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Regional Development based on Smart City and Innovation policy in Egypt

DOCTORAL DISSERTATION

(Summary)

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Abstract

In this doctoral dissertation, the researcher analyzes and assesses smart city policies and regional innovation in Egyptian governorates. The main purpose of the dissertation is to provide a comprehensive analysis of the proposed smart city policy, its components, and the characteristics of the Egyptian governorates. Furthermore, it seeks to determine if it is possible to adopt efficiently innovation policies such as the smart cities concept developed by advanced economies to developing countries like Egypt in order to ease regional differences.

Based on the experiences and models of developing countries, I examine the theoretical basis and conceptual framework of regional innovation policies and smart cities. In addition, the Egyptian context is discussed in depth with regard to the factors, components, and features of the proposed regional innovation policy, smart city programs, and a case study analysis of the pioneering model of Egyptian smart city policy. For determining the regional readiness to implement smart city policies, a narrative analysis of smart city policy in Egypt and a model of knowledge production and innovation for Egyptian governorates are also provided. As part of the proposal, a policy framework for effective implementation is also included.

In two stages, the research involved (1) the presentation of the conceptual framework and synthesis of the literature, and (2) narrative and empirical analysis (quantitatively: an analysis of the spatial autocorrelation of knowledge and innovation, and modeling regional innovation and readiness levels, as well as qualitatively: narrative analysis and interviews). According to the results, the smart city policy has different applicability in Egyptian contexts. A policy based on innovation and smart cities can be implemented with different degrees of readiness within the Egyptian governorates.

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1. Introduction

1.1 Research background

Regional development policy in the recent decades has emphasized endogenous factors and spatial uniqueness components (Arsmstrong & Taylor, 2000; Schultz, 1990). As a result of this uniqueness, there are differences between the regions, which in turn produce differences within the region's trajectory itself, because each type of regions has its own unique goals which are based on the nature and issues specific to that region. In most endogenous growth models, production is based on technology and innovation, unskilled and skilled labor, physical capital, as well as infrastructure and public services (Edwards, 2007, pp. 215–216). Consequently, **technological and knowledge progress within the regions is one of the internal factors and components that contribute to achieving regional goals**. These considerations prompted a shift in thinking from a typical trade-off between efficiency and equity (McCrone, 1969; Monnesland, 1994; Nicol & Yuill, 1982) to pursuing both simultaneously and in succession (Amin & Tomaney, 1995; Bachtler & Yuill, 2001; Morgan, 1997; Raines, 2001; Taylor et al., 2000). Economic growth literature has extensively studied the relationship between technological and knowledge progress and regional development, paying particular attention to **the conditions that encourage technological development** (such as the entrepreneurship ecosystem, incubator facilities, venture capital availability, etc.) (Nijkamp & Abreu, 2009). In the literature, it has been mentioned that urban areas, cities are examples of places where conditions are conducive to technological development (Matheri et al., 2019; Smith et al., 2019; Caragliu & del Bo, 2020).

There have always been issues and obstacles in cities. These issues are typically caused by unfavorable change in population, or more accurately, an environment that is unable to adjust to these changes (Anas, 1992; García-Ayllón, 2016; Rieniets, 2009; Wiechmann & Bontje, 2015). When the urban population declines, as a result of, for example, the strong absorption power of more competitive cities (Douglass, 2000; Heng, 2012) or due to historical events (wars) (Glaeser & Shapiro, 2002; Rieniets, 2009), the city is often forced into a prolonged economic stagnation, which can then lead to the vicious circle of backwardness and, rarely, to the disappearance of the city (ghost towns) (Rieniets, 2009). Alternatively, many cities in most developing countries are facing serious challenges due to their inability to cope with continuous population growth (García-Ayllón, 2016) and

its consequences (eg. pollution, traffic congestion, shortages of housing, rising prices for real estate, and poor living conditions).

Urban development policies aimed to provide solutions to the above-mentioned complex problems of cities which vary in economic, social, architectural, and environmental terms. Urban development policy describes a set of administrative measures at various levels of government that are primarily target cities (van den Ber et al., 2004). Urban policies can theoretically be implemented at all levels of government; nevertheless, policies at the *"*national" upper administrative levels are not specialized for cities yet have a substantial influence on them. In other words, *"urban policy*" is a policy that is designed specifically for cities and can be formulated locally by local governments. In contrast, *"urban development policy"* is a set of policies that aren't directly related to cities, but are somewhat *"*urban*"* in their impact on cities, they are formulated by national governments. The distinction between an *"*implicit" urban development policy and an *"*explicit" urban policy is therefore important. The first involves formulating an urban policy that incorporates housing, transportation, infrastructure, economics, spatial planning, and environmental policies (van den Ber et al., 2004). Because of this, urban development policy is in most cases not spatially targeted, unlike clear urban policy, which deals more effectively with the complex problems of cities.

The growing need for digital infrastructure, innovation, knowledge, and education in the workforce has created a new trend in urban development policy known as the concept of smart cities. This new policy concept was first developed on the basis of this demand and large-scale technological changes in the context of the 4th Industrial Revolution (Matheri et al., 2019).

Smart city initiatives have been implemented in multiple places in the past two decades. The new concept builds strongly on technological development, community involvement, land-use planning and other methods to achieve the goal of urban development policy (Smith et al., 2019). Smart cities have acquired a lot of traction in the last two decades, despite their brief history, with several countries undertaking urban development plans under this framework. During the last several years, scientific production in the field of smart cities has gained tremendous academic and policy success. Information and communications technologies (ICTs) are ubiquitous in today's cities, and their use by city residents in collecting, sharing, and using data acquired by sensors has prompted research across multiple disciplines (Caragliu & del Bo, 2020). It is said that the first urban big data project

was created in Los Angeles in the 1970s: “A Cluster Analysis of Los Angeles”. Amsterdam may have been the first smart city with the implementation of a virtual digital city in 1994. During the mid-2000s, IBM and Cisco launched separate initiatives that caused things to speed up. Barcelona hosted the first Smart City Expo World Congress in 2011, which has since become an annual event charting the development of smart cities (Verdict, 2020).

Smart city concept is a controversial hot topic in the field of regional development policy despite its popularity among policymakers. There is no general definition of the concept. The concept can be understood in many ways, including the utilization of digital solutions (e.g., urban transport, energy supply) and efficiencies obtained from digitalization (digital public services), which all contribute to the economic productivity (GDP), quality of life, and overall well-being of the city. Smart cities or urban intelligence - as a new contemporary concept of innovation policy based on knowledge and innovation clusters, smart economy, and knowledge economies - **promises that even conflicting regional development goals can be achieved simultaneously and not in a tradeoff way** (Errichiello & Marasco, 2014; Schaffers et al., 2012). Smart cities is a concept of innovation policy aimed at structuring knowledge, information, and communication systems (Anthopoulos, 2017; Kraus et al., 2015; Oktaria et al., 2017; Schaffers et al., 2012).

