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Building Sound Foundations for Smart City Government: The Case of Munich, Germany

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ABSTRACT

City governments around the world have increasingly engaged in “smart city” initiatives. Information and communication technologies (ICTs) are at the core of these initiatives. City governments appear to play important roles in making the urban spaces, in which they are embedded, more attractive, more competitive, more livable, and smarter. The authors interviewed City officials in Munich, Germany, and asked for the definitions of “smart city,” which they then compared to Munich’s smart city-related program. While the practitioners’ definitions differed in part from those in the academic literature, the smart city overhaul program at Munich city government had a direct relationship to the practitioners’ understanding of smartness. The authors portray and discuss the City of Munich institutional architecture overhaul and its expected and realized benefits, and compare the results to those of an earlier study on the City of Seattle. Both city governments evidently pursue different approaches, the effectiveness of which can more readily be assessed only at a future point of the smart city evolution.

Keywords: ICT as core competency, Interdepartmental Collaboration, Organizational Redesign, Process Change, Process Streamlining, Smart Government

INTRODUCTION

The term “smart city” was first used in the academic literature around the turn of the millennium (P. Hall, 2000; R. E. Hall, 2000). For almost a decade it has remained a somewhat literary device to conceptualize an idealized urban space that would have successfully addressed the daunting 21st-century challenges

of crowding, crime, sprawl, traffic congestion, waste, energy overconsumption, pollution, divides, government red tape, and bureaucratic inertia to some measurable extent, to name a few. Until recently, new definitions of “smart city” have abounded, and the term has carried a somewhat lofty and nebulous meaning. Part of the growing fogginess of the term’s meaning can be attributed to its interpretation in the trade press and in vendor communications,

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for example, IBM (Kehoe et al., 2010), Oracle (Thornburgh, Kingsley, & Rando, 2010), and Siemens (Anonymous, n.d.). More thorough academic grounding has been provided with the introduction and presentation of Chourabi and friends' layered framework on smart city initiatives (Chourabi et al., 2012) and the additional work of AlAwadhi and friends (AlAwadhi et al., 2012). The framework has specified an academic foundation for the term of "smart city" and its context, so that a number of research groups around the world meanwhile have carried out and coordinated their smart city-related studies under this theoretical umbrella including this study. As a naming convention and as proposed in other studies, we are using the capitalized "Smart City," when we refer to city government as also in "City of Munich," while we use lower-case "smart city" when we refer to the urban space in general, for example, as in the "smart city of Munich."

In this study, we add to the stream of research using the aforementioned framework with a particular interest in the organizational and technological prerequisites that local government might practically need to put into place for smart government initiatives to succeed. While we have replicated the AlAwadhi and Scholl (2013) study in terms of the underlying conceptual framework, methodology, and instrument, we focused on the case of the City of Munich, that is, a European City and a city government known for its fairly radical approach to administrative and technological overhaul. We were highly interested in understanding what practitioners in City of Munich, that is, both elected and appointed government officials, understand by "Smart City." We also wanted to investigate how the concept of a smart city was advanced in practice and what benefits resulted from such undertakings. Furthermore it also intrigued us to uncover how the project orientations and resulting benefits would match up with the vision and notion of a Smart City as defined by the practitioners themselves. In this way we hoped to find matches and gaps between aspiration and realization as well as matches and

gaps between the academic understanding and the practical realities of a Smart City.

Munich is situated in the South of Germany with a population of some 1.4 million. The city is the seat of the State government of Bavaria, which is the largest in territory of the 16 German Federal States. Major global corporations such as Allianz, BMW, Munich Re, and Siemens are headquartered out of Munich. The city is the major hub for high technologies in Germany. Its economic success, its bustling cultural scene, and the world-renowned research institutions have made the city a location in high demand. The city's reputation is one of a modern, forward-looking, technology-savvy, and innovative urban space and of a knowledge economy. The city government has chartered itself with matching and instigating the ambitions and aspirations of its constituents by embarking on continuous administrative and infrastructural modernization. In a move that made worldwide headlines in 2002 the City of Munich pioneered the migration of its software systems including some 15,000 desktop computers and laptops to an open-source platform. In the course of its decade-long transition from a proprietary platform to open-source the project dubbed "LiMux" proofed successful despite several initial setbacks.

The article is organized as follows: first, we review the smart-city related academic literature. Then, we explicate our research questions and detail the research methodology. Next, we present the findings and discuss their implications. We also discuss the Munich findings in light of the findings of AlAwadhi and Scholl (2013) on the City of Seattle. We conclude that approaches to establishing and developing smart government can take different avenues. Whatever approach is taken, however, smart city government appears as a necessary but not sufficient prerequisite for making urban spaces livable, energy-efficient, clean, safe, sustainable, competitive, attractive, and affordable among other qualities that might form a "smart city" in practical terms and with measurable qualities.

LITERATURE REVIEW

Various attempts have been made to academically define and conceptually describe a “smart city” (e.g., Giffinger & Haindlmaier, 2010; Giffinger & Pichler-Milanović, 2007; P. Hall, 2000; R. E. Hall, 2000; Harrison et al., 2010; Washburn et al., 2010). While those early contributions pioneered the academic and practice discourse, it took until Chourabi et al (2012) as well as AlAwadhi et al (2012) published a comprehensive framework on smart city initiatives that a more widely accepted academic definition of the concept of “smart city” emerged. In the following, we portray the evolution of the concept of “smart city” from its early beginnings to its current state.

The notion of a “creative milieu” that makes a city competitive, attractive, and livable was first presented and discussed by Sir Peter Hall at the end of the previous millennium (P. Hall, 2000). A few years later based on a yet sparsely developed theoretical foundation, Giffinger et al. (Giffinger & Pichler-Milanović, 2007) created a smart-city ranking scheme using certain urban characteristics. The authors identified six categories, in which a city’s smartness could manifest itself: economy, people, governance, mobility, environment, and living. Along those categories and based on a number of factors and indicators, the authors ranked seventy mostly smaller and mid-size cities within the European Union (EU). While several smart city initiatives have been carried out in European cities on the grassroots’ level, the European Commission has also developed a “Smart Cities and Communities Initiative,” whose major objective has been focused on drastically reducing energy use by 2020 and by developing a low-carbon economy by 2050.

More critical assessments of the concept of smart city also appeared relatively early (Hollands, 2008) that found a “smart city” to be either (1) a celebratory label, or (2) a marketing hype rather than a practical engine for infrastructural change, or (3) a loaded term carrying an uncritical, pro-development stance. For the

author, serious smart city projects consider human capital as the most important component.

Others used a triple-helix model of smart cities, which emphasizes smart cities as a process of cultural reconstruction underpinned by policy, academic leadership, and corporate strategy in their guidance (Leydesdorff & Deakin, 2011). In the authors’ view, the triple-helix model frames the relationship between industry, government, and academia as reflexive and as an overlay that influences how technologies co-evolve.

