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# Examining the Well-being of Citizens' Satisfaction: Comparing smart cities in Malaysia and China

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**Abstract**
In the digital era, smart cities are a potential solution as cities get more crowded and complex. This study investigates and assesses whether citizens' well-being is promoted by developing a smart city, consistent with Sustainable Development Goals 3 and 11. Online questionnaires were distributed to 105 and 134 citizens residing in Malaysia and China's smart cities respectively. Data was analysed using a structural equation modelling technique (SEM). This research supports the theoretical underpinnings of how smart cities are considered to be developed and the importance of citizen satisfaction as a mediator when evaluating citizens' well-being.

Keywords: smart cities; well-being; citizen satisfaction; SDG 3 & 11


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## 1.0 Introduction

The world population has continuously grown in urban and rural areas totaling 8 billion by mid-November 2022 (World Population Review, 2022). In 2023, the population in Eastern and South-Eastern Asia is expected to be the highest percentage among all regions with 2.35 billion or 29 % of the world population (United Nations Populations Fund, 2023). As economies of different countries shift to industrialisation, many people from rural areas continuously migrate to urban areas.

Urbanisation happens when cities grow due to increasing percentages of the population moving to a city (Tan et al, 2021). This leads cities to consume about 75% of global energy production and produce 80% of CO2 emissions (Lazaroiu & Roscia, 2012). Because of these challenges, the European Commission developed a sustainable urban model called "smart city".

As we traverse the 21st century, populations in Malaysia and China will likely to continue to grow. Subsequently, the urban areas in these countries, more popularly referred to as "smart cities", will continue to increase in population and can pose several consequences for the urban dwellers. Having this momentum of the inevitable growth of smart cities in Malaysia and China, this study aims to investigate and evaluate a scale that assesses whether citizens' well-being is promoted by developing a smart city, consistent with Sustainable Development Goal (SDG) 3 on good health and well-being and SDG 11 on sustainable cities and communities. Specifically, this study aims to identify the factors that influence citizens' well-being and to examine the mediator effect of citizen satisfaction between perceived

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smart public service (PSPS), perceived smart infrastructure (PSI), perceived smart environment protection (PSEP), and well-being in smart cities, comparing the situation in Malaysia with China.

*1.1 Problem of the Study*

The influx of citizens to smart cities in recent years has significantly altered its ecosystem's social and economic facets. Demands for better living conditions and higher income to sustain the well-being of its citizens in these cities have prompted governments to introduce smart-city initiatives in their countries. Such initiatives seem technologically feasible and relevant to inroads towards digital societies. Nonetheless, limited empirical evidence and scholarly work support the development of smart cities, particularly those which focus on the well-being of their citizens. These issues intensify when more and more cities end up with urbanisation problems with the introduction and development of smart cities in the countries. The impact and contributions of the smart-city initiatives have yet to be holistically surveyed and documented. Thus, this study is expected to contribute to answering such queries and providing justifications for the complex implications of smart-city development.

*1.2 Objectives of Study*

This study investigates the citizens' perceived smart city initiatives, namely the smart infrastructure, public service, and environmental protection effects on their well-being. It also intends to measure the significant relationship between the citizen's level of satisfaction, which acts as the mediator in affecting the citizen's well-being against the smart cities' perceived smart infrastructure, public service, and environmental protection.

## 2.0 Literature Review

*2.1 Smart Cities in Malaysia*

In Malaysia, the concept of a Smart City is rooted in several policies and development plans that include the 11th Malaysian Plan, National Physical Plan 3 (NPP3), National Urbanisation Policy 2 (NUP2), Malaysia Smart City Framework, Putrajaya Smart City Blueprints, Smart City Iskandar Malaysia, Green Technology Master Plan 2017 – 2030 and Low Carbon Cities Framework (LCCF). The Smart City Framework Malaysia (MSCF) is created to be the national-level framework for local authorities in holistically planning and developing smart cities in Malaysia. City managers, state governments, federal ministries and departments, industry players, academicians and other stakeholders are expected to address urban challenges based on three pillars: competitive economy, sustainable environment, and enhanced quality of life (MyGovernment, 2023).

