Designing Effective Strategies to Enhance Policy Capacity in Smart City Development

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Abstract - In the past two decades, the number of smart cities is increasing exponentially across the world. While private developers and multilaterals play quintessential roles in smart city development due to their vast financial leverage and endowment, the role of governments in steering, governing and regulating these developments are of paramount importance. The challenge of tilting the balance between innovation and regulation is of much interest to governments, with technological risks such as privacy, safety and cybersecurity issues surrounding the novel and emerging technologies for smart cities looming large. One central question lingers for policy-makers governing the smart city space: How could effective strategies be designed to enhance the policy capacity to accelerate smart city development? Applying a policy capacity framework and using a qualitative approach based on semi-structured questions, a total of 23 smart city experts from 13 countries were engaged in two rounds of an internet-based E-Delphi survey. Questions revolving instruments and strategies pursued by the governments and private corporations to enhance political, operational, and analytical capacities at three levels (individual, organizational and system) for smart city development were posed. Data were analyzed using thematic analysis. The results revealed that various strategies could enhance citizen-level, industrial-level, bureaucrat-level, organisational-level, city-level policy capacity in smart city development. These measures centred on creating the right learning platforms by industrial and government stakeholders,

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such as skills training workshops, higher education opportunities for upskilling, networking events, testbeds, and citizen forums, coupled with appropriate financial incentives. The results will highlight several important policy recommendations for the governments and allow countries to draw lessons when designing effective strategies to enhance policy capacity in smart city development.

Keywords: Smart city, policy capacity, policy design, strategy, Delphi

1. Introduction

1.1 The acceleration of smart cities globally in the 21st century

The prevailing discourse to preserve environmental sustainability (Trindade et al. 2017; Bibri 2019; Toli and Murtagh 2020), as well as the heightened attention to increasing administrative efficiency and agility in public service provision (Yigitcanlar 2015; Velsberg, Westergren, and Jonsson 2020) popularised the smart city concept and sparked the emergence of smart cities across the world since the beginning of the 21st century. While attaining the statuses of smart cities seem to be a natural evolution for the existing global cities in the developed countries, smart city development resonates even more strongly with the developing world, as it is often seen as an opportunity to accelerate socio-economic development through technology leapfrogging (Tan and Taeihagh 2020).

Among some of the major and most populous emerging economies, smart city development has also gained traction. China, for instance, introduced smart cities in 2010 and has the largest number of smart cities in the world as of 2019 (Wang, Zhou, and Wang 2020; Wong 2020). The Indian government launched the '100 Smart Cities Mission' in 2015 by allocating more than $1 billion to this ambitious venture to identify and invest in innovative solutions in various service sectors to solve the mounting population pressures felt in the Indian mega-cities as a

result of its exponential urban population growth (Smith, Pathak, and Agrawal 2019; Prasad, Alizadeh, and Dowling 2021). On the other hand, the Indonesian government launched the 'Gerakan 100 Smart Cities' in 2017 with a multi-ministerial effort mobilised to implement ambitious urban digitalisation programmes across major cities in the country (Herdiyanti, Hapsari, and Susanto 2019). In South Africa, the smart city concept took root as a 'digital city' as early as 2000, and the digital revolution in the country was perceived to enable more efficient public service delivery (Söderström, Blake, and Odendaal 2021). Likewise, Brazilian cities are also gearing up to embrace smart, sustainable and knowledge-based urban development to increase their sustainability and innovative capabilities (Sabatini-Marques et al. 2020).

1.2 Capacity for smart city development

Most of the published recent literature on smart city governance and management have not examined the issues and strategies that drive smart city development using the theoretical lens of policy capacity. While acknowledging that capacity is a fundamental requisite to smart city development, most studies have approached the strategies for building capacity for smart city development rather heterogeneously. This is likely due to variations in how the concept of capacity is operationalised and approached in different fields and conventions. For instance, various developmental and governance themes related to 'capacity-building to solve urban problems in smart city development' were elucidated as 'resilience and adaptation' (Ramirez Lopez and Grijalba Castro 2021), 'smart sustainable urbanism' (Ahvenniemi and Huovila 2021; Bibri 2021), 'performance assessment and evaluation of capacity' (Caird 2018; Li et al. 2020; Shen et al. 2018; Wang, Zhou, and Wang 2020; Cheniki, Baziz, and Bougdah 2020), 'risk management and surveillance' (Sonn and Lee 2020; Ullah et al. 2021), 'best practices' (Rachmawati 2019), 'city collaborations' (Spicer 2021), or 'strategic planning (Du, Zhang, and Mora 2021; Salvia et al. 2021).

