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## The Role of Intermediaries in Smart City Development – A Tale in National Innovation of One Country Two Systems

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# **The Role of Intermediaries in Smart City Development – A Tale in National Innovation of One Country Two Systems**

*Emergent Research Forum (ERF)*

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## **Abstract**

This study contributes to the extant body of knowledge on smart cities and Information and Communication Technologies (ICTs) for sustainable development. There still exists a research gap on how ICT enables sustainability initiatives, national innovation, industrial diversification, and smart cities development. We conduct an empirical investigation on national innovation initiatives and public-private partnerships in Macau, a special administrative region characterizing a high degree of local governance and institutional autonomy separate from the institutions of mainland China. The research-in-progress paper presents a framework within which the public and private organizations negotiate policies that influence the innovation process. Our study reveals the development of national research labs and tech entrepreneurship incubators. Our ongoing analysis not only uncovers the intermediary role of industry associations that facilitate knowledge sharing and innovation capacity building, they perform some functions of governance, to socialize, mobilize and share resources where existing government capacities are constrained.

## **Keywords**

Smart city, intermediaries, national innovation, case study.

## **Introduction**

Significant human impact on the environment has prompted nations and their governments to promote sustainable production, management and consumption of resources amongst their cities and communities (United Nations 2019). Extant literature suggests that ICT can play an important role in national sustainability initiatives (Brocke et al. 2012). Scholars establish that ICT can enable community development, whereby community members take collective action and generate innovative solutions to common problems, such as the sustainability of their cities and communities (Granier and Kudo 2016). More recently, governments and researchers highlight smart cities as major engines for deploying ICT and intelligent systems in order to enhance urban development (Estevez et al. 2016).

Notwithstanding the contributions of prior research, there is still a dearth of empirical studies on the role of ICT in enabling the development of sustainable cities (Brocke et al. 2012). The costs of using ICT in

sustainability initiatives has been rapidly rising (Buscher and Doody 2013). In response, governments are increasingly using private sector involvement to develop and finance the delivery of public service and infrastructure projects, aimed at improving the quality of citizens' lives (Lee et al. 2014). However, collaboration between constituents amid uncertainty of governance, processes or resources demands scrutiny of different strategies of coordination and failure to do so creates barriers to sustained cooperation.

This study attempts to contribute to an emergent body of research examining the use of ICT in developing sustainable cities and communities. We conduct a case study on the Macau smart city project, a public-private partnership with that includes the development of an integrated public services system, enhanced tourism services and the development of its transportation network. The government is seeking economic diversification, to develop a broad-based economy beyond gaming and strengthen the city's governance, hence pursuing a "smart" city strategy. On the other hand, Macau follows a different governance system than mainland China. We seek to address the research question "how does ICT and intermediaries enable smart city and sustainable development?" In order to address this question, our investigation centers on how ICT enables public-private partnerships, and the role of intermediaries in driving initiatives for sustainable development in Macau and facilitate collaborations between Macau and mainland China.

## **Background**

### ***An ICT-Driven Approach to Sustainability***

Technology-driven cities provide open and user-driven ecosystems (Chan 2013). ICT exists within a social and cultural context, and as such the institutionalization of ICT within community practices is critical. The role of communities in enacting technology-driven sustainability initiatives and change is particularly important, as like-minded groups, organizations and governing institutions must seek to work in partnership to use ICT to transform their circumstances in significant ways (Granier and Kudo 2016). Successfully operational community-based ICT requires high levels of commitment from the various stakeholders. Creating ICT using principles of participatory design bridge social networks, reinforce of existing networks within the community, improve information flows between community members and local institutions, and bring positive impact to community actors who hold leadership and unifying potential for various institutions, regions or economies (Srinivasan and Shilton 2006).

### ***A Capabilities-based and Interdependencies lens to National Innovation***

Successful economic development is intimately linked to a country's capacity to acquire, absorb, disseminate, and apply modern technologies, a capacity embodied in a country's innovation system (Metcalf and Ramlogan 2008). Also, building innovation capacities for national development is about increasing and deepening specific capabilities to explore new opportunities offered (Pietrobelli and Rabellotti 2011). Recently, scholars indicate that capabilities-based theories have significant implications for policy research such that business enterprises lie at the core of ecosystems that drive economic development and growth in market economies (Teece 2017). From a resource-based view, capabilities are the link in the process of coordinate, redeploy and leverage resources for innovation. Capabilities are rooted in processes and routines that are not necessarily built on a technological foundation. Without capabilities, there is an oversight of business conduct and entrepreneurial role for management in the economic system, leaving policy makers with poor regulatory and governance frameworks (Teece 2017).

