT systems into the existing public sector institutions and pay very limited attention to emerging opportunities and challenges posed by ICT.

Discussion and Conclusions: 'Future ain't what it used to be'

In a broad sense, the case of Tallinn demonstrates that new technologies in the public sector can increase productivity and performance, but also affect organizational change, and legitimacy and power relationships with the public. Importantly, all cases indicated that productivity increases were mostly associated with saved time (internally as well as for service users), whereas all stakeholders stressed the importance of transparency and citizens' re-defined roles in service provision.

The Tallinn's cases exposed the presence of the classic innovation measurement problem: ICT brings about numerous ways to track the changes taking place in public sector innovation projects, yet these tend to be of limited use when one is to find out the wider effects of innovation and change in public sector. The usual Web 2.0 related indicators such as usage statistics tell us very little about organizational productivity dynamics or change in power and control relationships.

Analyzing changes in control, power and legitimacy relationships in the case-studies reveals that more complex evaluative framework for public sector innovation measurement provides valuable insights into public sector change. Here the internal change (or resistance to change) of work processes and administrative power dynamics play crucial role in how technologies get developed and adopted.

Public sector tends to take into account various logics of change, but this is done implicitly through internal communication and interactions rather than explicitly through clearly identified indicators. There is an inherent problem for public sector stakeholders to describe or quantify expected productivity improvements and even more so expected change in authority and legitimacy. If in conflict, internal productivity and control of information prevail against external legitimacy concerns (e.g. ease of use, transparency etc.). This is reinforced by the fact that linking legitimacy metrics to innovations is very difficult and hardly ever done (i.e. no real-time measurement of citizens reactions etc.).

There are different kind of feedback loops in operation, yet most strongly the innovation processes are influenced by the expectations associated with processes within public sector. Even if new technologies are created in cooperation with private sector, the potential positive effects of innovation *through* public sector are not directly taken into account. That means that the potential positive effects arising from public procurement of technology in terms of new private sector capabilities does not play a significant role as innovation strategies mostly aim at off-the-shelf rather than radical innovations. Although it might.

Yet, the very context of public-private partnership (here manifested through public

procurement of technology) influenced heavily the innovation feedback processes and thus the extent to which new technologies changed public service provision. Public procurement strategy, in-house capacity to engage with private providers as well as contracting practices and procurement procedures all significantly influenced decision-making processes and ultimately the effectiveness of technology development. Most importantly, it is challenging for public sector to institutionalize innovation-enabling interaction and learning environment within the existing procurement institutions.

More interaction-enabling public procurement frameworks are essential in removing some of the main barriers in innovation and technology developments. This can be achieved, for example, through using more often negotiated procedures or communicating technology needs early. Importantly, it is not just what the law is, but also how the law gets interpreted in certain contexts. Therefore, investments into procurement capabilities constitute an important avenue for changing the public sector innovation feedback mechanisms.

Overall, the Tallinn's cases showed that the procurement routines lead to advances in simple activities and limited technological capacities in complex activities (and thus in policy capacity as well) due to strong path dependencies. This has many additional implications.

With the rise of smart cities, we need to better understand the co-evolutionary patterns in each modality of government as a technology maker. There is need to re-think not only procurement institutions, but also how governments should be vertically integrated in the days of fast-changing technology. The simplistic managerial approach seems to be a dead-end not only on transactional or service level, but also politically. Increasingly code equals power and who writes code is empowered. And yet, this is more complex. From the one hand governments retain the traditional mode of outsourcing/procurement in order to maintain control over service delivery. Although this is allegedly more costly and prone to technological lock-ins, the traditional technological capacities serve foremost the need to maintain control.

Hence, we can argue that organization of public sector innovation has invariably two opposing routes: it should be left entirely to the realm of the private sector and public sector should finance experimentation in the former without getting involved too closely; or internal technological capacities within the public sector should be entirely re-imagined: technology capacity becomes a central administrative capacity across the whole organization, supported by formal authority (e.g. the so-called Chief Information Officers having horizontal power) and individual skills).

Perhaps the most startling conclusion is that smart city solutions and infrastructure change the perception of time, as baseball legend Yogi Berra put it, 'Future isn't what it used to be'. Smart city technological advances and innovations lead to parallel temporalities in evaluating public sector. First, shortening of time horizons were efficiency

gains are strong and easy to measure (both within and through public sector; as in the case of operative info system in which case time to obtain permits fell from 2 weeks to 2 days) and where user skills match new technological solutions (as in the case of spatial planning database in which case users have the sole responsibility for data input and this is judged by algorithms). Second, prolongation of time horizons in areas such as trust and legitimacy where user feedback is driven by surveys and similar highly roundabout tools which virtually secures that the input is not taken into account in further developing the technological tools (none of our cases considered use of social media tools to track the use, problems and satisfactions of new tools, either internally or externally).

Such impact of increasingly digitized service design and evaluation is in fact similar to what private companies are experiencing when using big data in marketing their products: some companies know almost too well because of big data analytics what customers want and end up undercutting their own long-term brand-building efforts (as customers start to associate them with quick cheap offers) (see Horst and Duboff 2015). In the public sector case we can argue that something similar happens when smart city solutions and infrastructure is being built: quick efficiency gains and easy to use control mechanisms are set up — although in Tallinn's case poorly measured —, but long-term 'brand-building' is not considered almost at all in terms of how to build new technological tools and hence there are no advances in how to measure their wider impact.

We can thus argue that in procuring smart city solutions, Tallinn city government relied strongly on its existing capacities to administer such procurements and as a result almost no new capacities and capabilities were developed. In this sense we can argue that smart city solutions re-enforced existing capacities and problems with these capacities. At the same time, we can see trends towards automatization of service provision in which control and responsibilities are being re-balanced (towards central city departments; towards highly skilled private users) with enhancing efficiency for some of the partners. Without developing data-driven and dynamic user interfaces, key public values (such as trust) will remain only vaguely captured in design and evaluation of new services. However, these new interfaces require quite new and different capacities both from individual bureaucrats and institutions involved (in terms of giving larger access to users in design and evaluation).

In sum we can argue that in the case of Tallinn, evaluation frameworks used are relatively narrow and often determined by limited public procurement frameworks. One of the key recommendations from our research is that organizations should vocalize and formalize their innovation and procurement strategies in the evaluative frameworks before they set out to procure new technological solutions. The framework we have developed in this article showed that in the case of Tallinn, there were weaknesses in current attempts at procuring new fundamental technological solutions. However, these could be fixed with new organizational routines.

Notes

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2 There is an increasing role to play by citizens as well (see e.g. Kostakis et al. 2017; Lember et al., 2019), but this falls outside of the scope of this paper.

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