1.3 Capacity challenges in smart city development

Regardless of the developmental stage of a country, capacity deficits and shortfalls are commonplace. Various policy challenges of different intensity, levels and nature are often encountered in smart city development.

Chief among them is financial cost (Kumar, Goel, and Mallick 2018; Silva, Khan, and Han 2018; Bawany and Shamsi 2015; Khan et al. 2020; Tan et al. 2021). Among the developing countries, budgetary constraints and lack of resources to invest in smart city initiatives are ongoing struggles (Kumar, Goel, and Mallick 2018; Khan et al. 2020). Smart city development would inevitably require substantial financial investment in hardware and ICT infrastructure. A massive amount of reliable and scalable sensors, network infrastructure, network equipment and computing devices will need to be put in place to power up end to end connectivity (Bawany and Shamsi 2015). Typically, the financial cost entails both design and maintenance costs (Bawany and Shamsi 2015; Silva, Khan, and Han 2018). Besides the one-time and relatively smaller design cost which is required to deploy smart city projects at the beginning, governments and providers have to account for recurrent operational and maintenance costs as well to ensure the sustainability of the service provisions in smart cities (Bawany and Shamsi 2015; Silva, Khan, and Han 2018).

In addition to cost, lack of strong governance capacity is another major challenge in smart city development (McKinlay 2017; Anand and Navío-Marco 2018; Song, An, and Ma, 2017; Chen 2017; Kumar, Goel, and Mallick 2018; Khan et al. 2020; Fernandez-Anez et al. 2020; Tan and Taeihagh 2020). In tracing the evolution of the regulatory framework for several New Zealand local governments in smart city development, McKinlay (2017) describes the lack of capacity of the local councils to leverage the full potential that emerging technologies could offer to their local communities as a management capacity challenge within the local government.

Likewise, by referring to the smart city development contexts for four major cities in China, Song, An, and Ma (2017) highlighted the importance of collaborative governance among cities in the same country within which they could coordinate various urban systems management such as local governance policies, data sharing standards, funds coordination and talent support to improve administrative efficiency and scalability of the smart city projects. In India, the lack of strong interlinks and coordination of the work culture between the states and the central governments was highlighted as a common governance challenge in developing smart cities (Kumar, Goel, and Mallick 2018). This results in the lack of clarity in the operational frameworks of smart cities, which are important, especially in the context of natural disaster and crisis management (Khan et al. 2020). More importantly, governments need to situate smart city projects openly and transparently within a legitimate city-wide urban planning that cut across economics and geography (Anand and Navío-Marco 2018).

Another major challenge for smart city development is the lack of capacity in risk management. Cybersecurity and data privacy are some of the most commonly discussed issues in smart city security (Bawany and Shamsi 2015; Baig et al. 2017; Braun et al. 2018; Lim and Taeihagh 2018). A huge amount of sensitive data are stored and processed in various urban smart systems, and they are often prone to security threats such as cyberattacks from hackers and intruders. These threats could potentially disrupt services and paralyse the entire system, resulting in economic losses, security threats, and diminishing public trust (Bawany and Shamsi 2015). Besides the ability to ensure data security at different stages from collection, processing, storing to dissemination, there is also a need to protect the data transmission and storage facilities (Baig et al., 2017; Lim and Taeihagh 2018). This capacity, known as forensic readiness, is perceived as important to preserve valuable forensic evidence which might be required for investigations into cyber-crimes in smart cities and is currently lacking in many urban systems (Baig et al., 2017).