On the other hand, collaboration between constituents in an economy and its inherent ecosystems is not a simple 'cooperate or not' decision and demands scrutiny of different strategies of coordination (Yoo 2013). The development and coordination of the interdependencies between organizations can potentially alleviate conflict, which is considered a typical barrier to sustained cooperation. Studies of interdependence focus not only on the allocation and distribution of critical resources (Comeau and Griffith 2005) but also examine how organisations acquire resources to reduce uncertainty and interdependence to complete tasks. In this study, we focus on intermediary institutions for resources and participation necessary for national innovation, such that they stimulate interdependent and sustainable practices across a city. We adopt the view that intermediaries operate to aggregate demand or supply, reduce operating costs, match transacting parties, and provide a trusted digital infrastructure among collaborating sides (Linders 2012). In sum the theoretical notions of resource interdependencies and dynamic capabilities are foundational to this study.

## Research Method

Given the exploratory nature of our research to investigate smart city development processes and frameworks that are emerging and not well understood, a case study methodology is particularly appropriate (Siggelkow 2007). In addition, we adopt a qualitative approach and an interpretive stance. The case study selected must allow us to better understand the relationship between ICT, public-private partnerships and the emergent role of intermediaries towards innovation and sustainable development. Furthermore, the case must present different strategies of coordination between multiple constituents where there is uncertainty of governance in systems, processes or resources, per our study motivation. For the above reasons, we study the smart city development project of Macau. It is important to note that Macau is a special administration regions (SAR) of China and a former colony handed over to China following the end of the colonial rule of Portugal (in 1999). China's governance approach guarantees Macau a relatively high degree of local governance and institutional autonomy separate from the institutions of mainland China (hence two systems within one country). Preliminary data collection was conducted from two main sources: 1) interviews with key stakeholders of key firms and public services through field work in Macau; and 2) online documents pertaining to the smart city development. A sample of the 17 preliminary interviews conducted to date including stakeholders, their job titles and acronyms, description of interviews can be found in the Table 1 below (a full list of interviewees is available on request from the authors).

Interviewee No	Title and Organization	Topics Discussed
1	Senior IT Manager, Mandarin Oriental Group	hotel IT; smart city; Macau as a tourism destination; sustainability; talent training
3	Director of Macau Pass	relations with mainland big players; GBA impact and potential; regulation lagging innovation
5	Director, Science and Technology Development Fund (FDCT)	government funding agency for R&D; smart city progress; funding priorities
9	Development Officer, Macau Youth Entrepreneurship Incubation Center	gov startup incubator; entrepreneurship policy; smart city; GBA; talent issue; regulations
12	Executive Director, Smart City Alliance Association of Macau	smart city progress; industry associations; college and pre-college education
15	Chairman, E-commerce Association of Macau	e-commerce; tech associations; government-industry interactions in regulation negotiation

**Table 1: Sample List of Interviewees**

We are performing data analysis concurrently with data collection to compare the initial findings of the case against the initial statements and our lens. Sifting through the interview data, theoretical perspectives and literature, we discover patterns and develop mappings of the coded responses, to build an explanation on national innovation and ICT driven sustainable development in a one country two systems context. We performed open, axial and selective coding (Strauss and Corbin 1990) to reduce the data to manageable categories and to identify recurring themes. We present preliminary findings and future work below.

## Preliminary Findings, Future Work and Research Implications

A former Portuguese colony and now special administration region (SAR) of China, Macau is a densely populated city, with over 672,000 residents on 32.8 square meters of land. Following its handover to China in 1999, the city enjoyed rapid growth with GDP per capita growth rate at 12% annually, one of the highest in the world. Yet the economic boom was propelled by the structural change towards a gaming-dominated economy at the expense of other sectors: the gaming sector expand rapidly under the influx of foreign investments and mainland Chinese visitors to the only city operating casinos legally in China. According to the director of Smart City Alliance Association of Macau, the economic boom may not be beneficial to all sectors, adding: *“Macau is a high-income city with no industry, where can we develop the products?”*

Meanwhile, traditional industrial sectors had rapid contractions, and the city's public resources is under increasing strain from heightened tourist numbers, leading to rising fear about the sustainability of Macau's economy and the effects on the residents' quality of life. Interviewees expressed similar sentiments on the importance of diversification and pursuing long-term sustainability through its smart city strategy. According to the Manager of Mandarin Oriental Group,

