The Transformation Revealed Concept of Smart City Application in Urban Planning

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Abstract. The purpose of this paper is to present the findings of research conducted to reveal a smart city application concept in urban planning. The method is discussed in the context of case studies of smart city concepts in Malaysian states namely Johor,Penang and Selangor, with the efficient and effective state for implementation and application in urban planning being selected. The case study method was utilised to demonstrate the conceptual framework of smart city application in urban planning, as well as seven smart city criteria. The basic requirement for the proposed framework is that individuals must have urban planning expertise in the field of smart city applications. The authors, who are well-versed in urban planning and smart city concepts from the point of view of urban planning, propose a solution relevant to any urban planning circumstance.

1. Introduction

Cities intend to take an important role in the world's environmental sustainability. Cities have been neglected by communities for an unprecedented while now, even though most of the otherworld's societies are aware of urban cities, and also that statistic is normally to rise within the immediate future, so the cities generate greatly further economic growth than the remainder of the world. In his seminal article,[39], has mentioned that because of the variety of those features and the current social strain to just provide a pleasant standard of living for their inhabitants, today's urban metropolitan areas are striving to establish Smart City local administration frameworks. According to [24] concluded that even though "Smart City" is now a common expression, its precise definition is still a matter of debate. Even among its several components seem to be smart cities, interactive cities, cloud-based cities, data cities, cellular cities, as well as future cities. In addition, [4] asserts that its most effective method to comprehend smart cities and thus the telecommunications technologies that connect them is as evolving industrial automation funded by interconnected subcomponents of configurable both human and technological cognition. Preliminary work on urban planning and the smart city was undertaken by [19], urban planning formalities have traditionally been closely linked to technological advancement. Present urban planning discourse in Malaysia focused mainly on land use, zoning, and development regulations. It thus includes the provision of services, and infrastructure such as roads, and others[46]. Moreover, he added that the ideologies regarding smart cities represent the most recently admitted social and technical innovation, with both the guarantee about using technologies of information and communication (ICT) to enhance the sustainability and economic achievements of cities as well as, ideally, provide communities with such a greater quality of life. Furthermore, the roles, ethical considerations, and power

dynamics of urban planners have been frequent subjects of academia. A planner is a person who has participated in this study and practice in the field of planning to reshape and create cities through some coordinated plan, combining land use, preservation, and vital infrastructure assets[10;12;18].In practice, the said involvement varies depending on the particular context and location of a task, as contrasting politico-economic power relations and belief systems can affect and sometimes even restrict a planner's expertise[8;12;19;26].

The late 20th century saw high tech in information and communications technologies (ICT) and every power of the internet. These technological advancements have resulted in the development of a new technology-based urban planning and living solution. In essence, Smart City harnesses the potential of technology to make cities more engaged with stakeholders, thereby increasing city efficiency. Similarly, ICT is highlighted in urban planning as a crucial essential urban infrastructure and application that facilitates access to either a smart city, as well as every smart city concept depending on IoT technology's aspirations of ubiquitous computing and associated big data utilisations[33]. Whereas Smart City initiatives have grown significantly in the twenty-first century, efforts to provide a universally agreed-upon description of the attributes of a Smart City have yet to come to a halt. Furthermore,[24]mentioned that Smart City has been labeled as a sociocultural anomaly, with a hazy concept and inconsistent application. There is no one blueprint for designing Smart City in urban planning, and neither is there a single definition of a Smart City that is capable exactly into urban planning perspectives. Regardless of the nomenclature issue, the core principles of the features of a Smart City obtain easily discernible, making the Smart City a potent strategy for mitigating and resolving current urban problems and making cities more livable, [24].

1.1. Urban planning contemplates Smart City.

Earlier in the 20th century, information and communications technologies (ICT) and the internet became highly advanced. These technological advancements have led to the creation of an entirely new urban planning and living solvent based on technology.

In Malaysia, a Smart City would be any municipality that employs ICT and innovation advancement to achieve smart living as well as enhanced quality of life [37]. Additionally, smart cities may emphasize 5G connectivity, digital payment communities, effective public transit, UAV systems, energy-efficient buildings, and intelligent sewage treatment. KPKT and Standard Malaysia are collaborating with PLANMalaysia (the Federal Department of Town and Country Planning Peninsular Malaysia) to develop this same Malaysian Standard for Smart City Indicators. Globally, Malaysia (Kuala Lumpur) ranked 54 on the Global Smart City Index 2020. Currently, PlanMalaysia used ISO 37122 as the main indicator for evaluating smart cities level in Malaysia[31].

