SMART CITY MANAGEMENT FOR A SMART, HEALTHY CITY: A CASE STUDY ON KHON KAEN CITY, THAILAND

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Abstract

The aim of this study was to analyze the strengths, weaknesses, opportunities, and threats (SWOT) of Khon Kaen smart city development, as well as to study Khon Kaen smart city management for a smart, healthy city. In this study, we used multiple empirical methods of data collection, including interviews and focus groups, and we used SWOT, content, and descriptive analyses for the data. The results show that to develop a smart city model for sustainable living, Khon Kaen should set up eight key factors as a smart city management model: smart mobility, smart people, smart living, smart economy, smart government, smart environment, smart energy, and smart health

Key words: Smart City; Management; Smart; Healthy City

Introduction

City management is the primary challenge when integrating sustainability efforts [1]. The smart city concept started in the 20th century using information technology and telecommunication to implement the infrastructure for quality of life and sustainability [2]. Smart cities are one issue promoted for the sustainability challenge and are on the agenda of many cities around the world [3]. Smart cities aim to increase citizens' quality of life by employing technology, increasingly used as a way to address challenges such as energy consumption and traffic management [4]. Smart cities are designed to provide policy and practice shifts in the use of new technologies and data platforms to improve cities' functioning [5].

Thailand has a policy to promote smart city development, and the government, through the National Steering Committee on Smart City Development, opened the application process to cities that want to join the scheme by submitting proposals for evaluation and approval in May 2020, and many municipalities have applied to get approval for smart city development. The five criteria to receive government support are to have clear geographical boundaries and smart city goals, have infrastructure investment and a development plan, have a design for an open and secure city data platform, provide smart city solutions, and have a sustainable management model. The Thai government aims to build smart cities throughout the country. The first step was to set up smart city targets divided into ten zones, in seven provinces (Phuket, Chiangmai, Khon Kaen, Bangkok, Chonburi, Rayong, and Chachoengsao), which would start the process of smart city transformation along seven smart city dimensions: smart economy, smart mobility, smart energy, smart living, smart people, smart governance, and smart environment [6].

In 2018, Khon Kaen province set up the smart city plan. The first phase focused on smart mobility by developing the light rail transit (LRT) through collaboration between many local administrative organizations and the private sector to establish the Khon Kaen Transit System (KKTS) to manage the Khon Kaen smart city project [7]. The proposal to develop Khon Kaen smart city aims to double per capita income in the province within twelve years and to increase people's income from $6,000 per person per year in 2016 to $12,000-

$15,000 per person per year over the next twelve years [8]. As mentioned above Khon Kaen smart city has just started and is still in the development process, and research is still important. Study results can be used as guidelines for development. Therefore, the objective of this study was to analyze the strengths, weaknesses, opportunities, and threats (SWOT) of Khon Kaen smart city development, as well as to study Khon Kaen smart city management for a smart, healthy city.

Conceptual Framework

A smart city is a management system using international data connectivity [9]. Smart cities involve technology and communication development for future city management [10]. Smart cities use technology for convenience and service to residents to improve quality of life, and stakeholders collaborate for city development and encourage businesses and the private sector to use technology and innovation for management [11]. In addition, to achieve smart city goals, it is necessary to develop the infrastructure, for example high-speed wireless internet in the city, information technology, and industrial development using innovation [12].

Smart cities use information and communications technology to enhance livability, workability, and sustainability and employ information communication technology (ICT) to solve problems in a wide range of public policy domains, including energy, waste management, transportation, health care, security, public administration, education, and more. In addition, ICT systems can enable objects and environments to sense, communicate, network, and produce information, forming the Internet of Things (IoT), as well as to collect, transmit, and aggregate data from the environment, allowing that data to be analyzed and put to use [5].

The conceptual framework of this paper follows the smart city concept involving smart mobility, smart people, smart living, smart economy, smart government, and smart environment, as follows:

- Smart mobility means people can travel through various types of public transportation [13]. In addition, cities should provide more public transportation using alternative energy [14].
- Smart people represent the city's power through information technology and internet activities [15]. In addition, people can easily access big data and use the open data provided by the city for daily life [16].
- Smart living is city development following the concept of friendly design and safety from crime [17]. In addition, cities should develop more bike lanes and walkways, as well as encourage people to use more renewable energy in daily life [18].
- Smart economy refers to cities' development of infrastructure to support economic activities such as high-speed internet [19], as well as developing labor skills to support economic activities using high technology and innovation [20].
- Smart government is city management using technology connected to communication networks for service and increasing residents' quality of life. The key performance indicator for smart government is to have policy and planning for technology use and innovation for services, implementing policy into activities and practice, establishing a budget for management, administration using technology and application on computer systems, using electronic government procurement system, and having a center for information technology management and administration [21].
- Smart environment refers to city development and all activities in the city having less of an effect on the environment [22]. Transportation systems should be environmentally friendly [20]. In addition, cities have management systems to monitor the environmental impact [23].
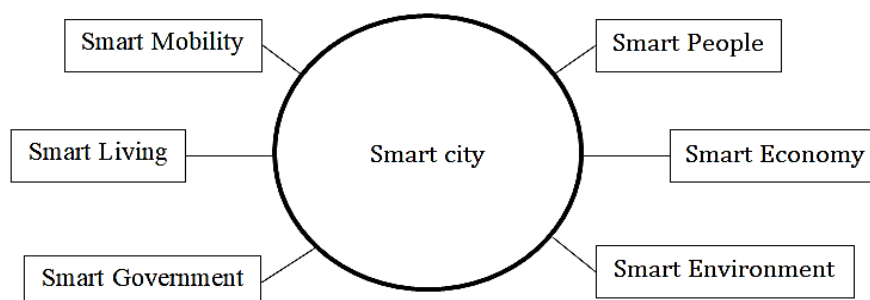
Figure 1. Conceptual Framework
Source: Authors, 2020