In the last decade, smart cities concept spread from developed countries to developing countries have started a series of smart city initiatives in the past few years (e.g. China, India, Vietnam, etc.). It first appeared in China in 2013 and India in 2015 (Atha et al., 2020; Bholey, 2016; Vu & Hartley, 2018). To address congestion and urban development challenges, India has initiated the Building 100 Smart Cities program. It took the method of establishing new smart cities while changing current cities into cities that use urban intelligence as a spatial development strategy for smart cities (Bholey, 2016). In 2020, nearly $28 billion has been allocated to the smart city policy (IBEF, 2021). At the same time, China has built an expansive smart city program, with more than 800 pilot projects either in operation or planned, representing more than half of all smart cities worldwide (Atha et al., 2020). Combined with big data processing and artificial intelligence (AI) analysis, China is becoming a world supporter in smart city initiatives, integrating embedded sensors, gauges, cameras, and other monitoring technologies for better management of its cities and public spaces (Atha et al., 2020). China is aiming to improve information security and enhance digital services through the use of these programs (Yao et al., 2020). China's smart city programs are primarily based on government investments, with estimates of the volume of

investments in the smart city solutions market amounting to about $1.1 trillion in 2018 and a predicted compound annual growth rate of 33% through 2022 (Atha et al., 2020, p. 24). Despite the popularity of smart city programs and initiatives in China, studies have highlighted that the presence of many empty "ghost towns" raises questions about the appropriateness of development goals, and whether smart cities will be able to attract enough people to become socially sustainable cities in the future (Angelidou, 2014).

Egypt, as a developing country, also announced its ambitious smart cities initiative. These initiatives were announced by the Egyptian government in 2015 for the New Administrative Capital in the east of the Cairo region, New Alamein City in the north of Egypt, and more than 12 other cities across Egypt. Citizens, governments, and other stakeholders are all involved in shaping this policy (Konbr, 2019a). Four main objectives have been outlined for the development of these cities: first, to create new urban and cultural centers capable of achieving social stability and economic prosperity, and second, to redistribute the population away from the narrow scope of the Nile Valley. Third, the creation of new attractions beyond the existing cities and villages; and fourth, the creation of new urban centers, including financial and commercial centers, urban intelligence centers, institutions of knowledge and innovation, and the proposed fourth generation universities within those cities. It is estimated that the budget for the construction of facilities, roads, and infrastructure in these cities is approximately 57 billion Egyptian pounds (about 5 billion dollars) (Abbas, 2021). Egypt now has a promising smart city initiative, **but will it succeed? Will the smart city initiative help Egypt achieve the Strategy 2030 goals of regional competitiveness and convergence?** Throughout Egypt's development strategy, called the National Sustainable Development Strategy, or "Egypt Strategy 2030," the country has defined all of its pillars, initiatives, and development goals by 2030 (Ministry of Planning and Administrative Reform, 2014). Based on the strategy, to meet major challenges (population growth, balanced regional developmen, etc), a smart city concept has been adopted by the Egyptian government. In theory, there are currently two regions (Cairo and Alexandria) implementing smart city concepts, featuring fourth-generation universities, research centers, and technology industries. According to the concept, smart cities attract knowledge, innovation, and high-growth job opportunities to bringing about development booms in the regions of these cities (Matern et al., 2020). What is the likelihood of this happening in Egypt, or to put is simply: *How likely is it that Egypt will be able to support balanced regional development based on a smart city concept that supports innovation and*

growth based on technology and knowledge? I address these issues in the following sections through a review of the theoretical background, the results of a case study, and the findings of the empirical section to evaluate the ability and readiness of the Egyptian regions to achieve regional development through smart cities and innovation policies.

1.2 Motivation and research relevance

My dissertation is relevant, as it provides a clear answer about how innovation policies such as smart city policies developed in advanced economies can be effectively adapted to developing economies, such as Egypt, to enhance regional development. The adoption of smart cities as a policy for urban development in Egypt has been accompanied by many differing opinions about the policy's feasibility, since it was introduced in 2015. As the implementation of the smart city policy in Egypt has begun and its first phase is almost completed, the NAC will be able to accommodate 5 million people, and US$45 billion has been spent on construction, opinions between supporters and opponents of the programme has remain divided. During an interview with a newspaper in September-2021, Tarabieh, associate professor at American University in Cairo (AUC), said that the current activity and trend are sound in terms of moving toward a greener Egyptian economy that is resilient and able to grow in spite of economic challenges. Nevertheless, he said that the provision of energy and water, as well as the delivery of water, raises questions about the extent to which appropriate technology is provided. In order to handle new challenges and integrate new technologies, he stressed how smart cities would operate and the degree of governance that would be utilized (Tarek, 2021). Elsaadany, a real estate analyst with the Egyptian Investment Bank, on the other hand, expresses reservations in the same interview about smart city plans focusing on high-income groups while disregarding the needs of upper-middle-class individuals (Tarek, 2021). Other experts mentioned that smart cities, in particular the NAC, are unique for their green architecture pioneer projects in Africa (Hutt, 2019). In other press articles, it was mentioned that there is uncertainty about how far the center of gravity will move from Cairo to the NAC located 45 kilometers away east of Cairo (El-Zobaidi, 2021). In a interview, planning expert Seif El-Din Farag said that Egypt definitely needs to build this type of city using the latest technologies to give more land for urban development in Egypt and that these cities will improve the quality of life for Egyptians (CGTN, 2018). In this sense, even the Egyptian media do not represent a unanimous opinion about the smart city initiative: **even though Egypt's monumental**

mega-project has already begun, there are still doubts about whether it will be able to accomplish the desired goals, whether it will succeed in its intended manner. Consequently, in my research, I **aim to identify the strengths, weaknesses, and concerns associated with the smart city program of Egypt in order to avoid potential pitfalls and contribute to its successful and successful implementation**. In the Egyptian context, my dissertation is unique in that it examines regional development using a smart city approach as an innovation policy.

As an Egyptian researcher, I was motivated to conduct this study because, to my knowledge, no study has examined in depth the effectiveness of state-supported innovation policies and smart cities **by examining whether or not the conditions for these smart city projects are available in the selected regions**. Studies have examined the concept and proposition of smart cities from different points of view, such as from the perspective of megaprojects (Hussein & Pollock, 2019), barriers to smart cities (Hamza, 2016), smart city architecture (Hassanein, 2017), and the Information and Communication Technology (ICT) aspect of smart cities (Konbr, 2019b). Due to this, my focus differs, therefore **I introduce the policy aspect of regional development, its dimensions, challenges, and present a political framework to ensure the achievement of development goals in a context where no prior study has examined this topic from a policy perspective, consequently my contribution can be valuable**.

As an urban and regional planner with an interest in regional development projects, I have noticed that in Egypt, the regional aspect is always viewed from an economic standpoint, while the smart city approach is always viewed from an urban standpoint, with no regard for the interaction between the two. In my dissertation, I have looked at both the economic (via regional innovation) and urban (as smart city policy is a sort of innovation) aspects, as well as the circumstances for smart city and innovation policies in the chosen areas.

My motivation for conducting this research turns out to be twofold: first, to fill a research gap, and second, to investigate a regional development policy based on smart cities and innovation in a systematic and integrated manner.