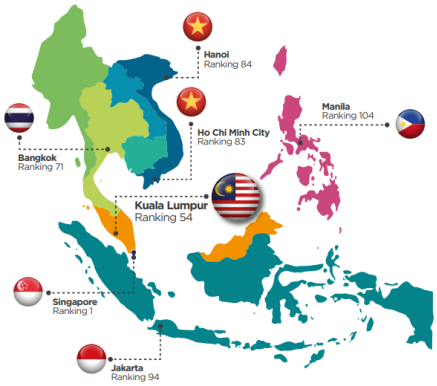

Figure 1. Kuala Lumpur ranking as compared to other ASEAN Cities
Source:: IMD Global Smart City Index 2020

[45] suggested that the smart city concept in urban planning aspects needs to be taken crucially. In his seminal article,[23], at this time, municipalities must provide smart city services because they are essential to society and are necessary for municipalities to perform their essential functions. Then, it is anticipated that smart cities will increase these capabilities by integrating more closely with the community and its residents. However, this research focuses specifically on smart city development in Malaysia with the involvement between the stakeholders, urban planners, and local authorities in urban land use with the use of smart city applications in urban planning. A transformation of smart city implementations in urban planning obtainable introduced as a concept that translates the extent to which the city serves people with the application of technologies that meet the needs of people towards urbanization. These also can achieve the quality of life stated in sustainable development goals 3,9, as well as 11. As a universally recognized framework, SDG 11 of the sustainable development goals calls for inclusive, safe, resilient, and sustainable cities, as well as those consequences on the urban form have found success with the smart city applications in urban planning nowadays.

Again, [45] stated that future smart city development will benefit from a thorough examination of the smart city in urban planning. To date, numerous urban planning methods have been developed and implemented to evaluate the condition of smart cities[31]. Existing studies lack a discussion of how land use contributes towards the smart city in urban planning concerns such as optimizing and maximizing land use density in one area.

The significance of urban planning aspects in smart cities is that cities are essential to the urban planning process from utilizing their facilities and technological advancements, as well as with citizen collaborative efforts, all is required to embrace the optimal solution smart city, as the primary goal of urban planning based on sustainable development is to enhance the standard of living for citizens[33]. A smart city is a principle in urban planning and development, according to[1] which describes a city integrated with "smart" technology to make life easier and more effective.

2. Literature Review

According to[38], the Smart City idea was created in response to advancing urban development as well as the greater amounts in demands of local societies, as well as rising financial and environmental costs. Since it contains the main such diverse domains as innovation, interaction, ecology, and sociology, it is exceedingly difficult to distinctly and precisely describe what a Smart City has been. Meanwhile, in his seminal article, [24], the concept of a Smart City is in a constant state of evolution, and the work of defining the development concept is ongoing. Moreover,[24]mentioned that Malaysia's development has always been in line with global development trends, such as the use of technology to transform the economy and urban life. Malaysia is not new to Smart Cities. In the 1990s, the Multimedia Super Corridor (MSC) was established as a special initiative to attract foreign information and communications technology (ICT) companies and develop domestic ICT companies to serve the domestic market in the demarcated area known as Cyberjaya. MSC has been instrumental in the development of digital skills and Smart City-related technology. Although the Smart City concept is relatively new to Malaysia, the idea of using technology to drive city development dates back to the first premiership of Tun Dr. Mahathir Mohamad, the country's fourth and seventh prime minister. Putrajaya, the federal administrative center, was conceived as an Intelligent Garden City, with its inhabitants' IT needs in mind, whereas Cyberjaya was modeled after Silicon Valley. On 1st November 2014, during the 2nd inter-session Global Science and Innovation Advisory Council (GSIAC) meeting in Kuala Lumpur, the Prime Minister of Malaysia endorsed the initial concept of Smart City development in Malaysia [37;34;26;22]. The participating ministers were tasked with initiating Smart-related projects in Iskandar Malaysia regional development. Smart City-related policy did not appear in an official federal government document until the 11th Malaysia Plan (2016-2020). As highlighted in the plan, the Smart City outlook includes smart governance, smart mobility, smart technology, smart infrastructure, and smart citizens. Given the widespread policy support for Smart Cities, there is currently no single federal authority in Malaysia responsible for their implementation. Nonetheless, the Ministry of Housing and

Local Government (KPKT) has just released the Malaysian Smart City Framework 2018, which outlines the country's Smart City implementation strategies.