In a review of the literature on the subject, “smart city” initiatives were also distinguished along the three dimensions of technology, people, and institutions, which smart cities were reported to use when strategizing (Nam & Pardo, 2011). According to the two authors a smart city was seen as a model for improving city government services and economic development catalyzed by local governments. In all “smart city” models analyzed, the authors found a recurring theme of variable social components linked with technologies aimed at transforming economy, environment, and community.

As mentioned the most comprehensive and integrative framework for scientifically conceptualizing “smart city” and analyzing “smart city” initiatives identified a set of eight dimensions to understand “smart city” initiatives. The eight dimensions include (1) management and organization, (2) technology, (3) policy, (4) governance, (5) people and communities, (6) economy, (7) built infrastructures, and (8) the natural environment (see Table 1) (Chourabi et al., 2012; Alawadhi et al, 2012).

According to the framework modern information and communication technology (IT, or interchangeably, ICT) appears to be at the core of any “smart city” initiative or project. Also, technological challenges, for example, in terms of interoperability, security, and technical skills need to be addressed in the government context. Furthermore, multiple, sometimes conflicting, managerial and organizational factors influence any government project. These factors include, for example, project size, managerial attitudes and behavior, organizational diversity, align-

Table 1. Smart city initiatives framework (Chourabi et al., 2012)

Dimensions	Meaning
Technology	Technology used as infrastructure, backbone, enabler, and facilitator of initiatives and for meeting/overcoming challenges.
Management and organization	Managerial and organizational factors influence projects broadly, such as project size, managers' attitudes and behavior, organizational diversity, alignment of organizational goals, and compliance to change.
Policy	The policy environment of the initiative, that is, the relationships between political factors, e.g., mayor- council or council-manager, and institutional factors, e.g., law, regulation, code, and inter-governmental agreements.
Governance	The governance model, the authority, and the involvement of constituents in the initiative.
People and communities	People and communities of the city affecting and affected by the implementation of smart city initiatives.
Economy	Economic inputs to and outcomes from smart city initiatives, such as business creation, job creation, talent attraction, workforce development and retention, and improvement in productivity.
Built infrastructure	The impact of the initiative on improving and leveraging the built infrastructure.
Natural environment	The impact of the initiative on preserving and protecting the natural environment.

ment of organizational goals, multiplicity and potentially competition of goals, compliance to change, and jurisdictional integrity among others (Chourabi et al., 2012).

The managerial and organizational dimensions are tightly interwoven with the policy context. The legislative settings (laws, regulations, codes, statutes, and intergovernmental agreements) and the city's governance structure (councils/elected mayors, or alternately, councils/appointed city managers) influence the nature, potential scope, and the likely outcomes of any "smart city" initiative, which may or may not be nurtured in the particular policy context (AlAwadhi & Scholl, 2013). Either way, this political context also deeply influences the model of governance used for and within smart initiatives, which might range from hierarchical to networked approaches (Chourabi et al., 2012).

The initiatives also have economic impacts and are sometimes directly geared to increasing the city's competitiveness, fostering business development, job creation, and talent attraction, developing and retaining the workforce, and improving productivity (Nam & Pardo, 2011). Quite a few "smart city" initiatives are

also directed towards preserving and protecting the natural environment and improving and leveraging the built infrastructure (Chourabi et al., 2012).

"Smart city" initiatives have been touted as being oriented towards citizens and communities. Both individual citizens and communities can affect "smart city" initiatives and can also be affected by the initiatives, which typically aim at benefitting citizens and communities, as well as actively involving them. In this sense a smart city would also have the characteristics of a culture of innovation (Nam & Pardo, 2011), a high quality of life, global competitiveness and attractiveness, security, and safety, as well as economic and environmental sustainability (Alawadhi et al., 2012; Chourabi et al., 2012). A city government would be a part of a smart city, managing and implementing policies towards those ends by leveraging ICTs and institutions, and by actively involving and collaborating with constituents (AlAwadhi & Scholl, 2013; AlAwadhi et al., 2012; Nam & Pardo, 2011). Several empirical studies on "smart city" initiatives indicate that despite some peculiarities and differences between the

initiatives, the principles of open, transparent, and participatory government appear to be an integral part of those initiatives (AlAwadhi & Scholl, 2013; AlAwadhi et al., 2012; Nam & Pardo, 2011). Since 2009, several other studies on participation, government-related social media, and social networking, for example, also show that ICTs have been used to create a culture of transparency (Bertot, Jaeger, & Grimes, 2010, 2012).

Moreover, for meeting the challenges concerning urban livability in the 21st century in a global context new institutional formats and novel mechanisms need to be developed for staying abreast of the systemic dynamics of a closely interconnected global society (Scholl & Scholl, 2014). Actionable and omnipresent information, along with its underlying technologies, has been said to be the key prerequisite and backbone for developing models of smart (democratic) governance, which foster smart, open, and agile governmental institutions, as well as constituent participation and collaboration on all levels and in all branches of the governing process (Scholl & Scholl, 2014). However, thus far, the two concepts of smart government and smart governance have only been developed in a rudimentary way. Smart government has to cope with complexity and uncertainty, and needs to build up competencies and achieve resilience (Willke, 2007). Smart-governance infrastructure is seen as an agglomerate of hard and soft elements such as norms, policies, practices, information, technologies, skills, and other resources (Johnston & Hansen, 2011). When developing smart governance infrastructures, several key factors have been identified, such as problem focus, feasibility/ implementability, constituents' ability to contribute, continued engagement, coordination, and access to open data and shared information (Johnston & Hansen, 2011).

In summary, the amended *Smart City Framework* (Chourabi et al., 2012; AlAwadhi et al., 2012) defines a comprehensive eight-dimensional analytical space, which allows to assess and compare the extent and degree of "smartness" in cities, in general, and city

government initiatives, in particular. Smart governance (as opposed to smart government) appears as a general principle and important element in developing city governments and urban spaces that maintain 21st-century livability, sustainability, competitiveness, and attractiveness.

RESEARCH QUESTIONS

As we pointed out, "smart city" (for the wider urban space) / "Smart City" (for city government) serve as an umbrella term, and an array of definitions and understandings have been presented, also in practical initiatives and projects. Besides academic definitions practitioners appear to have their own range of perspectives on what they define as a smart city. In this study we replicate in part the approach that AlAwadhi and Scholl used who juxtaposed practitioner definitions of smart city in Seattle, WA, to actual smart-city projects and initiatives in that city, which were under those practitioners' purview (AlAwadhi & Scholl, 2013). In this study, we apply this approach to the City of Munich, Germany, which leads to the following two research questions:

Research Question #1 (RQ#1): How do City officials in Munich define a Smart City?

Research Question #2 (RQ#2): What are actual Smart City projects and initiatives in Munich about, and how do they match up with the Munich practitioners' definitions of Smart City?

However, in this study we were also interested in understanding what the specific benefits were that Munich City officials already witnessed materializing through these projects, or, at least, expected to see at some point in time, which leads to:

Research Question #3 (RQ#3): What are actual or potential benefits of Munich's Smart City projects and initiatives?