Another macro policy challenge that is important in smart city development is the absence of a strong and supportive policy milieu to support smart city projects in some jurisdictions. For instance, Van Den Bergh and Viaene (2016), for instance, highlighted that many jurisdictions lack policy champions and a designated public agency or government department that is tasked to steer smart city projects. This issue is often compounded by the lack of institutional capacity and visionary leadership in the country.

Human intellectual capital is another major capacity challenge in smart city development. Smart city development would inevitably require a huge investment in highly skilled specialists and technical consultants, often lacking in developing countries (S. Tan and Taeihagh 2020). The lack of technical capacity to transform data into information for smart cities include various domains such as the ability to manage data quality and integrate different data, the ability to incorporate privacy-preserving functions into the data systems, the ability to understand the needs of various stakeholders, the ability to enhance geographic information delivery systems, and the ability to design smart city services (Lim, Kim, and Maglio 2018).

Additionally, the lack of digital inclusion, citizens' awareness and social acceptability are discussed as capacity challenges at the citizen level in smart city development (Anand and Navío-Marco 2018; Khan et al. 2020). While the lack of digital inclusion might stem from a structural failure to include all populations in the technology coverage to facilitate delivery of public services, it also refers to the lack of certain population's participation in the decision-making process for smart city development (Anand and Navío-Marco 2018). This is closely associated with the lack of awareness and/or social acceptability towards new and emerging technologies and access to these technologies (Khan et al. 2020).

1.4 Policy, knowledge and research gaps

Our literature review above reflects a threefold gap—policy, knowledge and research—in designing effective strategies to elevate policy capacity in smart city development. These gaps apply to both developed and developing countries. Specifically, there is a significant policy gap in systematising and institutionalising policy efforts to enhance implementation capacity at the government level. These efforts are important as smaller jurisdictions such as local governments often struggle to reap the benefits that smart city could offer when the baseline resources are scarce and when there is a lack of stewardship from the national government, as documented in some studies (McKinlay 2017; Khan et al. 2020). There is insufficient understanding of how countries could design and deploy strategies to enhance different levels and different types of policy capacity targeting different actors in smart city development. This knowledge gap brings forth the research gap, which is the lack of empirical studies that examine pragmatic strategies in smart city development that are efficient, scalable and deployable in most parts of the world.

1.5 Research question and objectives

Drawing insights from the policy capacity theoretical framework to address the policy and knowledge gaps in smart city capacity building, we posed the following research question: *how could effective strategies be designed to enhance the policy capacity to accelerate smart city development?* Essentially, we aim to dissect the key components entailing different dimensions of policy capacity (operational, analytical and political) in managing and developing smart cities at the policy level, as well as to identify pragmatic strategies to strengthen and build each dimension of these capacities at three different levels (individual, organisational and system).

The remainder of the paper is organised as follows. The next section explains the analytical framework of policy capacity by tracing the evolution and tracking the application of this theoretical concept. Section three explains the methodology applied in answering the research

question, including detailing the data collection and data analysis processes. The fourth section reports the findings. The fifth section discusses the association of the study's findings with the existing smart city development literature, highlights the potential of the policy capacity theoretical framework as a performance benchmarking tool to gauge policy readiness in smart city development, and shed light on other crucial and related areas for further inquiries in the future. The sixth and last section concludes and suggests future research directions.

2. Analytical Framework: Policy capacity in policy development

The academic interest to study policy capacity as an important ingredient in public policy and public administration had surfaced since the 1980s. Conceived under the framework of capacity building in an era when there was an increasing demand from international donor agencies to boost the sustainability of development in developing countries, policy capacity emphasises skills building and staff training to increase public organisational performances and impacts. In recent years, this concept has been applied to explain and analyse a wide range of government activities beyond the field of public administration. In health policy, the policy capacity of various actors in the government has shown to be one of the most critical ingredients in ensuring good coordination when instituting system-wide reforms in the health sector (Tan 2019).