Such plans are intended to strengthen Malaysian Cities' competitiveness and support the attainment of Sustainable Development Goals (SDGs) and New Urban Agenda (NUA) (Samsudin et al., 2022). With daily urban issues on congestion, energy, crime, pollution, and waste management, urban planners consider implementing Smart Cities as a primary solution (Samsudin, et al., 2022). Putrajaya and Iskander Puteri cities, in Malaysia, both introduced their smart city blueprints focused on city (micro) level implementation and regional (macro) level, respectively (Samsudin, et al., 2022).

There are several smart city initiatives introduced in Malaysia. In Melaka, residents positively view the role of smart meters to be aware of the smart living concept using energy-efficient appliances (Nasir et al., 2018). To reduce river pollution in Sarawak, an e-hailing app prompts community members to collect or clear garbage based on their geolocation (Rohana et al., 2019). At Georgetown World Heritage Site, urban public space revitalization strategies were proposed to ensure the comprehensive delivery of public space benefits for the people (Omar et al., 2018). Such efforts are important since there is a significant correlation between the level of the environment and the quality of life in the city of Malaysia among urban inhabitants (Eusuf et al., 2018).

Despite these smart cities' initiatives, acceptance and implementation have not always been positive. People's level of involvement in Melaka Green Technology City State initiatives like *Melaka Without Plastic Bag and Polystyrene*, *Green Transportation* and *2+1 Recycling Program* are relatively low (Abdullah, 2018). The concept of bicycle sharing as a move to reduce urban pollution is not that acceptable for public transport commuters (Rosnan & Abdullah, 2018).

Some of the major barriers to Malaysia's move towards the implementation of smart and eco-friendly mobility practices like cycling, carpooling and car sharing include weather, safety, security and inappropriate infrastructure (Brohi et al., 2018). Though common facilities are provided for people with disabilities (PWDs) in Malaysian public transport stations, they are found to be not functioning well and are not convenient for use for PWDs (Zainol et al., 2018).

Since urban dwellers are primarily living in smart cities, there is a need to explore the status of the well-being of urban dwellers. Selected administrative personnel of a Malaysian university consider themselves to have good economic well-being which resulted from their coping abilities to maintain living in the urban area (Harith & Noon, 2015). In Putrajaya and Iskander Puteri, there are still no clear measurement methods or indicators that can assess the achievement of Smart City initiatives implemented at the local level (Samsudin, et al., 2022). Furthermore, according to Chong et.al. (2022), citizen readiness to participate in smart city initiatives will impact the sustainability of smart cities.

*2.2 Smart Cities in China*

The growth of smart cities is highly valued by the Chinese government. With Beijing's decision to focus on building smart cities in 2009, several cities, like "Smart Nanjing" and "Smart Guangzhou," adopted the "Smart Beijing" concept. The size of the smart city construction crew has gradually increased. Building smart cities was thrust straight into the national economy in 2010 with the introduction of the 12th

Five-Year National Plan. The Chinese government proposes to "accelerate digitalization-based development and construct a digital China" to "adapt to globalisation" in the fifth section of the "Outline of the People's Republic of China 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035", "accelerate digitalization-based development and construct a digital China", the Chinese government proposes to "accelerate digitalization-based development and construct a digital China" to "adapt to the new trend of the full integration of digital technology into social communication and daily life, promote innovation in public services and the methods of operation of society, and build a digital life enjoyed by all", which points out the direction for the construction and development of smart cities in the new era (State Council of the People's Republic of China, 2021). To create livable, resilient and smart cities, President Xi Jinping declared at the 20th National Congress of the Communist Party of China in October 2022 that China would advance new urbanisation that is centred on people and work more quickly to grant eligible individuals who move from rural to urban areas permanent urban residency (State Council of the People's Republic of China, 2022).