1.3 Research problem and research gap

Given the current importance of policies based on knowledge, innovation and sustainable development goals (United Nations, 2021), studies have shown that the application of these policies is more challenging in developing countries or emerging economies than in developed countries (OECD, 2004, p. 26). These countries have limited resources, development issues, and economic and social challenges. Many studies have dealt with smart cities and smart urbanization, especially recently in developing countries. Many developing countries in East Asia and the Middle East have adopted the smart city approach as a contemporary urban development policy to meet the challenges and issues of urban management in developing countries (Baldascino & Mosca, 2016; Fromhold-Eisebith & Eisebith, 2019; Joia & Kuhl, 2019; Pereira et al., 2018; Yadav et al., 2019). Hence, the research problem for the thesis is formed through ***is it possible to adapt efficiently innovation policies like the smart cities concept developed by advanced economies in developing countries like Egypt in order to promote regional development policy? Or is this kind of adaptation inappropriate in developing countries like Egypt, where the conditions are very different? In the case of Egypt, does this original smart city concept need to be adapted?***

There appears to be a research gap in Egypt where the state promote greatly several innovation, knowledge, and smart city programs and believe in its success/successful implementation, but **no thorough scientific investigation has been conducted in the Egyptian context to evaluate the experience by evaluating the ability of regions to implement smart city and innovation policies**. This is also in line with Caragliu, A., and Del Bo, C. (2020), who state that while smart cities have attracted the interest of numerous policymakers at all levels of government, and appropriate financing has been granted, the landscape of policy evaluation is very scarce. This study is unique in that it aims to fill a knowledge gap by examining and assessing the Egyptian smart city policy in order to create a set of policy suggestions for the future. Additionally, the study will shed light on the potential of applying the smart city approach to grow designated regions in Egypt so as to boost the nation's overall economic development, on the one hand, and to enhance regional convergence, on the other.

1.4 Research questions

In Egypt, the state has started implementing several projects and programs aimed at regional and urban development based on knowledge, innovation, and urban intelligence since 2014. The new innovation policy of Egypt is part of the *Egypt Strategy 2030* issued in 2014 by the Ministry of Planning and Administrative Reform. For achieving these goals of the new innovation policy, smart city projects, fourth-generation cities, and fourth-generation universities within the Egyptian governorates were launched. Smart urban communities are largely intended to support the rapid increase of existing cities' populations. Furthermore, this expansion has negative repercussions for current urbanization, such as raising population pressures in Cairo and producing environmental problems. These new urban communities hope to establish a more equal allocation of economic activity within Egyptian regions by supporting economic growth and strengthening regional convergence. On the other hand, due to these projects, the country seek to enter into the era of urban intelligence based on knowledge, technology, and the Internet of Things. The State also tends to establish knowledge and research cities and cooperation among the components of innovation systems in terms of industry, university, and the private sector. The above-mentioned national strategy aims to exploit opportunities within smart cities to create an environment for innovation and knowledge.

I intend to conduct an in-depth study of the implementation of smart city and innovation policies in the Egyptian context, with the aim of identifying the potential for regional development using smart city and innovation strategies. During my research for the topic, I focused mainly on the central question, which, of course, raised several sub-questions:

- *Is it possible to adapt efficiently innovation policies like the smart cities concept developed by advanced economies in developing countries like Egypt in order to enhance regional development?*

This question raised the following sub-questions:

  - RQ1: How does innovation (policy) support regional development?
  - RQ2: Can smart city policy be applied in general to any developing country?
  - RQ3: Are there any preconditions that need to be met before Egyptian governorates can adopt the smart city concept?

- *RQ4*: *Which Egyptian governorates have the conditions to adopt the political concept of the smart city?*
- RQ5: *Which Egyptian governorates's RIS is the readiest for the implementation of the SC concept*?

Table 1 shows which chapters in the dissertation provide answers to the research questions, and what kind of methods were used (see Table 1).

Table 1 The research methods used for answering the RQs in the research sub-chapters

RQs	***Research methods***	***Sub chapter***
RQ1	Systematic Literature Review (SLR)	2.2
RQ2	Systematic Literature Review (SLR)	2.3, 2.4
RQ3	Narrative analysis, Case study, Interviews	3.2, 3.3, 3.4
RQ4	Case study, Interviews	3.3, 3.4
RQ5	Narrative analysis, Case study, Interviews	4.3, 4.4

1.5 Structure and methodology

In terms of the methodological framework, the thesis consists of theoretical sections (Chapter 2), analytical and empirical parts (Chapters 3, 4), and finally, policy proposals (Chapter 5) followed by the theses of the dissertation (Chapter 6) as shown in Figure 2. Regional innovation policies and smart city policy in developing countries will be described first to provide a theoretical basis and a conceptual framework for the subject. Then the empirical and analytical chapters are built on the theoretical part of the dissertation.

Chapter 2 consist of five sub-chapters. Sub-section 2.1 introduce the methodology of Systematic Literature Review (SLR), which is recently a very popular method in order to identify – in a transparent way – the most relevant papers of a given topic. A systematic literature review is used as a robust method for exploring relevant literature to provide that conceptual basis, theoretical framework, and experiences of policy practice in developing countries. It aims to identify, evaluate and synthesize the best available evidence. The systematic review is also characterized by specific research questions, a specific set of methodological features, and information that can be extracted in table forms to summarize the data. Therefore, this chapter adopts the methodological approach to explore the theoretical and conceptual framework and experiences of developing countries' innovation policies and smart city cases. The motive for adopting this approach is to identify and select all relevant sources relates to the particular research questions addressed. In Chapter 2, I

explore the theoretical background of regional innovation systems (RIS), innovation policy generally, and smart city concepts with a special focus on developing countries. Sub-section 2.2 offers a comprehensive summary of the theoretical background of the regional innovation system in three parts, which are: (1) role of innovation in regional economic theories; (2) the role of innovation policy to regional development; and why innovation has become important for regional development by illustrating traditional and contemporary policies; (3) innovation systems through the concept of regional innovation policy, its components, and measurement. In sub-chapter 2.3, I introduce smart cities as a novel concept in innovation policy. The concept of smart cities is discussed from the standpoint of innovation: definitions and components of smart cities concept are included and discussed, along with requirements, expectations and potential effects of smart city development. In the fourth sub-chapter (2.4), I offer a thorough investigation of the experiences of regional innovation systems and smart city policy implementations in several developing countries. Here I focused on the following questions: (1) What challenges have these countries faced when setting up their smart city development programmes? Was the original concept adapted to the circumstances in the regions? How they evaluate the efficiency of their achieved smart city programmes in term of regional development? Finally, the second chapter concludes with a set of conclusions and a summary of how innovation and smart cities contribute to regional development, in general and in developing countries (sub-chapter 2.5).