The Malaysian Smart City Framework background provides a comprehensive overview of Malaysia's physical, economic, and legal conditions. Smart City Initiatives in Malaysia is a novel approach to promoting Smart City planning, construction, strategic planning, and services through the use of IoT, cloud computing, big data, spatial geographic information integration, and other technologies. Malaysia's commitment to a global agenda is supported by several development strategies and plans, including the SDGs and the New Urban Agenda (NUA). Malaysia's planning process included several related goals and objectives aimed at transforming Malaysian cities into Smart Cities. According to the Malaysian Industry-Government Group for High Technology,[10], four (4) Malaysian cities have joined the ASEAN Smart City Network (ASCN): Kuala Lumpur, Kota Kinabalu, Kuching, and Iskandar Malaysia. Other Malaysian cities, such as Georgetown, Shah Alam, Cyberjaya, Putrajaya, and Bandar Melaka, for Smart City initiatives to be implemented in their communities. Malaysia's Smart City policy has been called into questionTo gain a deeper understanding of the nature of a Smart City, it is necessary to examine its constituent parts [38]. Several of Malaysia's Smart City policies are shown in Table 1. The Smart City's component that links directly to urban planning aspects technically can be seen in the implementation of (1)Smart Mobility which are transportation, movement, traffic management, and so forth, (2)Smart Economy which is the industrial park or commercial area focuses, (3) Smart Environment which is waste management, low- carbon, green building and so forth, (4) Smart People which are communities participatory in the planning process like Seranta(Public Hearing), (5) Smart Government which are e-government and (6) Smart Digital Infrastructure which are Wifi, High-speed Internet, 5G and so forth[23].

Table 1. Smart City Policy in Malaysia

Smart City Policy	Level	Smart City Component
Malaysia Smart City Framework	• National (Malaysia)	• Smart Economy • Smart People • Smart Government • Smart Mobility • Smart Living • Smart Digital Infrastructure
Smart Selangor Blueprint	• State (Selangor)	• Smart Governance • Smart Disaster Management • Smart Building • Smart safety and security • Smart food and Agro • Smart Energy • Smart Water Management • Smart Digital Infrastructure • Smart Transport and Mobility

		• Smart Waste Management • Smart Healthcare and Wellbeing • Smart Education
Penang 2030	• State (Penang)	• Smart Community • Smart Environment • Smart Government • Smart Mobility • Smart Economy
Sarawak Digital Economy Strategy	• State (Sarawak)	• Digital Government • Digital Health • E-Commerce • Smart City • Cyber Security • Digital Innovation and Entrepreneur • Social • R&D • Digital and Data • Digital Skills and Talent Development • Digital Inclusivity • Digital Infrastructure Agriculture • Manufacturing IR 4.0 • Tourism
Cyberjaya Smart and Low Carbon City	• City (Cyberjaya)	• Smart Mobility • Walkability • Compact Development • Integrate Nature into Urban • Efficient and Effective Resource • Smart and Green Building • Smart Community

Smart City Iskandar Malaysia Framework	• Regional (Iskandar Malaysia)	• Smart Governance • Smart Living • Smart People • Smart Mobility • Smart Environment • Smart Economy

Source: Author, (2023)