Finally, we were eager to see how the results of the AlAwadhi & Scholl study on Seattle would compare to the findings of the Munich study on the same subject, which leads to:

Research Question #4 (RQ#4): How do practitioners' "Smart City" definitions compare between the Munich and Seattle cases (RQ#4)?

We address the first three research questions in the findings section, while we cover research question #4 in the discussion section below.

METHODOLOGY

The purpose of this explorative study is to build and further develop the related academic theories on smart city (that is, the urban space) and on Smart City (that is, City government). We have used a semi-structured instrument which is described in the next section.

- **Instrument:** The eight-dimensional Smart City framework (Chourabi et al., 2012) provided the theoretical underpinning for developing the semi-structured interview instrument. We anticipated that we would also identify additional concepts in a grounded fashion, so that the instrument was structured only in part (Glaser, 1999; Glaser & Strauss, 1967; Urquhart, Lehmann, & Myers, 2009).
- **Sample:** A total of seventeen interviewees were purposively sampled (Ritchie, Lewis, & Gillian, 2003) and interviewed by the same co-author. This purposive sample encompassed about four fifths of the population of project-related decision makers and project leaders from across City departments. Most interviewees held leadership positions in various City departments or were elected officials (city council, deputy mayor) involved in the institutional architecture overhaul of the City government's information technology infrastructure including the central Department of Information Technology of the City of Munich, which employed several hundred ICT and IT-related professionals at the time the study was conducted. Also, two council members and the deputy mayor who had been involved in the project on the political site were interviewed.
- **Data Collection:** All seventeen interviews were conducted within one week in early spring of 2012. The interviews were conducted in person and lasted between fifty-five and eighty-five minutes. All interviews but one were conducted in German. The interviews were audio taped and transcribed. At least two researchers coded the transcripts for analysis. In addition, notes were taken during the interviews and interviewees' non-verbal communication was observed and recorded.
- **Data Analysis and Coding:** In total, 150 codes and sub-codes were used for coding the rich data, 114 of which were derived ex ante from extant theory (the Smart City framework (Chourabi et al., 2012)), while 36 codes were derived from the data, that is, via open coding (Strauss & Corbin, 1998). In so doing, we incorporated a hybrid approach for data analysis and theory evolution (Gorman, Clayton, Rice-Lively, & Gorman, 1997). The codes were pre-clustered into eleven groups of categories (general information, defining Smart City, project description, management and organization, technology, governance, people and communities, policy, economy, natural environment, and built infrastructure, the latter eight of which correspond to the Smart City framework, (Chourabi et al., 2012). Coding involved a total of four researchers. Each interview transcript was independently coded by at least two researchers using a cloud-based software tool for qualitative and mixed-method data analysis (Dedoose 4.2.83, <http://www.dedoose.com>). The researchers compared the coded data code by code and uncovered a very high inter-rater reliability. In the fairly rare case of strong coding dif-

ferences between any two raters, all raters were consulted in order to address and potentially resolve the coding differences.

While the coding process has been completed for most of the data and along all clusters (that is, the main categories of the Smart City framework), in this study we mainly rely on the clusters/main categories of (a) general information, (b) defining Smart City, and (c) project description. After the open coding procedure had been finished, an axial coding process was applied, during which the converged main categories/clusters and subcategories were further analyzed regarding their inherent structures and processes leading to paradigms, whose internal relationships were identified wherever possible (Strauss & Corbin, 1998).

- **Interview Categorization:** Again, independently, the respective coders categorized the interview transcripts with regard to pre-defined descriptors of project orientation (technology focus, service focus, technology and service foci), emphasis (internal, external, internal and external), and participation (intra/inter government, non-government, intra/inter government and non-government). The descriptors were then compared, and discrepancies of categorization discussed and resolved.

FINDINGS

How Do Practitioners in Munich Define a Smart City (Addressing RQ#1)?

Early in the interview, interviewees were asked with an open-ended question about their ideas and their definition of a Smart City. Our results indicate that in City of Munich's officials' view the term "smart city" first and foremost refers to "Smart City Government" rather than to a complex socio-economic urban space (including its local government). We used the number

of code occurrences as an analytical indicator of concept strength in the transcripts.

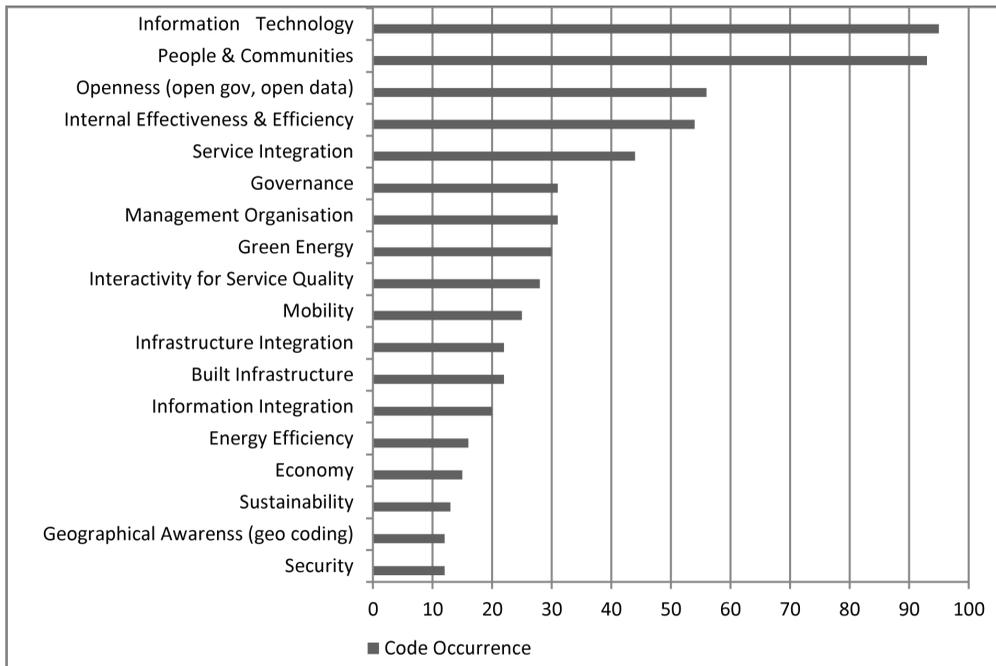
From a relatively high frequency of code occurrences in the definitions they gave, we inferred that City of Munich officials' main orientation with regard to "smart city government" is directed towards the use of *information technology* for improving internal and external services and processes and, explicitly, to serving *people and communities* more effectively (see Figure 1). Codes representing the top-2 concepts of IT and people/communities were found more than 90 times each. A second cluster of three concepts with code occurrences between 40 and 60 included the concepts of (a) *openness*, (b) *internal effectiveness and efficiency*, and (c) *service integration*. Furthermore, thirteen concepts were found with at least twenty occurrences, or more representing a relatively high code frequency.