Methodology

In this study, we used qualitative methods with in-depth interviews and focus groups. The area of study included six municipalities in the Khon Kaen province of Thailand (Khon Kaen municipality was the center of research area, and the five other municipality neighborhoods were Ban Ped, Muang Kao, Tha Pra, Ban Thum, and Si La).

Methods

We used a three-step method for this study: First, we conducted a literature review to create a conceptual framework. Second, we conducted in-depth interviews with key informants, and third, we conducted focus groups. We used purposive sampling for interviews with 15 key informants, and we invited five people for a focus group and discussion about smart cities, including municipality staff, residents, and academics.

Analytical Techniques

We used data and investigator triangulation and methodological triangulation techniques to check and compare the data. Then, we used SWOT, content, and descriptive analyses of the interview data to analyze the full data set.

Results

The smart cities initiative in Khon Kaen is in a very early stage. The strengths, weaknesses, opportunities, and threats of Khon Kaen smart city development are shown in Table 1.

Table 1 Strengths, weaknesses, opportunities, and threats of Khon Kaen smart city development

Strengths	*Weaknesses*
• Driven by inclusive growth	• Lack of public transportation
• Prepared for smart city	• Reduction of business income
• Low cost of living	• Lack of knowledge in research and development and innovation
• Population and job growth	• Security perception
• Access to health care system	• Less household use of renewable energy
• Accessibility to higher education	• High price of electric vehicles
• Broadband network deployment	• Weak policy and funding instrument

	• Digital gap
Opportunities	*Threats*
• Investment opportunity	• Competing investment destination
• Digital infrastructure readiness	• Unplanned suburban growth
• Introducing participatory city planning	• Uncontrolled population growth
• Central government has policies to promote smart city.	• Weak institutional environments for technology and innovation
	• Economic crisis with coronavirus (COVID-19)

Table 1 shows that Khon Kaen smart city requires more development and design policy and practice to set up activities to achieve smart city targets. The study also found that Khon Kaen city is not focused on a smart, healthy city as a significant factor, so to develop a smart city, Khon Kaen should include smart, healthy city as a significant factor. Based on the analysis, the Khon Kaen smart city management model have eight factors: smart mobility, smart people, smart living, smart economy, smart government, smart environment, smart energy, and smart health. The activities development of Khon Kaen smart city management for a smart, healthy city are shown in Table 2.

Table 2 Khon Kaen smart city management for a smart, healthy city	
Factors	*Management Activities and Practice*
Smart mobility	• Develop public transportation between airports, train stations, and bus stations with a monorail or light rail.
	• Re-develop traffic light systems using a processing system connected to a real-time wireless traffic security camera that processes the vehicle volume on the road and controls traffic lights.
	• Develop a mobile application connected to all public transportation so that passengers can know the exact time public transportation will arrive at a bus stop or station.
	• Revise policy and promotions such as financial incentives to bridge the cost gap between electric and conventional cars, develop programs to deploy charging infrastructure, and implement informational campaigns to raise awareness and increase visibility regarding available electric vehicles and their benefits.
Smart citizen	• Encourage people to participation in the online network of the Internet of Things (IoT).
	• Develop the city into knowledge center, and set up a curriculum and course of training for skills development using student-centered learning.
	• Develop online training systems and set up an online training course for life-long learning.
	• Develop a smart library that provides easy access to data via the internet.
	• Develop a creative center as a knowledge and skills development center for youth and residents.
Smart economy	• Encourage businesses to use innovation and collaborate with academic institutions