One of the earliest definitions of policy capacity is coined by Painter and Pierre (2005). Defined as 'the ability to marshal the necessary resources to make intelligent collective choices and set strategic directions for allocating scarce resources to public ends' (p. 2), policy capacity interacts with administrative capacity and state capacity to form core components of governing capacity. There are, in particular, two different aspects of policy capacity – one that is focusing on the hardware of government which requires having optimal financial resources and the right

technical expertise in public policy making; and the other one that is building on the software of government which emphasises on creating accountability and trust from the citizens towards the state to maintain the currency of their political support.

Since then, several major publications have contributed to the conceptual development of policy capacity. In Wu, Ramesh, and Howlett (2015)'s framework, policy capacity encompasses three major competencies/skills required – operational, analytical and political, and capabilities/resources at three different levels – individual, organisational and system. Echoing Painter and Pierre (2005)'s definition, Peters (2015) conceived policy capacity as policy resources needed to administer good public administration. These policy resources include having both technical and situational expertise to manage tasks that come with different degrees of difficulties, ensuring that there is adequate implementation capacity of street-level bureaucrats, enabling learning and adaptation to take place within organisation, and maintaining equilibrium in navigating the relationships with their political masters as well as the citizens that they serve (Peters 2015).

3. Methods

The Delphi method was applied in this study to gather expert opinions on strategies that could be adopted and designed to enhance policy capacity in smart city development. Delphi method has the advantage of being efficient, timely, and able to elicit in-depth and high-quality responses from the experts (Franklin and Hart 2007; Brüggen and Willems 2009). In recent years, the smart city literature has seen a gradual increase in adopting the Delphi technique as a method of inquiry (Bailey 2012; Galo et al. 2014; Ivars-Baidal et al. 2019).

In this study, a qualitative e-Delphi method was employed. Following previously published studies employing a modified Delphi method qualitatively (Rikkonen, Tapio, and Rintamäki

2019; Fletcher and Marchildon 2014; Sekayi and Kennedy 2017), we gathered an expert panel of members with a wide range of professional backgrounds and expertise areas. The panel members include academics, civil servants, technocrats, and business/private actors from 13 countries. To execute the qualitative e-Delphi research, we used the e-Delphi.org platform and sent two rounds of semi-structured questionnaires to all expert panel members across three months (July–October 2020). We allocated a two-week timeline in each round of the survey and interspersed round one and round two with a six-week duration.

In the first round, we sent a semi-structured questionnaire comprising strategies that could enhance policy capacity in smart city development based on the existing knowledge gaps in the smart city policy development literature and anchored on the policy capacity theoretical framework. The questions were also refined through multiple rounds of discussion among all authors. We sent the first-round questionnaire on 21 July 2020. Of the 25 experts who agreed to participate, 23 experts (92%) completed the first round.

The second-round qualitative e-Delphi was sent on 23 September 2020 to the 23 experts who contributed to the first round. In the end, 15 experts (65% of the 23 experts that completed the first round) completed the second round. Based on the first round of qualitative e-Delphi and data analysis, a narrative summary was incorporated into the second-round qualitative e-Delphi, with areas where consensus was achieved and areas where opinions diverged being highlighted to the participants. The second-round e-Delphi was designed to allow participants to re-examine their earlier responses in the light of the collective responses from other experts analysed from the first-round e-Delphi. We analysed the data collected from both rounds of e-Delphi surveys by first identifying and extrapolating the preliminary emerging themes in our data through several rounds of reading through the participants' responses. These preliminary emerging themes were later delineated more precisely using the thematic analysis approach through line-by-line reading and coding (Nowell et al., 2017). Thereafter, the preliminary

emerging themes were strengthened by fusing closely related themes in their explanations and underlying meanings, removing themes unrelated to the overarching question, and differentiating them more distinctively from one another.

4. Findings: Strategies to enhance policy capacity in smart city development

4.1 Analytical capacity

From the relatively disproportionate qualitative responses, it appears that most participants opined that analytical capacity—centred on the development of technical skills, business acumen—is the foremost important capacity domain to be harnessed for smart city development. At the individual level, capacity building of knowledge and know-how can be acquired from networking opportunities to establish peer support and mentorships with the industry leaders. In addition, policy-makers require skills in lateral thinking, and it is important for the key leaders that drive smart city initiatives in the cities to possess interdisciplinary skills and knowledge. Training in design, research and intermediation practice for bureaucrats and private actors who drive smart city development is crucial. In addition, a smart city is essentially about producing 'smart citizens' who are adept at technology to reap the benefits from smart city development.