While code frequency can be seen as an initial indicator of concept weight and relevance in a specific context, a number of concepts were found closely related, and, in fact, interviewees connected several concepts in their responses demonstrating a fairly comprehensive and integrated understanding of "smart city"-related concepts. For example, it was clearly articulated that better internal effectiveness and efficiency as well as better service integration would be attainable via effective and innovative uses of IT. Interviewees also connected other concepts such as a sustainable and future-oriented City management with the strategic shaping of an urban space by involving citizens, businesses, and the administration. As one interviewee put it

I see a smart city as a vision of a city in balance, which acts in a smart, long-term oriented, sustainable, and ecological manner.

Another interviewee elaborated on the various aspects of steering smart government initiatives and of managerial challenges in the overall context:

Figure 1. Code frequency for smart city characteristics



For me it is primarily the management of rising challenges such as infrastructure and urban challenges – all in the context of the city. Hence, it is not only administration. The steering of the city as a system is important. Particularly, the sustainable steering of the city.

Based on the Munich City government officials' understanding of a "smart city" and its "Smart City" government the following six areas of smartness could be distinguished:

1. The facilitating role of information and communication technologies,
2. An orientation towards serving the needs of citizens and communities,
3. Openness and transparency in government,
4. Internal efficiency and effectiveness,
5. Process, service, information, and infrastructure integration, and
6. Sustainability, attractiveness, and "livability" of the urban space.

THE FACILITATING ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

As pointed out the most frequently mentioned concept in the context of smart city was the role of information and communication technologies. We coded 95 excerpts relating to various aspects of ICT in smart city government. Our interviewees saw ICT as a core competency of a Smart City that could and should not be outsourced. Having sustainable and future-ready ICT infrastructures and capabilities was also seen as an image factor for a city. In particular, Munich as the German hub of high technology ventures needed to provide the most advanced infrastructures of that kind.

For City government itself, many interviewees presented ICTs as the catalyst and primary facilitator of any administrative reform. ICT was seen as the driving force for streamlining processes, services and internal structures,

but also as an advanced steering and planning tool. The role of ICTs was also portrayed as an agent for internal and external change. One interviewee said:

The intensive use of IT can help to improve our business processes or being closer to our citizens. Here, IT can help us serve our citizens more efficiently and potentially even help anticipate their needs.

However, the interviews also showed that in order to anticipate the needs of its customers, a Smart City had to first change its service paradigm. ICTs were also regarded as enablers for reversing City agencies' service paradigm from an inward orientation, that is, an administrative focus orientation, to an outward orientation, that is, a citizen needs and service orientation. While the traditional administrative attitude had expected that citizens and businesses were to come to the administration whenever in need of a service, the administration would then have to shift to a proactive service model that serves citizens and businesses at their point of convenience and necessity. One interviewee summed up this classic administrative stance in the following manner:

We [as the City] are inside and we fence ourselves off from the outside ICT. Our ICT happens inside the fence at our office desks. Desktop workstations are the dominant form of ICT, but definitively nothing mobile. The people come to us, get a waiting ticket and get in line.

According to the interviewees, the new understanding of service delivery should see City agencies stepping out of their offices and serving citizens and businesses on site. Mobile ICTs it was said were needed to make this change happen. Also, new and high-bandwidth network infrastructures were seen necessary for facilitating secure and mobile interactions of City agencies with their customers. Only if the network infrastructures fully supported mobile devices, for instance, for pothole or traffic

management, then City officials would be able to interact quickly and effectively with citizens and businesses. According to the interviewees, if implemented in smart ways, ICTs presented essential tools for managing the complexities of City government and the urban space. In addition, ICTs were also needed to implement electronic or open government services for citizens and businesses. On a more critical note, one interviewee said:

I don't think it's only information and communication technology. But of course it's a driving factor, information communication technology. I think a Smart City has the ability to react quickly to changes, to get into a goal oriented contact with the citizens and businesses.

A recent study conducted by the City of Munich showed that almost 80 percent of private households in Munich had Internet access (Breu & Behr, 2011). However, for enabling the full usage of the City's digital services, the implementation and full access to broadband Internet would be essential for a Smart City to reach its constituents. In addition, citizens would also need to possess the necessary skills to use those digital services offered by the City. Moreover, just offering digital services was not presented as the sole strategy, since that might run the risk of excluding populations without access to the Internet. As one interviewee put it:

It is useful to offer more access to information as well as possibilities for transaction and participation through digital media. However, this should not be the only way, because it can lead to an exclusion of citizens. [...] Of course, this necessitates special efforts from the City. For instance, we are currently discussing different models for cell phone parking. For the City it would be the cheapest to permit only cell phone parking. But this is not very reasonable considering that citizens need to be able to pay their parking tickets differently. This, of course, leads to parallel online and offline services.

In summary, the City of Munich interviewees saw ICTs as an absolutely necessary facilitator but not sufficient factor on its own for developing both smart city government as well as a smart urban space. For the city administration, ICTs were seen as indispensable enablers of internal administrative reform and process streamlining. ICTs were also found fundamental when reversing the administration's service paradigm from process to constituent needs orientation. However, officials were also aware of the challenges of potential digital divides, that is, the constraints that the uses of ICTs still incur.

SERVING THE NEEDS OF CITIZENS AND COMMUNITIES

As mentioned according to the interviewees, a key characteristic of a Smart City was seen in a strong orientation towards the needs of its people and communities. This it was said includes not only individual and groups of citizens but also business and other communities. Citizens and communities alike would expect speedy and proactive services from their city government, some interviewees remarked. However, catering to their constituents' needs was seen not as an easy task for the City due to the wide spectrum of constituents' needs. Hence, a goal-oriented approach, that is, serving the specific needs in each case, was seen as desirable. Moreover, privacy and trust were identified as important qualities that Munich citizens would expect to be upheld when interacting with city government. One interviewee said:

What is the actual objective of a Smart City? In my understanding it is having a strong relationship with its citizens. For me a Smart City is able to connect the following topics: How does the city get closer to its citizens? How does it become more citizen-oriented? How can the City design more efficient services for its citizens?

In a nutshell, an orientation focused on constituents' needs was seen as the key when

moving the service paradigm away from the traditional administrative process focus.

OPENNESS AND TRANSPARENCY IN GOVERNMENT

Somewhat to the researchers' surprise, the interviewed city officials attributed about the same emphasis and relevance to open government initiatives as they did towards the improvement of internal administrative efficiency and effectiveness. Smart and open were seen by some interviewees as interchangeable terms.

In their view, open government had the potential to help create economic and social benefits, while at the same time it would also foster a strengthening of democratic government practices through citizen participation. Open government data provided on portals and apps would in several study participants' perspectives lead to the development of innovative value-added services and applications, thus, creating economic benefits for the City, its people and businesses. Open government would also have the potential to lead to more direct exchanges between the City and its constituents. Citizens would be able to take on roles of administrative support, which in turn could reduce barriers and reservations that might exist on both sides. According to one interviewee, designing transparent and participatory decision-making processes would have the potential to create a smarter urban society:

For me transparency and participation are important aspects of a Smart City. Participation of people in important decision-making processes can increase the know-how of the urban society. This does not necessarily need to be technology driven. Creating transparency and participation can also be accomplished without the use of technology.