*“Technology may be underdeveloped in the public sector, but certainly very developed in the casinos. Building a smart city allows Macau to enhance its strength as a world-class travel destination ...government has been diversifying offerings beyond gaming, such as arts and sustainability”*

### **Diversification through ICT driven entrepreneurship**

Preliminary analysis reveals that the development of highly skilled workforce is foundational to the digital transformation of firms and the growth of new technology firms. Ongoing analysis seeks to examine policies to develop the workforce for transformation According to the manager of Macau Youth Entrepreneurship Incubation Center, a government-funded startup incubator, monetizing innovative ideas is beneficial:

*“entrepreneurship in Macau can address the problem of heavily relying on the casinos and gaming concessionaires and diversify the economy”*

On the other hand, the supply of available local tech talents in Macau is already limited, given Macau’s small size. Managers of the Macau Youth Entrepreneurship Incubation Center explains:

*“Unemployment rate is extremely low even compared to around the world, and the income level is pretty high. Therefore, it’s very hard for some of the technology companies as they look for employees here, so they would have a subsidiary out of mainland China or even the other areas.”*

Macau is part of China’s new national development strategy to deepen the economic and social integration in the Guangdong-Hong Kong-Macau Greater Bay Area (GBA). For Macau, the GBA regional development creates both additional demand and resources (policy support, financial incentives, etc.) for developing and deploying smart city solutions, the director of Macau Pass explains about a unique advantage:

*“part of the GBA initiative is to make sure there’s a free flow of people easily going in and out (of these cities), with that there will be free flow of trade and commerce and also finance...if we have cross border payment, maybe we can leverage on the better tax initiatives in Macau. Macau is cosmopolitan, if they (Chinese firms) set up business here, they have international exposure.”*

Ongoing analysis will examine how Macau’s smart city development fit into the GBA, including cross-border, institutionalized interactions between stakeholders in smart city projects across regional cities. We will examine how Macau can benefit from diversification and also the GBA regional development in technology industry development, and issues of greater regional connectivity which may also lead to outflow of other critical resources such as tech talents and exacerbate the problems of skill shortage.

### **The Intermediary Role of Emergent Associations**

Our analysis reveals that public participation models are vital to deployment of smart initiatives. Macau’s model of “association society” (Chairman, E-commerce Association of Macau) is highly unique, where the city’s ethnic Chinese residents formed thousands of active associations to socialize, mobilize, share resources, and solve disputes, essentially performing some functions of governance. And the leaders of associations served as mediators between the colonial administration and the public. As a result, over “90% of residents in Macau today are members of some associations” according to General Manager, Macao Envision Accelerator. According to interviewees, professional associations as a core fabric of the Macanese society have continued to serve as important avenues of communication in Macau’s smart city development. For instance, the Smart City Alliance Association of Macau (SCAAM), the E-Commerce Association of Macau (ECAM), and the Macau Commerce Society, organizes meetings and education seminars, host public events, engage the government in policy formulation, and interact with other associations. This allows the government to better respond to the concerns of professional members, and through them, the wider community. The director of Smart City Alliance Association of Macau explains:

*“Government cannot do everything...Government needs to focus on what kind of tech the local firms can develop, then make the infrastructure ready. And because the public knowledge about the programs is limited, open and effective engagement with the general public, in addition to the communication with professional association groups for smart city development is important.”*

Our analysis suggests that better communication between the government, associations, Chinese firms like Alibaba, and the local industry groups and startups is beneficial. The director of Macau Pass explains:

“we work with a lot of (mainland Chinese) technology companies to bring in that (their technology) straight into Macau. But we still need our tech team here to integrate and to localize...we’d perform a lot of localization to the technology, to the user interface, to the UX, UI, so that local audience will be more welcoming to new products because the Chinese way of Internet use is so different to the West.”

This study has both theoretical and practical implications. Future work includes further theoretical treatment and scrutiny on cross-border partnerships, strategies of workforce development for digital transformation, how legislative response can support new industry development and local innovation capacity, and the development of a regulatory environment to govern the digitized industries. This study and ongoing research efforts will reveal important lessons on how ICT enables public-private partnerships, and the role of intermediaries in driving initiatives for sustainable development. For research, it will uncover important insights into resource and capabilities-based theories in ICT for development research. This research has practical implications on how governments, intermediaries and industry associations, businesses and citizens collaborate towards national innovation and its smart city development objectives.

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