It is important to establish formal and informal associations with field practitioners and universities to promote seamless knowledge and innovation transfer among different entities at the organisational level. One direct approach to achieving this aim is to engage or hire researchers from universities/think-tanks or engage private consultants. It is opined that public agencies should harbour strong research and development orientations in their organisational structures. Organisations should also build analytical capacity by investing in their employees and supporting knowledge sharing and training of their employees. The training of local and

national government leaders should include exposing them to the socio-technical benefits, risks and unintended consequences of smart city development. There should be mandates for government officials and city planners to attend these seminars and produce simulation plans as deliverables from their training exposures. More courses at the undergraduate and graduate levels that are interdisciplinary can be designed for the students to broaden their skill sets and knowledge base at the university level. Private companies should also increase employees' exposures through broader business sector deployment of solutions as a strategy to enhance analytical capacity at the organisational level. The training needs described above would warrant more investment in the analytical capacity at the organisational level.

At the system level, the government plays a central role to create a nurturing and supportive ecosystem to drive smart city innovations in the city. For instance, research funding should be systematically and progressively established and increased gradually to monitor and evaluate various smart city initiatives. The government should also inject the right market incentives to encourage private corporations to invest in analytical capacity-building efforts. Furthermore, cities should learn best practices, acknowledge failed initiatives, derive practical lessons from them, and examine the political dynamics favourable to smart city development from the existing case studies.

4.2 Operational capacity

The development of operational capacity, which hinges on paying detailed attention to the implementation structures and policy processes, is another crucial component of policy capacity. At the individual level, being fluid and agile in managing the operational demands is deemed important, whether it is for government officials, entrepreneurs or employees of private companies. At the organisational level, seamless and effective horizontal coordination across a city's public agencies is important to leverage the respective agencies' multidisciplinary skill

sets and development portfolios to bring about desirable outcomes for the citizens who are the main recipients of smart city development. Beyond this, national and international collaborations with multiple stakeholders to co-create smart city solutions are important to enhance operational capacity. Besides, public-private partnerships in smart city initiatives will give the needed implementation boost to improve operational capacity in smart city development.

Establishing a capacity-building programme using a whole-of-government approach, which includes bringing different parts of the ecosystem together, is an important strategy to develop operational capacity at the system level. Besides, smart city agendas would require various testbeds and human interfaces in their operations so that many levels and different types of stakeholders, which include non-tech stakeholders and street-level bureaucrats have the opportunities to engage with the operations of different smart city agendas.

4.3 Political capacity

Political capacity is another important domain of policy capacity building in smart city development. At the individual level, public participation can be leveraged to influence a city's performance by pushing the government to focus on using the right digital tools to improve citizens' lives. For instance, including the improvement of public services in the citizen scorecards and evaluations of the city government's performance can be an effective strategy to hold city governments accountable in smart city planning and budget development. Besides, a citizen forum can also be established to build collaborative partnerships and consultative relations between the government and citizens to ensure that smart city's planning and development are on the right track.

At the organisational level, both public institutions and private entities such as civil society organisations and advocacy groups play crucial roles in ensuring that policy changes and

reforms align with the broader visions of smart city development. Hence, they should be able to keep the city governments on their toes and ensure that smart city development is socially inclusive, environmentally friendly, and financially sustainable.

A top-down approach is needed at the system level to push for cutting-edge innovations in smart city development. This strategy often requires leadership through a policy entrepreneur who could command public attention and political influence in the ecosystem through acumen and charisma. A policy entrepreneur should possess the ability to steer smart city development in overcoming the initial hurdle of innovation adoption and paving the way to implementing pilot programmes to test whether innovation can be sensibly adopted. In addition, having a collaborative spirit among all relevant stakeholders in the region, whether they are governments or private entities, is also an important strategy to harness political capacity to drive rapid smart city development in the region.