A prerequisite for making open government data available for public consumption (e.g., on portals and apps), were described as

new organizational structures and processes within the city. Another interviewee called this effort the “biggest reorganization in a century”. Integrated processes and infrastructures were needed, the interviewee said, to support these open government efforts. In this administrative overhaul, ICTs would play a key role.

Openness and transparency were seen as important elements not only in democratizing decision-making processes but also help drive the administrative overhaul in Munich.

INTERNAL EFFICIENCY AND EFFECTIVENESS (IEE)

The drastic improvement of internal (administrative) efficiency and effectiveness appeared to be of highest importance aspects to the interviewed Munich City officials. Again, ICTs were regarded *the* prerequisite and key element for that purpose. ICTs were seen as key in dismantling unnecessary organizational barriers, eliminating undesirable redundancies, and in reducing red tape, in general. The vast majority of interviewees saw process, infrastructure, and organizational efficiency and effectiveness as the central characteristics of a Smart City. Once processes operated smoother, the City would be able to react more agile, more effective, and more quickly to changes. One interviewee said:

A smart administration is very simple for me: Through the use of information technology bureaucracy can be reduced and processes improved. This in turn would allow the administration to work efficiently inside and outside for its citizens.

According to some interviewees a Smart City would operate in a cost, time and resource efficient and effective manner. It would balance its resource input and output. Resource efficiency would not only refer to the efficient use of natural and financial resources but also to the effective management of human resources. As in other cases, so in the City of Munich, the notion of doing and achieving more with

less appeared to have taken traction. However, in order to make that happen, the City would need to attract even better educated people than before.

IEE and their ongoing improvement were seen as a capstone of smart city government, and once again also in this regard, ICTs were portrayed as indispensable facilitators for achieving that end.

PROCESS, SERVICE, INFORMATION, AND INFRASTRUCTURE INTEGRATION

According to a majority of interviewees, in a Smart City the organizational and technical performance of different administrative units had to be high and effectively coordinated. Collaboration and cooperation across department borders needed to be supported via standardized processes and a common cross-organizational strategy. Additionally, interoperable ICT systems needed to enable the effective sharing of information and processing of internal and external transactions across department borders. For instance, in order to implement one-stop portals for citizens, different city agencies and departments needed to integrate their processes and information services. Such cooperation and collaboration, however, would require even more well-integrated and non-isolated ICT infrastructures. The integration of ICTs was also seen as a driver for identifying isolated applications and for dismantling administrative silos. The forcing of ICT integration was also heralded as promoting consolidation efforts.

At the same time, business processes were seen in need of streamlining and standardizing across organizational borders to enable new services based on a common institutional architecture, which would help monitor and control the process flow. Once the City-internal integration and streamlining efforts were successful implemented, the City would be enabled to offer much more efficient online services, it was said. At the outset of the City-internal

overhaul, citizens and businesses would not necessarily enjoy any direct or tangible benefits. One interviewee summed it up saying:

I think a Smart City, in fact, [...] needs to integrate business and ICT a lot, and the idea of requirements engineering and optimizing business processes in a way that it works, that it is well integrated with ICT is one of the key success factors for the [...] Smart City. I mean there are a lot of gadgets like maybe Wi-Fi and so on, but that's only on top of a clear structure.

Another aspect mentioned was that of ICT-based integration of processes and services would potentially create higher levels of service comfort for all partners involved, internal and external. Based on integrated network infrastructures the City would shortly be able to provide secure online transactions for businesses and citizens. A Smart City it was said would have to meet expectation that information and data, which constituents wanted to access, were readily accessible online while the infrastructures were secure and trustworthy at the same time.

SUSTAINABILITY, ATTRACTIVENESS, AND "LIVABILITY" OF THE URBAN SPACE

Interestingly, not too many City of Munich interviewees thought that a Smart City was about the sustainable use of energy or natural resources. This is not to say that the study participants expressed that green energy, energy efficiency, and sustainability were considered unimportant, but rather in their conceptions of Smart City other aspects appeared to have a higher urgency (e.g., organizational and ICT overhaul).

Nonetheless, the quite a few interviewees pointed out that because the world population was growing so rapidly that a severe scarcity of fossil resources could become a reality and major problem to metropolitan areas in the not too distant future. As a consequence, as long as

individual mobility was highly dependent on fossil resources, urban life and commute in its current form would be compromised. A Smart City would need to address this problem. One interviewee said:

Another effect is, for instance, that the growing scarcity of crude materials results in a sharp increase of prices. Cities like Munich, and megacities probably even more, face a daily inward and outward mass migration of the working population. These people are dependent on automobiles, which in turn are dependent on fossil fuels. Hence, this is an important topic for a Smart City.

With less frequency, Smart City was also related to smart grids (that is, smart traffic grid, smart electric grid and metering, and smart utility), which are characterized by interactivity, effectiveness, efficiency, mobility, and infrastructure integration.

Creating a "livable," "attractive," and even "loveable" city was another central theme for a Smart City according to the study participants. In their view "livable" referred not only to some vague concept of quality of life but explicitly to the concepts of a safe, humane, economically attractive and competitive, opportunity-rich, socially balanced and peaceful, and ecologically sustainable city. The interviewees saw this as the City's responsibility to create incentives, for example, for a stable and attractive job market. A strong education infrastructure with regard to schools and universities was also perceived as an important factor. However, not only the economic stability and prosperity of the city was considered a key characteristic of its smartness, but also its social balance. Effectively addressing migration and gentrification problems was seen as equally important for maintaining the quality of a livable city. One interviewee summarized the concept of a "livable" city in the following way:

Many aspects contribute to a livable city. [...] But besides livable, I could also call it a socially balanced city. Social segregation and similar

aspects need to be addressed to make a city livable. However, frequently social factors are not the real focus when discussing aspects of a smart city.

In sum, sustainability, attractiveness, and livability of an urban space were seen as greatly intertwined. A smart urban space would distinguish itself from other urban areas through its greater sustainability, attractiveness, and livability, which would ultimately make the smart city also more competitive. Smart city government would play a major role in facilitating these aspects of smartness of an urban space.

In the next section, we present the findings regarding the actual projects and initiatives, which the City of Munich pursued at the time this study was conducted, which then is compared to the Smart City/smart city definitions given by the interviewees.

What are Actual Smart City Projects and Initiatives in Munich About, and How do They Match Up With the Munich Practitioners' Definitions of Smart City (RQ#2)?

For addressing the second research question, we had to first identify those projects, to which the practitioners referred as their Smart City projects. It turned out that the City of Munich focused on a single, however, fundamental Smart City program under the title of "MIT-KonkreT," which stands for "Munich Information Technology Concrete." Launched in 2007, this almost decade-long program was chartered to encompass numerous concatenated and related project, which in sum would result in the most radical and foundational reorganization of Munich City government's information technology infrastructure and processes. MIT-KonkreT, it was said, implemented an ITIL-based approach (<http://www.iti-officialsite.com>) to holistic ICT service management of and requirements engineering for the City's various business processes across departments and City-owned or controlled enterprises. The

program aimed at implementing fundamental organizational, functional and technical changes. The objectives of these changes were to create an efficient IT-organization, which would have the capacity and the capabilities to effectively support a citizen-oriented City administration.