In Chapter 3, I describe the RIS of Egypt in general, its components, and its performance in the Egyptian case. In the second part, I describe the components, aims, and expectations for the Egyptian smart city concept. In order to do so, I give a comprehensive overview of the nature of the Egyptian context through the levels of regional development in Egypt and the characteristics of the state from a geographical, population, and economic development standpoint (Sub-chapter 3.2). After discovering the Egyptian features and regional characteristics in sub-chapter 3.3, I summarize the factors and tools of the Egyptian innovation system. Sub-sections of this chapter present both the development path, innovation indicators, and regional components at the national and regional level. This sub-chapter aims to present the Egyptian innovation system – both at the national and the regional level – by comparing it with other developing countries. In sub-chapter (3.4) I discuss the smart city policy concept in Egypt from the perspective of the components and factors that drives innovation. This sub-chapter outlines the framework of the Egyptian policy for smart

cities by presenting the proposed city projects their objectives and expectations. The NAC, which is the leading smart city initiative in Egypt, is discussed in this part as a case study (Sub-chapter 3.5). I present how the smart city model works, the driving development components and the framework model for the smart city in the Egyptian case. Finally, I evaluate the policy concept within the Egyptian framework in sub-chapter 3.6.

In chapter 3, I use a qualitative methodology to analyse the components and frameworks of Egyptian smart city policy. The first method is the *narrative analysis*, while the other method is the *case study analysis.* First, as a part of the narrative analysis, I describe and analyse policy documents and data provided by the relevant authorities and ministries related to the Egyptian regional innovation policy and smart city concept, as well as the strategic plans of the various authorities. Secondly, as part of the case study analysis, I conducted interviews with two Egyptian officials - one is the Technical Advisor to the Minister of Housing, Utilities and Urban Development, and the other is the Chief Technology Officer (CTO) at Administrative Capital for Urban Development Company - ACUD, in order to gain a deeper insight into the pioneering Egyptian smart city policy model. The purpose of these analyses is to offer a comprehensive picture of the policy framework because it is not clearly specified by one administrative government entity. Consequently, I collected policy papers and data from multiple ministries in the form of national strategies, urban development plans, and project proposals to help answer the raised question. In order to understand policymakers' perspectives of smart city model, I conducted a "*semi-constructed interview*". I use this method in order to develop an inductive and descriptive picture of smart city policy in the Egyptian context, but not to identify stakeholders' reactions to the beneficiaries of the policy. Because of this, I sought out as much information and data as possible from government officials and policymakers. By utilizing the above-mentioned methods, I was able to gain a comprehensive understanding of smart city concepts, from policymakers' views to experts' opinions, expectations, and concerns. Nevertheless, there is a question that still arises*: do the regional innovation system work effectively in Egypt in order to achive the main objective of the smart city proposal?* Hence, I have an incentive to conduct an empirical analysis at the regional level to answer this question.

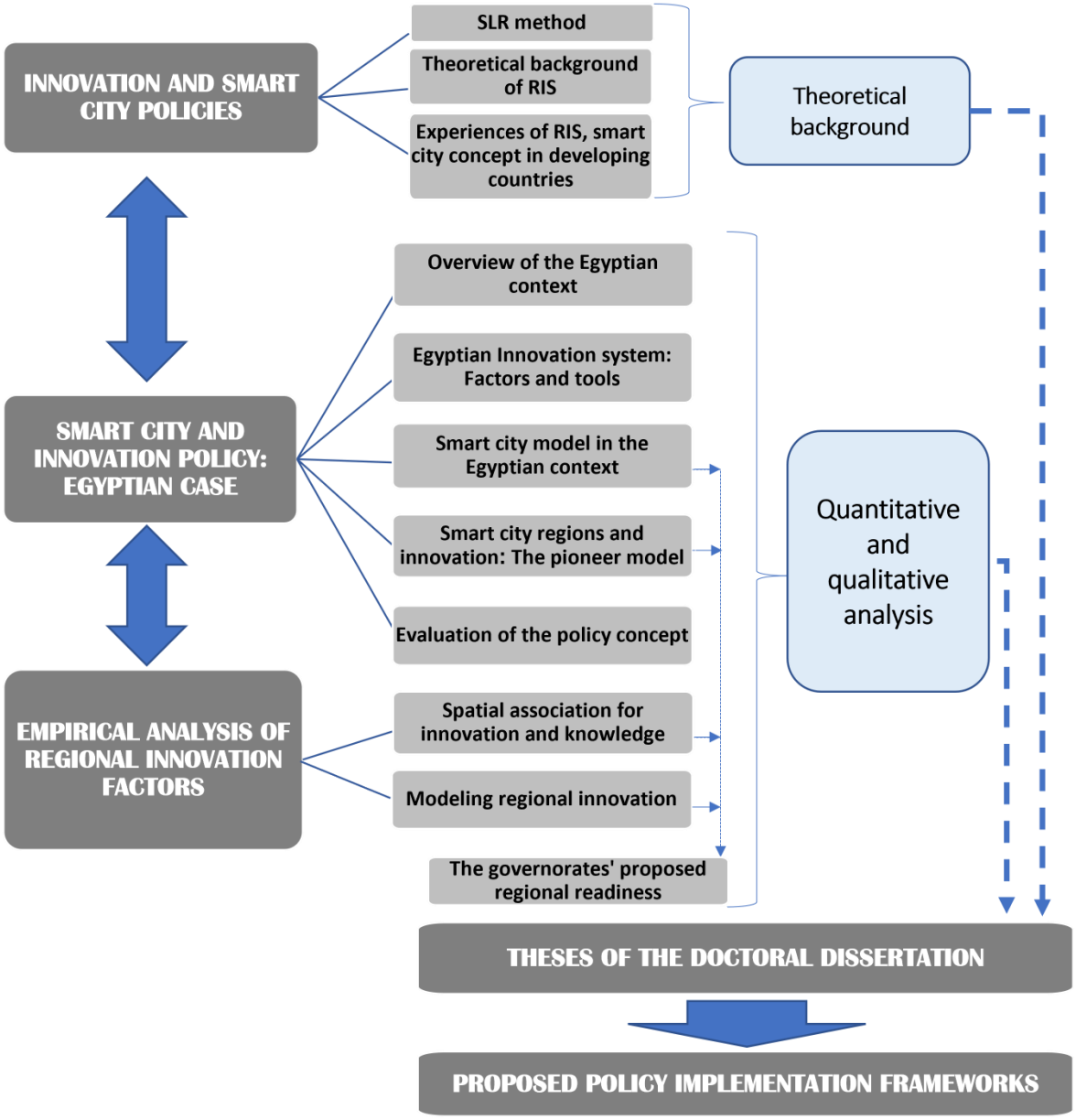
In Chapter 4, using an empirical approach, I examine the relationship between the highly-associated variables of the innovation system and the innovation outcomes of the Egyptian regions in order to answer the question whether the requirements and expectations