Table 2 Khon Kaen smart city management for a smart, healthy city	
Factors	*Management Activities and Practice*
	to transfer business innovation knowledge.
	• Build a platform space online for local start-up businesses.
	• Develop a MICE (Meetings, Incentive, Travel, Conventions, Exhibitions) city using IoT
	• Develop agriculture through smart farming using IoT
	• Develop the industrial zone into a green industry park.
Smart environment	• City development using the concept of a green and clean city; extend green areas such as city parks and eco-building designs.
	• Environmental management to reduce pollution from the household level to the city level using smart systems and IoT as the platform for management.
	• Promote and support household use of circular economy and the 3R concept (reduce, reuse, and recycle) for solid waste management.
	• Promote renewable energy use in households, businesses, and all government levels.
Smart governance	• City management connected to technology and IoT for management in and outside the city to improve residents' quality of life.
	• Public service using one-stop service connected to IoT
	• Have open data in the IoT and set up the data mining for decision-making support to administrative staff and all city stakeholders.
	• Set up the center unit and have authority for smart city management.
Smart living	• Install security cameras in important areas of the city for safety; residents can connect to the public security camera with a security password to identify users.
	• Control public light systems in the city automatically and connect them to security systems.
	• Develop and design the infrastructure in a friendly way, such as improving walkways and staircases so that handicapped and older people can easily use them, and should install escalators and elevators on pedestrian bridges.
	• Promote and encourage residents to develop their houses into smart houses as a convenient home setup, where appliances and devices can be automatically controlled remotely from anywhere using an internet connection on mobile or other networked devices.
Smart energy	• Promote solar energy for use in residents' homes.
	• Local administrative organizations collaborate with the central government to set up a promotion strategy to motivate people to use electric vehicles (EVs); for example, the central government should reduce taxes for EVs.
	• Renovate all government buildings to use renewable energy.

Table 2 Khon Kaen smart city management for a smart, healthy city	
Factors	*Management Activities and Practice*
Smart, healthy city	• Have medical applications on smartphones for health checks, connected to a hospital to book medical service. • Develop a clean and green city concept, and implement an efficiency waste management system. • Use circular economy to help with solid waste management. • Develop the city following a friendly design concept. • Develop more green spaces, such as public parks, including developing more areas for exercise in the city. • Ensure food quality and safety of agricultural products to supply to the city. • Develop bike lanes for people to be able to use bikes as their mode of transport in their everyday lives; offer safe and attractive bike lanes, as well as bike lanes that are inclusive of different kinds of bikers. • Develop an online tool that facilitates the collection and sharing of medical information between residents and hospitals or medical doctors.

This paper showed that the Khon Kaen smart city management model should have eight factors: smart mobility, smart people, smart living, smart economy, smart government, smart environment, smart energy, and smart health, as shown in Figure 2.
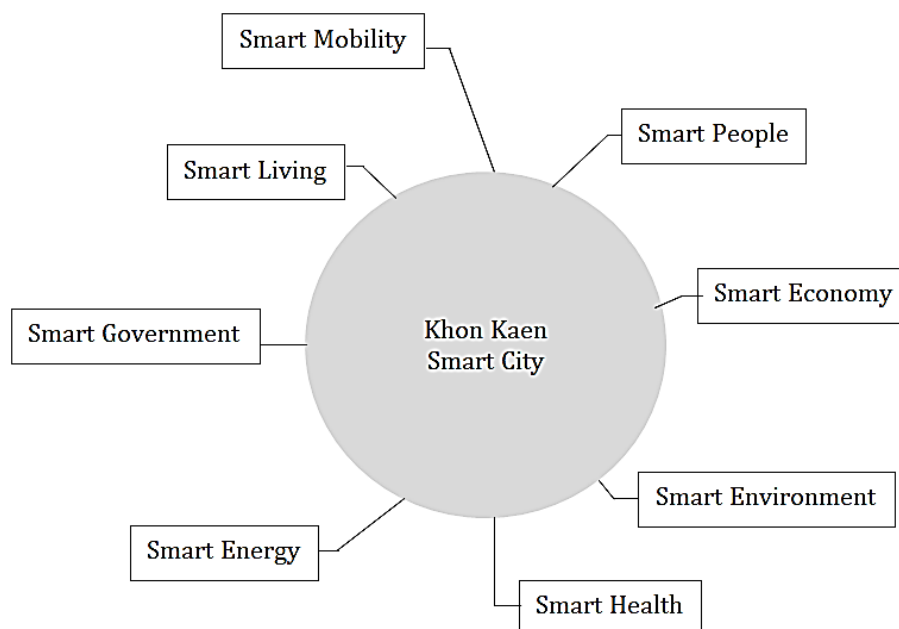

Figure 2. The Khon Kaen Smart City Management for a Smart, Healthy City
Source: Authors, 2020

Conclusion

The smart city project is one issue of city development based on using information technology for development, a knowledge-based society, and technology use as a mechanism to reduce social and economic equality, as well as using information technology and the internet as a tool to solve many problems people face.

The significant factors that push smart cities are high-speed internet and free Wi-Fi in public areas [24]. In addition, cities should use a clean and green city concept for management and implementation to create a fresh environment [25], as well as a circular economy concept for solid waste management and as a way to boost the economy [26]. Khon Kaen smart city is in the process of development, and the first stage is development of smart mobility, such as light rail transit (LRT), renovating Khon Kaen international airport, and developing public transportation connections to all important areas of the city. The study found that the old management style of Khon Kaen smart city is not suitable for future development. Thus, in this paper, we conclude that the Khon Kaen smart city management model should involve eight significant factors: smart mobility, smart people, smart living, smart economy, smart government, smart environment, smart energy, and smart health.

Acknowledgment

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