After the program's preparatory phase, which actively involved all key stakeholders, was successfully completed, in 2010 the City's ICTs were restructured into three divisions under MIT-KonkreT:

1. **Decentralized ICTs**, situated within the City departments and enterprises (called dIKAs), which would provide ICT services based on their units' requirements (requirements management, functional IT-services, local service-desk);
2. **One Central ICT service provider** (called IT@M), implemented as a City-owned enterprise, which would be responsible for all technical ICT-related tasks (planning, provisioning, programming, operating, and managing ICTs)
3. **The ICT strategy and ICT controlling division** (called STRAC), which would be responsible for setting and implementing strategies, standards, and innovations (that is, setting the ICT strategy for Munich's entire city government).

From City documents and the interviews, it became clear that all three divisions were created to provide a focus on each division's respective core competencies. However, directed by a unified citywide strategy the divisions were also seen as connected through standardized processes, and they were chartered with the common goal of offering best-in-class and flexible ICT support for the functional departments in City government. In other words, with MIT-KonkreT the City of Munich opted for introducing and implementing a consistent *institutional architecture* for its ICTs, which can be seen as the equivalent to an enterprise architecture in the private sector.

When comparing the objectives of MIT-KonkreT to the aforementioned definitions of Smart City a strong foci on ICTs as facilitators emerges, in general, and, in particular, on internal efficiency and effectiveness as well as an emphasis on service, process, and infrastructure integration, whereas the MIT-KonkreT program would have no discernible or direct relationship to smart city dimensions such as creating a livable city, open government, or sustainable use of natural resources. However, most interviewees saw MIT-KonkreT as the basis and actually the indispensable prerequisite for building the capacity to address the other smart city dimensions in the long run.

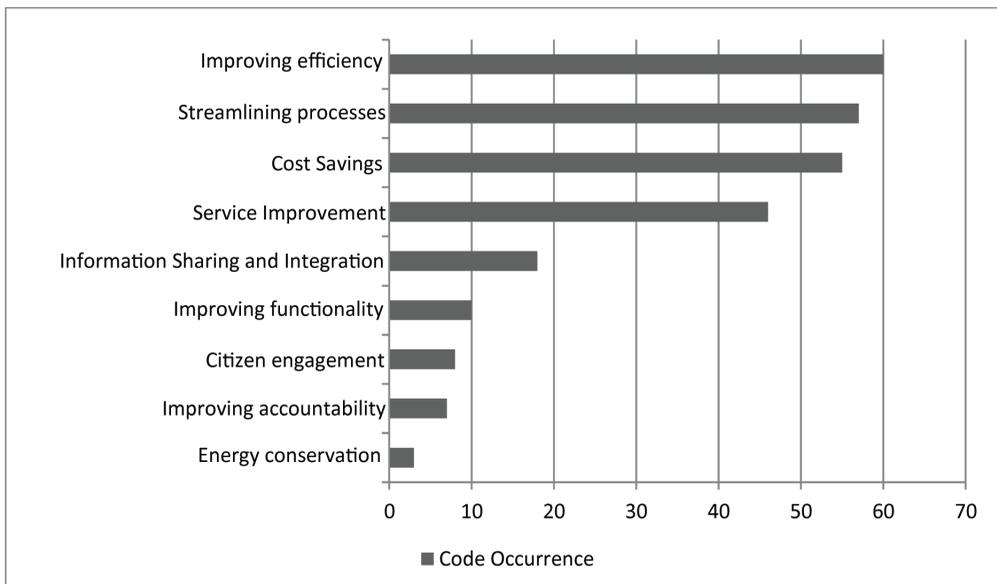
In summary, the almost decade-long MIT-KonkreT project appears as a foundational, and even radical, overhaul of the City's ICT service management, which readies Munich City government for administrative agility and numerous potential innovations, which would effectively enable comprehensive smart government practices in the longer run.

What are Actual or Potential Benefits of Munich's Smart City Projects and Initiatives (RQ#3)?

Next, we wanted to better understand what benefits the City officials had envisioned when implementing the MIT-KonkreT program (see Figure 2). While certain benefits had already materialized in the unfolding program, others were expected to become visible and measurable in the not too distant future. In the analysis we did not distinguish between actual and potential benefits, but rather lumped them together, since they appeared to serve as proxy for the managerial motivation for launching the program. We again used frequency counts and ranking of the mentioning of certain benefits in the transcripts for getting an initial idea. When we asked to explain the motivations for carrying the MIT-KonkreT project, we hoped that interviewees would provide exactly that information. In fact, the data we found confirmed this assumption.

As Figure 2 shows, efficiency improvement, process streamlining, and cost savings were the top-3 most frequently and foremost mentioned benefits and motives for launching

Figure 2. Code frequency of "smart city" benefits



the MIT-KonkreT program as well as for its outcomes. The interviewees not only viewed efficiency and process improvement as a benefit in and by itself, but also as a prerequisite for a Smart City. One interviewee said:

First of all, the way that the City's ICT function has been organized up until now, would not have been able to cope with any new challenges let's say in five or ten years. So, the idea of the reorganization was to structure the organization and the ICTs in ways that the three different divisions would focus on their core competencies, which then would become prerequisites for addressing all these digital and electronic government topics.

Constituents' engagement and improving accountability, on the other hand, were of far lower priority. One interviewee said:

MIT-KonkreT is currently not very citizen-oriented, because it is primarily inward oriented. However, the project is a prerequisite, or let's call it even a support pillar, for future applications and procedures, which will be more citizen-oriented and allow citizens to engage.

In summary, the benefits of MIT-KonkreT appear to be reaped primarily government-internally, focusing on aspects of efficiency improvement and cost savings. In addition, the major emphases both in terms of motivation, purpose, and expected benefits clearly lay on government-internal business. External aspects such as citizen engagement and energy conservation were viewed as far less relevant. However, the interviewees showed a clear sense of why the current Smart City efforts would provide the foundation for more outward-oriented projects after the overhaul was sufficiently advanced.

How do Practitioners' "Smart City" Definitions Compare Between the Munich and Seattle Cases (RQ#4)?

For this particular case comparison we relied on previously published results a City of Seattle

study that used the same analytical framework (see AlAwadhi & Scholl, 2013) and identified some interesting differences and similarities. Both differences and similarities refer to (a) how City officials defined a smart city (see Figure 3) and (b) how practitioners saw benefits that can be realized by Smart City projects (see Figure 4).

According to many interviewees in both Seattle and Munich, smart city government is about proactive service and government action internally as well as interaction with citizens (people and communities). Proactive service was understood as referring to service innovation and integration, interactivity in service, and service quality. The interviewed practitioners in both cities saw ICTs as premier facilitators for implementing Smart City projects and initiatives.