5. Discussion

This study demonstrates a set of strategies that the governments could employ to enhance policy capacity that is replicable and deployable in both developed and developed countries in smart city development across three different domains and at three different levels. Our findings revealed a disproportionate emphasis on analytical capacity as opposed to operational capacity and political capacity among the participants. Skill development through training and exposure to various new and emerging technologies and platforms is particularly important in capacity-building. This would allow smart cities to live up to their full potentials in benefiting all segments of the populations. Indeed, analytical capacity, which relates very much to the technical aspects, is the precursor to smart city development, akin to the fuel that is indispensable to ignite the combustion to fire up the engine. The importance of analytical or

technical capacity in public policy has been advanced and described in the literature (Howlett 2009; Saguin, Tan, and Goyal 2018; Howlett 2015).

In efforts to assess and benchmark smart cities such as European Smart Cities Ranking (ESCR) (Giffinger et al. 2007), CITYkeys (Bosch et al. 2017), Smart Cities Index (IMD 2020), and IESE Cities in Motion Index (Berrone and Ricart 2020), analytical or technical capacity is also a crucial consideration. Analytical or technical capacity is described through indicators including internet access and speed (Giffinger et al. 2007; Bosch et al. 2017), 3G coverage and mobile phone penetration ratio (Berrone and Ricart 2020), cybersecurity and data privacy (Bosch et al. 2017), ease of starting a business (Berrone and Ricart 2020), e-government services like processing identification documents online (IMD 2020), and public expenditures on education and number of universities and research centres (Berrone and Ricart 2020). Cities such as Singapore, Hong Kong, New York, and Zurich rank high regarding the analytical or technical dimension (IMD 2020). Existing smart city assessment systems contain dimensions associated with the capacity building but have not yet systematically benchmark all aspects of smart cities' policy capacity (i.e., analytical, operational, political), with more emphasis on analytical or technical capacity than the others.

Our findings contribute to the theory building of policy capacity, specifically in depicting tangible strategies to deploy and implement in the context of smart city development. While policy capacity has been researched extensively in public policy, public administration, and public management literature, much of the focus has been on delivering conventional public services. This study adds to a plethora of empirical studies by highlighting a knowledge gap and crafting an opportunity for a new area of research for policy-making in smart cities. This entail detailing how could policy capacity be harnessed for smart city policies, who are the actors involved and who are the beneficiaries in capacity-building for smart cities, and how could policy capacity be evaluated and accessed most objectively.

Understanding the above helps to pave the way to interesting and relevant future research agendas. The study of policy capacity in a smart city can be advanced in a more objective and quantifiable manner by establishing a unified performance benchmarking system for capacity in smart city development at the regional level. This benchmarking system can be piloted by gathering expert opinions to achieve consensus on a set of performance indicators that could comprehensively and holistically capture all developmental aspects of smart city development. Besides, smart cities in developing countries could benefit more from case studies from other jurisdictions to determine the reform strategies deployed by these jurisdictions to draw useful policy lessons and overcome similar policy challenges.

6. Conclusion

This study fills a significant literature gap in policy-making for smart city development by understanding pragmatic actions that could be undertaken to design strategies to enhance smart city development. This is an important endeavour for developed and developing countries as smart cities continue to flourish worldwide. In the context of developing countries, many are keen to ride on the bandwagon of smart city development to accelerate socio-economic development and tackle a wide range of urban challenges. The Covid-19 pandemic, which started in November 2019 and continues to be a considerable challenge to the world now further raises the roles of smart cities in pandemic response and crisis management. Studies have shown that the ability to leverage technology swiftly as well as having sufficient policy capacity to effectively exert command and control to enforce social distancing measures to preserve health system capacity has enabled some countries to control the Covid-19 pandemic relatively better, evidenced by the lower number of infections and fatality rates in these countries (Woo 2020; Kavanagh and Singh 2020). Understanding the importance, roles and

means to enhance policy capacity has become important as never before. Future studies should continue to embark on this theory-building effort to enable governments to raise smart cities' capacities to resolve longstanding policy challenges and be better prepared for emergencies and crises.

Acknowledgement

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