of the Egyptian smart city policy can be achieved. In this chapter I identify regions that are most capable of integrating innovation policies and smart cities concepts, and identify the variables that are most related to knowledge and innovation output in Egypt. To achieve this goal, in sub-chapter 4.1, I use a two-pronged empirical methodology, 1) exploratory spatial data analysis (ESDA), and 2) modelling the knowledge production function (KPF). The first part of the analysis explores the governorates that have a spatial autocorrelation of the innovation and knowledge production outputs. The second part of the empirical methodology seeks to identify the variables highly associated with innovation and knowledge outputs. The first goal is achieved by using the global spatial autocorrelation analysis (Moran's I statistic) and the Local Indicators of Spatial Associations (LISA) founded on significance and cluster analysis. In order to accomplish the second objective, I run parsimonious models on cross-sectional data using Ordinary Least Squares regression (OLS). Considering the nature and limitations of the data and sample size, this model is more appropriate than other econometric models. In this case, the regional analysis is conducted based on 27 governorates in Egypt. Therefore, the less ambitious models were resorted to, which deal with small samples in econometric models. In the sub-chapter 4.2, I explain the model and variables used with an accurate and detailed description of the data and its sources. Results of the analysis are presented in two parts: the first is the spatial autocorrelation, while the second is the regional innovation modelling (Sub-chapter 4.3). This chapter is considered the most exciting part of empirical results determining the spatial importance of the governorates and their relationship to knowledge outputs. Moreover, it identifies clusters of spatial autocorrelation of both types, positive and negative. This part determines the spatial distribution and concentration of innovation outputs in the Egyptian context. The last subsection also identifies the variables and innovation factors that are most relevant to the regional innovation outputs. In the last sub-chapter (4.4), **I present a synthesis of the regional readiness of the Egyptian governorates, based on the empirical analysis and analysis of narratives in the third chapter. In this analysis, governorates are evaluated according to their readiness for innovation and smart cities based on their capabilities and components**. Based on this readiness degree, decision-makers can get an accurate picture of how prepared Egyptian regions are for implementing the smart city policy based on the development of the innovation system.

Chapter 5 presents theses and policy implementation framework. I present the theses for the doctoral dissertation in chapter 5.1. Subsequently, I describe a policy implementation

framework in sub-chapter 5.2. **Chapter 6** summarizes the study's limitations, both in terms of the data and models used, as well as a vision for future research that can be explored to open up new research possibilities.

Figure 1 Dissertation structure



2. Synopsis of the dissertation

Egypt has introduced a new regional innovation policy. It has decided that Egypt will develop smart cities, fourth-generation cities that rely on knowledge, data technology, and innovation. In this thesis, I tried to answer the following question: *In order to ease regional differences, can innovation policies, such as the smart cities concept originally developed by advanced economies, be adapted efficiently to developing countries such as Egypt*? To address this question, first, I examined literature on innovation and the development of smart city concept in developing countries. The review of the regional innovation literature conducted that the "one-size-fits-all" policies are ineffective. Consequently, to develop effective strategies and policy concepts, regions must identify their own strengths and weaknesses, and choose strategies and policy concepts based on their regional assets. Second, I analyzed the regional innovation policies of three developing countries: China, India, and Saudi Arabia. There were a set of criteria for choosing these countries. First, the systematic literature review of relevant research studies should include case studies on the selected country. Secondly, the selected countries should share some of the same attributes as Egypt (e.g. smart city programs, national strategic development plans, and top-down regional planning design). Countries with large populations (such as Egypt), where high population density poses similar challenges to development. Furthermore, at least one case study from the Middle East should reflect the region's features. In this review, I looked at the features and components of the three countries' regional innovation systems (RIS) as well as the challenges they confront. My research indicates that developing countries rely on two kinds of knowledge for innovation, local knowledge and the other is knowledge derived from developed countries. The research has also shown that the effectiveness of the RIS of these three countries varies depending on whether they emphasize the role of universities, government, businesses, or the private sector.

In addition, I analyzed the smart city programs of China, India, and Indonesia. There are a number of reasons why these countries were selected. First, smart city policy is part of a national strategic plan in Egypt as well. Second, some of these countries have developed national plans to establish new smart cities, as is the case in Egypt. In addition, the selected countries should have a model that applies urban intelligence to existing cities (such as in Indonesia), as the Egyptian government also intends to implement the smart city policy on a group of existing cities at a later stage of the policy. While the smart city programs of these developing countries share some common characteristics (e.g. ICT usage, smart

infrastructure, developing a sustainable concept), the tools used to implement policies vary based on local circumstances and development goals. I did not aim to determine whether the examined smart city programs will be successfully adapted in these developing countries. Smart city approach is still a relatively new idea, and its applicability poses many questions, particularly for developing countries. Since the programs have just been rolled out in these countries, so it may be too early to evaluate their effectiveness. Such an analysis would be misleading and could give the wrong impression. Hence, my study focused on the concept of smart cities in each country, as well as the development goals, components, implementation approaches, and spatial development strategies (in terms of implementing new smart cities and/or transforming existing cities in order to adopt the urban intelligence approaches), while highlighting some concerns regarding the implementation of the policy. Consequently, the analysis of developing countries' cases reveals that each country has its own way of addressing the policy based on its goals, tools, and issues.

As a next step toward responding to the second part of the above-mentioned question in the context of the Egyptian case, interviews have been conducted and policy documents have been analyzed as well to identify three main themes: (1) the objectives and concept of smart city policy in the Egyptian context, (2) identifying smart city proposals and their components in Egyptian governorates, and (3) the components of the pioneering model (NAC). The interviews and the thorough review of policy documents highlighted that through smart cities, Egypt aims is to develop new urban communities that integrate sustainability, innovation, and knowledge-creation with the support of fourth-generation universities in those cities. Also, the model aims to build a new knowledge-based economy that is compatible with the changes and development paths in Egypt.

Moreover, in the third chapter, a case study approach was used, while in the fourth chapter, the spatial autocorrelation approach was applied to model knowledge production and regional innovation to determine which Egyptian regions (governorates) have a high potential for implementing smart city policies. The results of the analyses show that not all regions are prepared for these policies, because their RIS is not ready for that. The following results emerged from the analysis of the Egyptian policy on smart cities: the Greater Cairo Area (GCA), especially Cairo and Giza governorates, as well as the Alexandria governorate, have the innovative and knowledge components. As these governorates have a number of characteristics associated with innovation, they are providing opportunities for the development of knowledge, technology, innovation, and information technology.

Still, a question arose in this context: *does it make sense to allocate development resources for knowledge, innovation, and urban intelligence to Cairo, Giza, and Alexandria governorates alone, or should they be distributed to the other governorates as well?* As stated in the Egyptian case's narrative analysis of its smart city policy (in subchapter 3.3), the state plans on implementing an ambitious program for 14 smart cities distributed around the country. According to a national strategy based on urban intelligence and information technology, new urban development aims at providing urban areas for population growth and strengthening urban intelligence components. Toward answering the above-mentioned question, the empirical analysis (spatial autocorrelation and regional innovation modeling) in the 4th chapter presents the findings. First, knowledge and innovation outputs are spatially correlated in Cairo, Giza, Qalyubia, and Alexandria governorates. Second, the other governorates do not show a concentration or localization of innovation, knowledge, and technology factors. Third, universities and educational institutions show a highly significant association with the outputs of knowledge production in the Egyptian regional innovation system.