PLANMalaysia is the progression with the most direct incorporation of the Smart City concept. The department has established two primary objectives for the development of smart cities: 1) to create an overall framework for the creation of smart cities in Malaysia, and 2) to serve as a reference stage for all government agencies to assist and verify the systematic implementation of Smart City development in Malaysia [23;31;37]. Concerning these objectives, the department has formulated policies, strategies, and an action plan based on urban categories and the national urbanization policy, as well as a mechanism for implementing and monitoring Smart City development. The inclusion of Smart City development in the National Physical Plan 3 (NNP3) shows the initiatives that the department would undertake to stimulate dynamic, balanced, and sustainable social, economic, and physical development. The Smart City initiatives are included in the NPP3 action plan, which suggests the expansion and improvement of the digital infrastructure and the strengthening of infrastructure facilities and services for Smart City initiatives. Through its third principle, the National Urbanisation Policy (NUP) has acknowledged the Smart City initiatives. The concept has highlighted several initiatives, such as fostering a thriving urban economy, bolstering digital applications by enhancing the preparedness of its urban services via electronic innovations, and promoting advanced automation across information dissemination and hands-on training. Although other ministries may not promote the Smart City agenda directly, several ministries and agencies have incorporated the enhancement of smart dimensions for the betterment of the areas under their purview. Noting that these initiatives do not directly reflect the Smart City development concept, but still fall within the Smart City dimensions, is important.

2.1 The urban planning aspect in Smart City applications in Malaysia.

According to [53], urban planning encompasses everything that must have a designated location within a city. A crucial aspect of urban planning is allocating space for people, buildings, roads, sewers, parks, and all the other elements that comprise a city. The land use component of a plan describes analyses and proposes changes or additions to a city's land utilization. In urban planning, a city's development is guided by its land use plan. Land use is the foundation of an urban plan. The organization of land uses determines the physical location and functional role of all other plan components, including housing, transportation, urban design, environmental resources and infrastructure, and public services. The community faces several challenges, including encouraging the redevelopment of existing urban areas, making room for new growth in ways that strengthen the community, and preventing urban sprawl from encroaching on rural and undeveloped areas. Urban planners have developed an interest in analyzing the development of smart cities from an urban planning perspective. At least there are three ministries in Malaysia played significant roles related to urban planning as well as urban management namely the 1) Ministry of Local Government Development,2) Ministry of Transport, and the Ministry of Energy, Science, Technology, Environment, and Climate Change (MESTECC), and Ministry of Science, Technology and Innovation (MOSTI) are involved in urban planning aspect based on the Smart City applications.

The Ministry of Transport and the Ministry of Energy, Science, Technology, Environment, and Climate Change (MESTECC) are among the ministries that can be related to urban planning in Malaysia

from a technical standpoint. As the primary driver of national development, the Ministry of Transport has responded to digital challenges by implementing enabling technologies in public transportation systems. To provide efficient and effective services, all modes of public transportation will require the most up-to-date technology and applications to assist passengers with trip planning. Recently, Keretapi Tanah Melayu (KTMB) introduced the 'MyRailTime' mobile application, which enables passengers to obtain essential commute-related information beginning with the KTM Komuter service. Users can view the schedule, arrival time, and departure time of KTM Komuter services at their respective stations in real time.

3. Methodology- Case Study Approach

This research applied a case study methodology to address the study's question with in-depth interviews as the data collection method. Therefore, towards the study of complex occurrences within a particular circumstance, qualitative methods for case studies emerge as the superior methodological approach. The majority of studies employing the case study method select a small geographical area and a small number of respondents as their subjects. Consideration must also be given to the type of case study to be conducted. To understand the nature of a unit, a case study is an in-depth comprehensive assessment of several small, but extremely in-depth units. The case study is also adaptable and "open-ended" to collect information that is not only relevant to research questions but also from the perspective of the study area alone. Similarly, a case study, as defined by [53], focuses on a comprehensive and real-world examination of a contemporary phenomenon (the case) and typically relies on multiple forms of evidence. Data collection is the process of obtaining the necessary information from interviewees who have been identified using a specific technique and set of procedures such as the officers from PlanMalaysia and PlanMalaysia Johor. For this study's collection of data, professionals in urban planning who has participated in smart city projects in Malaysia over the past four years will be interviewed. Generally, data collection of this study was done in the pilot survey in 1 month with day visits to PLANMalaysia Johor in September 2022, [42] PLANMalaysia Selangor via Zoom on October 2022, and via event held during World Urban Forum Malaysia in October 2022. Therefore, table 2 the case study of three states has been shown.