Interestingly, the interviewed city officials in both cities put far less emphasis on the two related topics of open government and open (government) data than, for example, on service and integration. While the City of Munich had not developed any open data portal at the time this study was conducted, the City of Seattle's had already operated its fairly comprehensive open data platform as a public access point to government information and services in the form of "data.seattle.gov" for some time. So, against this backdrop the researchers were somewhat surprised to find so little mention of the open data portal on part of City officials in Seattle. One reason for this lack of enthusiasm for the open data portal might be attributable to relative low usage numbers, in particular, from business users. Actually, according to some interviewees the most frequent users of Seattle's open government data appeared to be other City of Seattle departments. So, ironically, the open data initiative had resulted in more government-internal information sharing than with the publics.

Another interesting difference in the "smart city" definitions was the stronger focus and heavier weight that Munich officials put on institutional architecture aspects, that is, for example, on aspects of city-wide internal management organization and governance. This includes the efficient and effective design of

Figure 3. Comparison of code frequency for smart city characteristics

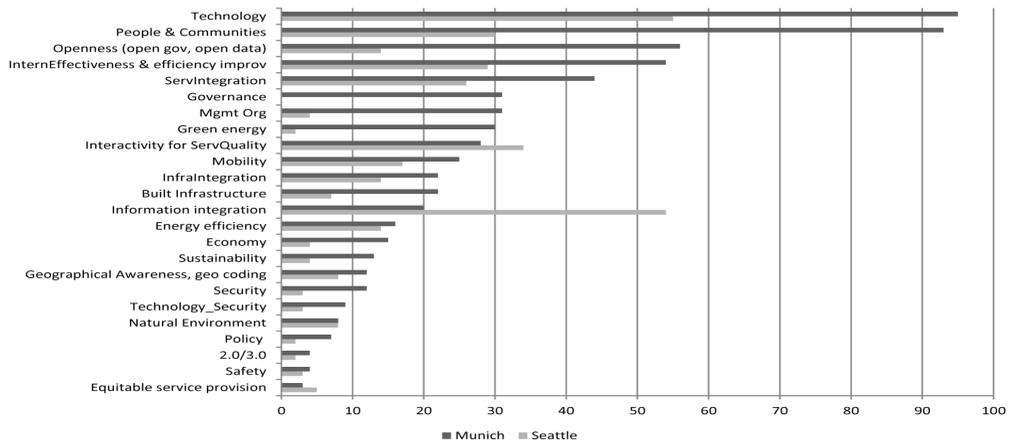
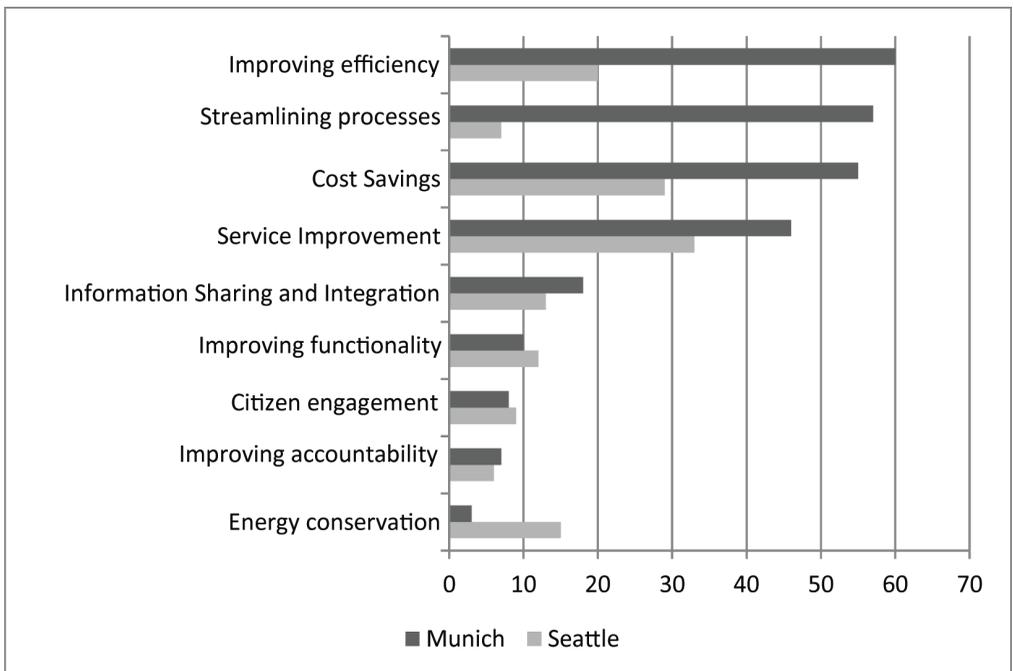


Figure 4. Comparison of code frequency of “smart city” benefits



processes and services. Particularly, the topic of governance had little attention from interviewees in Seattle who, on their part, put the strongest emphasis besides ICTs on information integration.

The main difference, however, we found in how the two city governments pursued the concept of a smart city, or, smart city government, respectively, in terms of practical projects. While according to the interviewees the City of Munich focused on a complete ICT overhaul with the intent to create an institutional (enterprise) architecture, that is, one multi-year program with numerous integrated projects, the City of Seattle had a total of some 24 projects, which were loosely coupled at best. Six projects at the City of Seattle had a government-external orientation (that is, toward citizen or business), ten projects were oriented both internally and externally, while eight projects had an internal-only orientation. In other words, from a high-level perspective the projects at the City of Seattle, by and large, appeared to be balanced between internal and external orientations.

The comparison of perceived benefits from Smart City-related projects in both cities (see Figure 4) also highlights some interesting differences. As Figure 4 shows the interviewed officials in Munich primarily see internal benefits such as efficiency and process improvements. In contrast, interviewees in Seattle saw the main benefit in service improvement, which had a more external focus. Both practitioner groups, however, saw cost savings as direct benefits from implementing Smart City-related projects, whereas the engagement of citizens was lowly ranked by both groups. Interestingly, interviewees in Seattle also identified a strong benefit in energy conservation. Equally interestingly, City officials in Munich found almost no relationship between their Smart City-related efforts and energy conservation.

In summary, the interviewed officials in both cities mentioned cost savings as well as service and efficiency improvements in city government most frequently. While Seattle officials also were more concerned about energy conservation, Munich interviewees emphasized

more than their Seattle equivalents the emphasis on internal improvements and process streamlining than any other benefit.

DISCUSSION

Since the introduction of the amended Smart City framework (AlAwadhi et al., 2012; Chourabi et al., 2012) into the literature and its use in various empirical studies in recent years including this study, the concept of a “smart city” has academically been more solidly established and has increasingly guided the systematic study on the subject. The framework has extended the definition of smart city beyond the realm of municipal government to include important parts, or even the entirety, of the urban space.