In light of these results, *I believe that regional innovation development policies applying smart city approach should be prioritized only in governorates with a high level of innovation potential.* Such high level of innovation potential to implement a smart city program is available only in Cairo and Alexandria governorates, the two largest urban agglomerations of Egypt. Moreover, only thirteen governorates out of 27 are prepared or potentially capable of preparing for regional development based on innovative policies and smart cities, depending on their capacity to remove bottlenecks. Accordingly, the policy should not be applied to the remaining governorates and cities in Egypt. It is not apparent that knowledge production is spatially correlated in these marginal and rural governorates. Additionally, the economic base and rural characteristics of those governorates make it difficult for them to implement smart city policies. On the other hand, my research confirmed that smart city development is a reasonable policy approach for the development of the Egyptian state within the framework of the new urban development axis of Egypt 2030.

In the next section, I present the theses of my doctoral dissertation. Its purpose is to demonstrate my answers to the research questions posed in the dissertation in an accurate and clear manner. The argument behind my theses is primarily bolstered by qualitative and quantitative analyses presented in chapters three and four, a literary analysis of innovation policies and smart cities, and an examination of the experiences of developing countries in chapter two.

3. Theses

Here I summarize the main conclusions of my research. My theses are based on the a literary analysis of innovation policies and smart cities, and an examination of the experiences of developing countries, the case study of Egypt, and the conducted empirical analyses. My main objective was to understand *whether it makes sense for developing country like Egypt to support the implementation of smart city innovation policies*, or that such policies cannot be applied for developing countries.

Each of my thesis is organized in the following way to be as precise, accurate, and detailed as possible: (1) the thesis statement (T1,T2, etc), (2) research question(s) answering the given thesis (RQ1, RQ2, etc.), (3) chapters of the dissertation providing evidence(s) for the statement, and (4) argumentation for the statement and conclusions.

Thesis 1 (T1): The innovation-driven and technology-centric concept of smart cities (SCs) represents a place-based tailored policy approach, which means that each region must adopt the concept to its own regional characteristics to promote regional development. Consequently, I assert that the concept of smart cities can be applied to developing countries as long as they *adapt* it to their *own spacial context,* and do not fall into the trap of copying the successful solutions – but relevant only in their context –of developed economies. Appropriate adaptation can enable the SC concept to be successfully implemented in developing countries.

The first thesis provides answer to the first and second sub-questions:

- *RQ1*: How does innovation policy support *regional development*?
- *RQ2*: Can smart city policy be applied *in general to any developing country*?

Evidences from *subchapters 2.2, 2.3, and 2.4* supports T1. *Subchapter 2.2* discusses the theoretical underpinnings of regional innovation policies. In addition, *subchapter 2.3* introduces smart city concept as a novel innovation policy. In s*ubchapter 2.4,* I present examples of smart city innovation programs in developing countries (China, India, and Indonesia). In these chapters, I used systematic literature review (SLR) method to examine the related research questions.

T1 is supported by a number of research findings. First, the literature review on innovation and its role in regional development in subchapter 2.2 revealed why *innovation*

is a place-based phenomenon, which means that internal capabilities of the regions, as well as localization and regional distribution of knowledge factors are important to promote regional competitiveness. Innovation and new knowledge occurs through the activities and interactions of the localised network of actors and institutions, which is called the regional innovation system (RIS). In the sub-chapters 2.3.2 and 2.3.3, it is explained that innovation is the engine for regional development, and it is supported by the RIS. There are various innovation policies that aim to increase innovation through the development of RIS. Smart city is a complex innovation policy as it relies mainly on technology, IT, digitalization, etc. To generate innovation via smart cities, RIS is a prerequisite, since the given RIS must be able to create, adapt, accept, and utilize smart city policy. A number of studies have shown that, as a result of spatial differences and development objectives, the performance of the RIS and knowledge diffusion in developing countries such as China, India, and Saudi Arabia are regionally uneven. Consequently, the study concluded that place heavily influences regional innovation policies. Smart city as a novel policy notion of innovation that can be utilized to enhance innovation. My research on smart city concepts (subchapter 2.3) revealed that *the term does not have a commonly accepted standard definition*, and *tailor-made nature* is its primary characteristic. Confirmed by the literature review as well, it appears that developing countries such as China and India *place emphasis on local factors in the design of their newest regional innovation policies* that support the development of smart cities.

This fact was also confirmed in sub-chapter 2.4 by the analysis of the smart city experiences of China, India, and Indonesia. The findings indicate that *the examined developing country adapted the* SC *concept to its own circumstances*. The establishment of smart cities in India is a response to increasing population and subsequent issues related to urban development. On the other hand, China developed smart cities to replace "eco-cities" in order to improve city services and infrastructure by using ICT. With regards to the Indonesian smart city approach, it is based on the development of existing cities to address challenges by utilizing urban intelligence and information and communication technologies. As part of an effort to improve the urban environment, a number of sectoral initiatives are being introduced in collaboration with the private sector to deal with urban and environmental problems. Therefore, it is evident that some characteristics are similar (e.g. dealing with urban challenges or implementing sustainable policies), but there are *significant differences in the tools used to implement those policies*. Furthermore, my examination of developing country experiences shows that localizing technology infrastructure, economic structure, enhancing local knowledge, and engaging the private sector is critical. In order for

smart city policy to be effectively implemented at the local level, all of these factors need to be considered.

In the light of the above, I believe that developing countries may have a greater chance for success with smart city policies if they know the characteristics of their regions and build their strategies on their revealed assets.

Thesis 2 (T2): According to my findings, *certain preconditions* need to be met in order to facilitate the implementation of smart cities in Egypt's governorates.

The second thesis provides answer to the third sub-question:

- RQ3: *Are there any preconditions that need to be met before Egyptian governorates can adopt the smart city concept?*

Evidences from *sub-chapters 3.1 to 3.4, and 4.3* support T2. In *subchapter 3.1,* I discuss the Egyptian state economic readiness for innovation. In *subchapter 3.2,* the Egyptian Regional Innovation System (RIS) is introduced by using a narrative analysis. While in *subchapters 3.3 and 3.4,* case study analysis and interviews provide a comprehensive overview of the Egyptian smart city program and present a thorough description of the New Administrative Capital (NAC) pioneer model. In *subchapter 4.3*, I investigate the spatial autocorrelation of innovation and knowledge for the governorates in Egypt. In order to clarify the rationale for this thesis, the following points can be mentioned. First, in *sub-chapter 3.1*, I examined whether the Egyptian state is ready for innovation policy based on long-term analyses of well-known economic indicators. According to the investigation, Egypt's situation has changed significantly and it seems ready in general. In *sub-chapter 3.2,* the analysis of the Egyptian case study clearly indicates that certain factors and components of RIS leading to high regional innovation performance are more prevalent in the northern governorates compared to the southern governorates of Upper Egypt. The narrative analysis of policy in *sub-chapter 3.2* identified the following preconditions and components that contribute to strengthening the regional innovation system in the governorates:

- *The concentration of the population* is accompanied by *the concentration of employers* in the industrial sector in the northern governorates of Egypt (Cairo, Giza, Qalyubia, and Alexandria), which represents 25% of the country's total population.