Table 2. The case study of three states

State	Description
Selangor	Instead of focusing on a single city, the Smart City initiative for Selangor was launched in 2015 to transform the entire state into Southeast Asia's leading Smart State by 2025. According to the Smart Selangor website, the smart philosophy for Selangor is based on citizen engagement, while technology is used as an enabler, and a special purpose vehicle, Menteri Besar Selangor Incorporated (MBI), was established to oversee the planned development. The Smart Selangor Blueprint states that the smart initiative uses smartphone apps to enhance democracy, infrastructural facilities, disaster risk management, buildings, safety and security, energy, water and waste management agriculture and food manufacturing, transportation and mobility, healthcare, and education. Smart Selangor Delivery Unit (SSDU) has been entrusted with driving the smart agenda. For example, the Smart Selangor Wi-Fi project, led by the installation of approximately 3,600 Wi-Fi hotspots throughout the state that provides free Wi-Fi to the public. In terms of Smart Mobility, the Smart Selangor Bus, in conjunction with the Selangor Intelligent Transport System app, improves the state's public transportation system. This entails providing a free, user-friendly, and efficient bus service. In 2018, the state government launched the Smart Selangor Parking app, which allows for online payment of parking fees. Users simply use the app to pay for parking instead of worrying about time running out as in previous metre and coupon systems. Drivers can also pay traffic compounds online with Smart

	Selangor Parking(urban planning in transportation). So far, five Selangor local governments have agreed to use this app: Shah Alam City Council (MBSA), Petaling Jaya City Council (MBPJ), Kajang Municipal Council (MPKj), Selayang Municipal Council (MPS), Ampang Jaya Municipal Council (MPAJ), and Sepang Municipal Council (MPSepang). As of 2017, the Smart Selangor Command Centre in Shah Alam has provided centralised disaster monitoring. Weather, sea level, air pollution index, floods (urban planning in the environment), Smart Selangor Bus (urban planning in transportation), and Smart Selangor Wi-Fi (urban planning in infrastructure and services) are all monitored by the command centre. The Communities OnLine (COOL) app was released in 2019 as a digital platform for citizen engagement.
Penang	Ahead of schedule in 2018, the Penang Island City Council (MBPP) announced its intention to transform George Town into a Smart City, including an emphasis on governance, planning, mobility, social engagement, economy, and environment. In the same year, IBM, MBPP's private partner, established an intelligence operation centre to combat traffic congestion(urban planning in transportation), mitigate flash floods, and improve incident preparedness and response time(urban planning in the environment). IBM has attempted to advise on appropriate AI, blockchain, IoT, and cloud computing technologies(urban planning in infrastructure and services) for MBPP; AI technology will be used to increase MBPP personnel productivity and efficiency, and blockchain technology will be developed and implemented to improve transactions and core services, IoT technology will enable better preparedness and effective resource allocation, and cloud computing infrastructure will be used to facilitate MBPP Smart City operations. Seberang Perai will be granted city status later this year, according to an announcement made a year later in March 2019. Furthermore, the Seberang Perai Municipal Council (MPSP) was reported to be working with Intel on a Smart City vision for the city called SCOPE (Smart City of Penang). Underneath the slogan 'Seberang Perai Resilient, Inclusive, Green, and Competitive,' Seberang Perai is projected to become a Smart City with a low carbon footprint by 2022. The project will address the four major urban issues facing the city: traffic congestion, flash flooding, solid waste management, and environmental concerns. Intel developed a dashboard that integrated existing systems into a unified platform. In 12 hotspots, sensors to monitor water levels, 194 CCTVs to monitor traffic flow, and an Environment Monitoring System to supervise the temperature, humidity, and air quality of the city have been implanted.
Johor	Iskandar Malaysia has been promoted as Malaysia's test bed for Smart City implementation. Formerly known as the South Johor Economic Region (SJER), the 2,217-square-kilometer economic region was restructured, rebranded, and launched as Iskandar Malaysia in 2006. The economic region has strived to balance its economic and social development with environmental concerns based on the six Smart City dimensions, with a new vision of a Metropolis of international standing. The Iskandar Regional Development Authority (IRDA) was founded by a parliamentary act as the region's development authority. IRDA and MIMOS Bhd have formed a partnership to develop smart technologies for deployment in Kulai and Sedenak[44].Iskandar Malaysia is Southeast Asia's largest megaregion, three times the size of Singapore, with a population of 1.3 million (one-third the population of Singapore). Iskandar Malaysia's master plan known as Comprehensive Development Plan 2006-2025 (CDP) iii strengthens this area as one of the ‘smartest regions’. The guiding principle of Smart City for Malaysia is to transform Malaysians' living standards through a sustainable economic and technological ecosystem to achieve