1. **Aboutness:** With regard to the subject of smart city it is noteworthy that a large number of City of Munich interviewees echoed exactly this wider scope in their own definitions of a smart city. Like in previous studies elsewhere, so did the City of Munich interviewees offer quite a range of smart-city definitions, however, with considerable intersections in scope. In almost every interview the definition given for smart city included (a) the notion of ICTs as *the* major facilitating element, which (b) would be instrumental for benefitting the city’s constituents in every possible way, and in particular, (c) also through making government more open, transparent, and participatory. Smart City government was seen as an important building block for forming and maintaining a smart urban space. Consequently, most interviewees had no difficulty with relating the massive ICT overhaul project (MIT-KonkreT) at City government to developing smarter city government and thus more or less directly promoting a smarter and more attractive urban space. Against this backdrop and as mentioned before, we were interested in how the smart city definitions from practitioners in Munich compared to those

from their functional equivalents in Seattle, that is,

2. **Focus:** As presented above the Munich officials' connected in their smart city definition both the urban space and city government as intricately intertwined. A smart city government was seen as an important catalyst and facilitator for developing and maintaining a smart urban space. A smart urban space, in turn, would require smart city government for its continued evolution and representation. In this understanding it appears only consequential that some Munich officials indirectly linked the comprehensive administrative overhaul project to the objective of developing Munich into a smart urban space. Hence, although the City of Munich did not have an official "smart city" agenda at the time when this study was conducted, the officials' "smart city" definition matched with what was actually done, that is, the long-term MIT-KonkreT program and its various projects, which was seen as an important enabler in the overall context.
3. **Two Cities—Two Approaches:** When comparing the "Smart City"-related approaches in the City of Munich to the City of Seattle it becomes evident that neither City had an explicit program or strategic objective to pursue the concept of a Smart City. Nevertheless the programs and projects, which the two city governments carried out, are both in support of Smart City concepts and goals. The major differences pertain to the strategic orientation and coordination in the two "Smart-City"-related approaches. While the City of Munich executes a long-term strategic program in a top-down fashion, the City of Seattle conducts a relatively high number of projects, which are not necessarily coordinated nor integrated.

In Munich, the radically redesigned administrative setup is hoped to provide the basis for future programs and projects geared at attaining higher administrative agility and service quality. In Seattle, the ICT-related

institutional architecture remains unchanged, that is, somewhat fragmented. However, quite a number of projects are targeted at creating smart grids in terms of power, traffic, and communication. Compared to Munich, though, City government's ICT in Seattle is strategically less aligned. This notwithstanding, the various City agencies in Seattle emphasize management, efficiency, and energy conservation-related aspects in their smart grid projects. Smart City-related benefits such as increased urban competitiveness and attractiveness are more tangible for the business community and the population at large in Seattle than in Munich. However, that may change, once the administrative overhaul at the City of Munich is complete.

4. **Openness:** Paradoxically, the terms "open government" and "open data" were relatively more frequently mentioned in the smart city definitions of Munich officials than in those of their Seattle counterparts. However, in terms of practical projects, the City of Seattle had a measurable advantage over the City of Munich at the time when this study was conducted. Unlike its counterpart in Germany's South, the City of Seattle had repeatedly been highly acclaimed for the quality and functionality of its interactive Web portal and open data sites (seattle.gov and data.seattle.gov), which had won the City of Seattle several national awards among US municipalities with a population of over 100,000 (Bishop, 2011).
5. **Societal Impact:** Although "people and communities" and "cultural impacts" were identifiable elements in the officials' smart city-related definitions in both cities, it was only the City of Seattle at the point in time when this study was conducted that had projects with a discernible culture- and people-centric focus. However, like in Munich, other aspects, mainly related to ICT-enabled administrative improvement and smart grids, dominated the smart city project portfolio of the City of Seattle.

6. **Limitations:** While the researchers were able to interview over four fifths of the decision makers, both elected and appointed, involved in the central MIT-KonkreT program, the City of Munich conducted other departmental projects in parallel, which—although not labeled as such—could also be validly counted as “Smart City” projects such as citizen involvement, traffic management, and construction/permitting.

Methodological limitations also include cultural and organizational differences between the two City governments compared. Although the same interview protocol was used in both Seattle and Munich, the administrative and political structures as well as the cultural approach to governing and technology-based innovation in both governments were distinct so that findings need to be carefully assessed with regard to their comparability and transferability between such distinct contexts. For example, for the federated structure of City of Seattle government with its multiple divisions of power, independent mandates, and the autonomy of departmental decision making a concerted institutional architecture approach as carried out and documented for Munich City government appears unattainable in practice.

In summary, the smart city-related projects conducted in both city governments were remarkably consistent with the officials’ definition of a smart city. While, the definition of officials in Seattle mainly referred to smart government at local (City) level, that is, City government, the Munich officials appeared to include in their definition the complex and multidimensional urban space of a city (including its local government as a part of that urban space). In both cities, the development of “Smart City” rests on a fundamental redesign of the ICT-related institutional architecture (in the case of Munich) and on continuous ICT-enabled administrative innovation (in the case of Seattle). Citizen-, communities-, and culture-oriented projects appeared to play a second-tier role in both cities, and as mentioned before, neither City had

an explicit and official “Smart City” agenda by the time this study was carried out.

As pointed out elsewhere, the terms of “Smart City” (as a placeholder for smart local government) and “smart city” (as a proxy for the multidimensional urban space) need to be distinguished in discourses about the subject. It appears to suggest itself that a smart local government is a necessary but not a sufficient condition for making an urban space smart (AlAwadhi & Scholl, 2013). We agree that the two terms of “smart city” as an urban space and “Smart City” as smart municipal government have utility as vehicles that help facilitate academic and practitioner conversations about the future and intertwinement of urban spaces and their municipal governments in the 21st century. ICTs appear as important foundational elements in shaping and enabling the smart city.

CONCLUSION

In this study, we used the theoretical lens of the Smart City framework (AlAwadhi et al., 2012; Chourabi et al., 2012a) and implemented the methodological design of a previous study (AlAwadhi & Scholl, 2013). Like with the earlier study on the City of Seattle, the object of this study on the City of Munich in Germany was it to analyze definitions of “smart city given” by City officials and compare them to the practical “smart city” program at the City of Munich and its expected (and realized) benefits. Furthermore, we juxtaposed the findings from the earlier study to those from the Munich case.

While the practical programs/projects aligned fairly well with the “smart city”-related understanding of officials in either City, the Seattle officials were mainly focused on smart city government, while Munich officials connected the concepts of smart city government to the concept of a smart urban space, to which smart city government serves an important facilitator. In both cities, ICTs are at the core of smart city projects. In order to serve towards that end, the City of Munich opted for a highly integrated strategic approach, that is, a fundamental overhaul of its ICT-related institutional (enterprise)

architecture as a prerequisite for carrying out projects that make the City administration more responsive, more service oriented, and more change ready.

It remains to be seen, how practical projects will fare, once the institutional overhaul is complete. In contrast to Munich, however, the City of Seattle embarked on numerous smart city and smart grid-related projects in a more tactical fashion. The smart city projects in Seattle have already made measurable impacts. At this early point, no assessment can be offered to which extent one or the other approach described above might be more effective with regard to the development of smartness of both urban space and embedded city government. Future research will investigate further cases of smart city initiatives along the lines of the Smart City framework (Chourabi et al., 2012), which we hope will allow us to more deeply understand the effectiveness of and choices in the various smart city-related approaches.

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