- In the northern governorates, *high-tech industries* (such as electronics, software, communication, programming and computer activities, data processing and analysis) comprise 80% of the total innovative industries at the national level.
- *Research activities and universities*, where 44 % of universities are located, 43 % of research centers are, and 24 % of workers are engaged in scientific research, development, and patents.
- The governorates of the north encompass 50% of the total number of *business incubators.*

Therefore, it is clear that some components of the RIS can be found relatively well in some governorates, whereas they are scarce in others. Nevertheless, the Egyptian state views SC programs as a way to enhance innovation in cities through technology and information. SC programs tend to focus on universities and innovation-based education. Therefore, governorates that provide favorable conditions and promising chances for the construction of regional innovation systems must be utilized. Consequently, a governorate supporting smart cities should *ensure that it has adequate* manpower and employment in *technologically-related industries, R&D activites, business incubators, and universities*.

In *subchapter 3.3*, the narrative analysis of the smart cities program confirms the previous point, which indicates the Egyptian government intends to implement the policy in the new administrative capital in East Cairo, as well as the new city of El Alamein on the north coast west of Alexandria. In addition, the Egyptian government is supporting the setting up of fourth-generation universities and knowledge centers in these cities and within the governorates where they are located in order to facilitate the development of innovation and knowledge in those regions. The state's intention is to implement policies within the governorates that include all of these conditions and components (for example, universities and R&D centers, clusters of technical and technological industries, and business incubators). Accordingly, the narrative analysis of the smart city policy reported in sub-chapter 3.3 confirms the second thesis, namely, that the conditions and requirements listed above must be met in order to support the implementation of the smart city concept within the governorates of Egypt.

In the context of the argument of the second thesis, in *subchapter 3.4* I examined the pioneering model in the new administrative capital that supports the concept of urban intelligence among the fourth generation of cities. According to my analysis of the NAC model, the government is working to provide the following components:

1. Enacting the smart services strategy by providing a multi-objective pattern for the services within the new administrative capital.
2. Setting up the city's data control center to provide the city's information and data infrastructure for the NAC model.
3. Providing the city with an extensive network of smart infrastructure to facilitate research and information activities as well as to activate urban intelligence.
4. Developing a smart multi-mode transportation network connecting the new administrative capital with Cairo Governorate (e.g. monorails, light rail transit (LRT), or bus rapid transit(BRT)).

Thus, the study confirms that the concept of smart cities can be activated only if the conditions for infrastructure, services, transport, and information network are in place. As a result, another argument can be made for the second thesis in light of the discussion in sub-chapter 3.4, that, in order to facilitate the policy in the other proposed fourth-generation cities, there must be an availability of the necessary conditions, components, and structures required to implement the concept of the smart city. This finding lends support to T2 that preconditions and components that are integral to the concept of smart cities can be found in some governorates and absent in others.

In summary, according to my arguments presented above, I believe smart cities programs can be successfully implemented only in Egyptian governorates where certain preconditions are prevalent.

Thesis 3 (T3): In light of the findings, some governorates have the capacity to generate high innovation potential and opportunities because of conditions that are present, while others do not. Although potentials are most lacking in upper Egypt and the Delta regions, it is present in the governorates Cairo, Giza, Qalyubia, Alexandria, Beheira, Assiut, and Qena.

T3 provides answer to the fourth research question:

- *RQ4*: *Which Egyptian governorates have the conditions to adopt the political concept of the smart city?*

In this instance, chapter 4 of the thesis (most of all *sub-chapter 4.3)* provides supporting evidence. In this chapter, Exploratory Spatial Data Analysis (ESDA) and the regional knowledge production function approach were used.

Based on the empirical analyses for modeling knowledge production in *sub-chapter 4.3*, opportunities are related to both innovation and knowledge in Egyptian governorates. As a result of the analysis, and based on the empirical evidence provided, R&D in the academic sector has a different impact on innovation output compared to R&D in the private sector. Comparatively to private research activities, academic research activities are significantly associated with innovation outputs. Taking into account that regional knowledge production and the academic community have a high correlation, *fourth-generation universities can significantly contribute t*o the achievement of a successful regional innovation system within smart cities through the transfer of innovation outputs and knowledge of the proposed technological industries.

The Exploratory Spatial Data Analysis in *subchapter 4.3* revealed that, based on high innovation potential, innovation outputs are geographically related across Egyptian governorates. The findings show that *the outputs of knowledge creation differ among Egyptian governorates*. Despite the lack of in upper Egypt and the Delta, Cairo, Giza, Qalyubia, Alexandria, Beheira, Assiut, and Qena all have potential. Furthermore, according to these findings, Egypt has 14 governorates, making a regional development program based on innovation and smart cities impossible to implement. According to the findings of subchapter 4.3, there was no evidence of spatial autocorrelation for regional innovation outputs in these governorates. They also lacked knowledge and innovative capabilities, as well as elements and resources. Currently, most of the country's academic research activity takes place in the Greater Cairo Region governorate, which includes ranked universities and national research centers. Universities in mega cities like Cairo, Asyut, and Alexandria with the longest and most distinguished reputations are expected to collaborate with industry more than regional universities.

Previous point was also confirmed in the analysis of the findings, which indicate that the Cairo Region Governorates (CRG) and the Alexandria governorate are best suited for innovation-based development as a result of the concentration of research activity and universities within them. In spite of the findings of the ESDA analysis, which indicate a concentration of knowledge production in the northern governorates, the southern governorates, and the Delta region governorates lack innovation potential. As a result of these concentrations, there may be regional divergences, which may lead to the concentration of knowledge and innovation in certain governorates but not in others. Thus, *smart city programs dispersed across governorates with preconditions and opportunities might help to reduce regional inequities.*

In conclusion, the analysis supporting the third thesis indicates that there are opportunities for each of the smart city and innovation policies only in certain Egyptian governorates, while other governorates lack some of these necessary elements and conditions. For this reason, it would make sense for Egypt to implement a smart city policy as part of its strategic guidance framework for sustainable development, as stated in Egypt Strategy 2030, only if the preconditions and opportunities are provided within the governorates.

Thesis 4 (T4): Different governorates in Egypt have varying degrees of readiness for smart city policies and innovation-based regional development. It is impossible to activate a smart city policy until the requirements are met, i.e. until the bottlenecks are solved and the preconditions are met, which poses a roadblock for many Egyptian governorates.

T4 answers the fifth research question:

- *RQ5: Which Egyptian governorates's RIS is the readiest for the implementation of the SC concept?*

The sub-chapter 4.4 examines the level of regional readiness of governorates in Egypt for implementing smart city policies and innovation programs. The results of my quantitative and qualitative investigations confirm that Egyptian governorates have RIS with varying characteristics, features, and aspects, and consequently, they have varying levels of readiness for SC policy implementation. Therefore, a uniform, one-size-fits-all regional development policy is not feasible, as regional capacities, reflected in innovative infrastructure, information and smart urbanization, differ from region to region. Based on the outcomes of my research, I developed a *regional readiness measure* for Egyptian governorates for applying regional development through innovation policies and smart cities.