	"smart and inclusive socio-economic growth" enabled by green technology and ICT [44]. In this regard, Iskandar Malaysia's Smart City implementation differs from that of other Smart Cities because it was prompted by the Federal Government. The Smart City initiative was founded on five pillars: (i) Creating a stimulative effect for job creation and economic expansion throughout the nation to accomplish better habits; (ii) Integration with initiatives mentioned inside the 24 accepted and endorsed blueprints; (iii) Coherent with certain other on-going projects and initiatives in Iskandar Malaysia; (iv) A simpler and much more productive lifestyle and corporate atmosphere utilizing technology; and (v) Generating significant motivation to accomplish Iskandar Malaysia's vision [44]. Meanwhile, the Menteri Besar of Johor (MB) Chief Minister presided over the Johor State Planning Committee Meeting No. 1/2021 on April 4, 2021. The Johor State Menteri Besar proposed that efforts be made to provide the Johor State Smart City Blueprint. The Johor State Smart City Blueprint serves as a state-wide blueprint for all districts in Johor. This is for Johor to prepare its cities for Smart City status by 2030. Johor's smart cities will be built using the Malaysian Smart City Framework and Disaster Resilient Town Planning Guidelines. The adoption of emerging and alternative technologies will be considered in the development of smart cities in Johor. Johor's achievement as a Smart City-state ought to be based on the People-Centric Smart City, which is centred on the community as a consumer. This is done to meet needs and assist a city in functioning properly and efficiently. It combines infrastructure thinking, open data sharing, urban system operation, and digital services. The Smart City Integrated Operation Center and Smart City Dashboard is being available in 2021. The development of a special display of smart cities following the Malaysian Urban Observatory (MUO) began in the Batu Pahat MP area.

4. Discussion and Conclusion

A certain section outlines the experiences and findings of the researchers for the corresponding case studies. Throughout this qualitative study, a comparative analysis was conducted. The resemblances and distinctions between Smart City initiatives from respective blueprints and frameworks are presented in Table 3 utilizing the three case studies mentioned previously.

The term "Smart Cities" has become so overused that it risks becoming interchangeable with other urban planning terms. In every Smart City, the three factors of technology, connectivity, and engagement should be present. Technology necessitates connectivity, such as user-provider and user-user connections, as well as infrastructure integration through a centralised channel to standardise all accessible services.

The viability of smart projects is ultimately determined by stakeholder participation. According to the city experiences of Selangor, Penang, and Johor, one of the most difficult challenges is customising Smart City applications related to urban planning, as opposed to arbitrarily investing in and implementing the latest adaptable technology. Simultaneously, rigorous linked infrastructure development considerations should be conducted to avoid repeating the historical errors of wasteful expenditures on technological infrastructure. Smart City in urban planning is not about sensor devices and real-time data, but rather about making better use of existing data and making it approachable to communities. The suggestions for current blueprints and frameworks should be reexamined after nearly five years of Smart City policy implementation to make it more updated with the current needs and demands, especially from urban planning perspectives.

Table 3. Variations of Smart City urban planning applications in Selangor, Penang, and Johor

Components	**Selangor**	**Penang**	**Johor**
Name of Policy	Smart Selangor Blueprint	Penang 2030	• Smart City Iskandar Malaysia Framework • Smart City Johor Blueprint
Level	State/ Local authority	State/ Local authority	• Regional/Local authority • State/Local authority
Local Authority	The Shah Alam City Council (MBSA)	Penang Island City Council (MBPP)	• The Iskandar Puteri City Council/Majlis Bandaraya Iskandar Puteri (MBIP) • PLANMalaysia Johor
Start	2015	2018	• 2012 • 2021
End	2025	2030	• -
Descriptions	Technology-driven and application	Technology and community based	• Thoroughly focus on the broad context of regional level • Smart City people centric

Source: Author, 2023

This paper is intended for urban planners, local authorities, policymakers, and local development agencies in Malaysia to stimulate the advantage of the potential innovation of smart city applications in urban planning. Possible future research in this area could investigate the role of planners as programmers, data analysts, and software developers in smart city initiatives. In addition, this may be beneficial to inquire planners about what, if any, repercussions the implementation of smart city innovations has on those collaborating to train young urban planners.

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