To estimate the degree of readiness, some of the findings from the qualitative analysis reported in chapter 3 and the empirical analysis presented in chapter 4 were employed. The degree of readiness was measured using five indicators: *the outputs of knowledge production in governorates, the significance of local spatial associations, spatial association clusters, smart city proposals within Egyptian governorates,* and finally, the *classification of governorate capitals based on development capabilities*. Each governorate was given a score (ranging from 1 to 4) based on the findings of the analysis, and I generated the readiness score for each governorate by aggregating the scores of the five indicators.

The findings of the readiness analysis supported T4, indicating that there are governorates that are better prepared to implement the policy (leaders), a group of governorates that are less prepared (catchers-up), and a final group of governorates that have no evidence of policy implementation readiness (laggards).

This last group of governorates (“*laggard” regions)*, according to the conclusions of the investigation, lacks inventive features, does not represent the spatial significance of innovation outputs, and has no smart city initiatives suggested inside them. **They are governorates in upper Egypt and some of the Delta governorates** that are primarily rural and arid. In these marginal and rural governorates, there seems to be no indication of spatial autocorrelation of knowledge generation. Furthermore, the governorates' economic basis and rural qualities make it difficult to adopt innovations and smart city plans. As a result, based on their preparedness and capacity to eliminate blockages and satisfy criteria, only *13 governorates out of 27 are prepared or have the potential to prepare for regional development based on innovation and smart cities policies*. As a result, the policy should not be implemented to the remaining governorates and cities in Egypt.

The most ready governorates (“*leader*” *regions*), according to the results of the readiness analysis, are Cairo, Qalyubia, Giza, Alexandria, Assiut, and Qena, where the analysis revealed high levels of readiness to execute the policy within the governorates' capitals. Where the empirical and narrative policy analysis for this group of governorates clearly demonstrates the presence of the components and circumstances required for innovation policies and smart cities. These governorates have high scores in the knowledge production output and a high significance of the local spatial association, in addition to the existence of spatial autocorrelation of these governorates with knowledge production outputs, as measured by the degree of readiness. The capitals of these governorates have a high capability rating, according to an examination of city classifications based on development capacities. In addition, under those governorates' smart city policies, there are proposed seven new smart cities.

In contrast, the analysis revealed that a number of governorates had lower levels of readiness (“*catchers-up*” regions), based on the fact that they did not have a high level of innovative activities components, but they have four smart city plans under the Egyptian smart city strategy. As a result, it is possible to suggest that in order for this group of governorates to catch up to the group of “leaders” governorates, they must first complete the conditions and components, followed by the possibility of implementing urban intelligence programs in the capitals of those governorates based on regional readiness. To overcome the

bottleneck, these requirements are fulfilled through supporting innovation activities inside regional universities and the business community within governorates, as well as by integrating the governorates' spatial autocorrelation with the innovative capacities of the governorates' "leaders."

T4 concludes that smart city policy may be implemented in both proposed smart cities and existing cities - which are the governorates' capital cities - given that the governorates' readiness to execute the policy is taken into account. Degrees of priority for policy implementation of the smart city program in Egyptian governorates are proposed after a analysis of readiness (see Table 18). The governorates' proposed new smart cities will be the first and second priority for implementing this program, according to requirements and components, and depending on regional readiness. The third and fourth priorities for implementing the urban intelligence policy involve existing cities (governorates capitals) with significant innovation capabilities and components, as well as high levels of readiness (leaders). The fifth priority in terms of implementing the smart city policy is a group of smart cities proposed within the national program for smart cities (East Port Said (Al-Salam), Al-Galalah City and Resort, New Mansoura, and New Toshka City), in which the governorates of these proposed cities lack the conditions and components, as well as demonstrating the lowest degree of regional readiness for implementing the policy. Because of their proximity to the "leading" governorates, these governorates may be able to catch up to them in terms of policy implementation once they achieve the necessary requirements and conditions.

To summarize, the *governorates of Egypt differ in their readiness to execute smart cities and innovation-based regional development*. *Some governorates will be unable to execute policies until the backlog is lifted and the conditions are satisfied*. It might be claimed that smart city development is a suitable method for Egypt, based on the new urban development axis of Egypt Strategy 2030; nevertheless, this depends on the governorates' preparation level.

In sum, the results of doctoral dissertation support that the Egyptian context can apply a policy model based on innovation and urban intelligence to implement regional development policies, but only if we consider the level of readiness of the regional innovation system of Egyptian governorates and cities in the implementation.

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List of Publications

Kabil, Moaaz ✉ ; **Ali, Mohamed Abouelhassan** ; Dávid, Lóránt Dénes
Gender Perspectives in Tourism Studies: A Comparative Bibliometric Analysis in the MENA Region
TOURISM PLANNING AND DEVELOPMENT , 23 p. (2022)
DOI WoS Scopus
Article (Journal Article) | Scientific

Ali, Mohamed Abouelhassan
Smart city approach for sustainable urban development in developing countries: Egypt case
Biskek, Pishpek, Frunze, Kyrgyzstan : University of Central Asia (2021)
Conference proceedings | Scientific

Ali, Mohamed Abouelhassan ✉
Smart city policy in developing countries: Case study of the new administrative capital in Egypt
JOURNAL OF PUBLIC AFFAIRS Paper: e2774 , 16 p. (2021)
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Article (Journal Article) | Scientific

Ali, Mohamed Abouelhassan ✉
Modeling regional innovation in Egyptian governorates: Regional knowledge production function approach
REGIONAL SCIENCE POLICY & PRACTICE 13 : 13 Paper: rsp3.12450 (2021)
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Article (Journal Article) | Scientific

Ali, Mohamed Abouelhassan ✉ ; Moaaz, Kabil ✉ ; Rahaf, Alayan ; Róbert, Magda ; Lóránt, Dénes Dávid
Entrepreneurship Ecosystem Performance in Egypt: An Empirical Study Based on the Global Entrepreneurship Index (GEI)
SUSTAINABILITY 13 : 13 Paper: 7171 , 22 p. (2021)
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Ali, Mohamed Abouelhassan
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Ali, Mohamed Abouelhassan
Entrepreneurship development performance in Egypt: An empirical study based on the Global Entrepreneurship Index (GEI) data 2006-2017
In: Csiszár, B; Hankó, Cs; Kajos, L F; Kovács, O B; Mező, E; Szabó, R; Szabó-Guth, K (eds.) IX. INTERDISZCIPLINÁRIS DOKTORANDUSZ KONFERENCIA 2020 ABSZTRAKTKÖTET : 9th INTERDISCIPLINARY DOCTORAL CONFERENCE 2020 BOOK OF ABSTRACTS

Pécs, Hungary: Doctoral Student Association of the University of Pécs (2020) 384 p. pp. 88-88. , 1 p.
Abstract (Chapter in Book) | Scientific

Articles in press

Abousafi, Enas Moustafa Mohamed; **Ali**, **Mohamed Abouelhassan;** Iparraguirre, Jose Louis

Industrial clusters and the five drivers of regional productivity in Egypt

*Book: Industry Clusters and Innovation in Arab Countries (*2022*)-* **(Under reviewing)**

German International University (GIU), NAC, Egypt