Building new smart cities is progressively becoming popular in China as a new style of urban development and governance model. China's population will consist of 64.7% of permanent urban inhabitants by 2022. (National Bureau of Statistics of China, 2022). In China, the number of smart cities being built is increasing. The number of proposed or under-construction smart cities in 2019 was 100% of cities above the sub-provincial level and 95% above the prefectural level, totaling about 700 cities (including county-level cities) (Hu, 2019). In 2021, the number exceeded 800, which is the largest scale in the world and creates multiple smart city clusters (Huang et al., 2021). Improvements have been made in all areas, including the level of livable environments, precise governance, information resources, reform, and innovation (Zhang et al., 2022). Building smart cities is now a key strategy for advancing China's economic reform, industrial modernization, and increased urban competitiveness overall (Wang & Deng, 2022).

*2.3 Perceived Smart Infrastructure*

Using ICT, smart infrastructure offers unique qualities and connectivity that hasten the transition to social, environmental, and economic sustainability (Savastano et al., 2023). The governing and administrative authorities can monitor, access, and control infrastructure services and natural resources thanks to smart infrastructure's more user-friendly processes. Smart infrastructure uses a variety of enabling technologies to manage infrastructure services more sustainably. Moreover, smart infrastructure is the perfect response to the problems brought on by ageing infrastructure and rising demand (Berglund et al., 2020).

Infrastructure that is perceived as being smart, such as transportation systems, electrical grids, water networks, and logistical systems, is referred to as perceived smart infrastructure. The greatest path ahead for sustainable development, increased safety, health, and administration of smart cities is considered revamping infrastructure development with the best-emerging technology and new procurement strategies (Jayasena et al., 2022). Hence, the first hypothesis in this study is:

H1. Perceived smart infrastructure has a significant influence on citizens' well-being.

*2.4 Perceived Smart Public Service*

Architecture now requires the use of smart devices. On the other hand, these architectural designs make up a system to implement the idea of smart cities. These smart gadgets are being used by many cyber-physical systems in smart cities, such as smart social security, smart healthcare, smart education, smart construction services, etc. (Khalil et al., 2022).

Perceived smart public service refers to the level of intelligence associated with public services as perceived by urban residents. Telemedical services, online social security, digital education, construction services, and other services are frequently used as indicators of such intelligence. Hence, the second hypothesis in this study is:

H2. Perceived smart public service has a significant influence on citizens' well-being.

*2.5 Perceived Smart Environment Protection*

Perceived smart environmental protection refers to the sophistication of urban environmental protection techniques, such as the use of smart technologies to reduce pollution emissions, monitor the environment, and simplify rubbish disposal.

Hence, the third hypothesis in this study is:

H3. Perceived smart environmental protection has a significant influence on citizens' well-being.

*2.6 Citizen Satisfaction*

Comparing one's reality and expectations results in the subjective emotion of satisfaction. The expression of emotions, which are communicable, is the external manifestation of satisfaction. The centrality of technology as a force of revolutionary change is one of the discourses around smart cities that stands out the most. Yet, literature has emerged that challenges the techno-determinism present in discussions of smart cities (Odendaal, 2021). A corpus of literature on civic governance with a focus on the city has developed as a result of expectations of worries about sophisticated ICT as an urban solution (Park & Yoo, 2023), and it now includes a discussion of the people's pleasure. Hence, the next seven hypotheses are formed as below:

H4. Perceived smart infrastructure has a significant influence on citizen satisfaction.

H5. Perceived smart public service has a significant influence on citizen satisfaction.

H6. Perceived smart environmental protection has a significant influence on citizen satisfaction.

H7. Citizen satisfaction has a significant influence on citizens' well-being.

H8. Citizen satisfaction as a mediator significantly influences the relationship between perceived smart infrastructure and citizens' well-being.

H9: Citizen satisfaction as a mediator significantly influences the relationship between perceived smart public service and citizens' well-being.
H10: Citizen satisfaction as a mediator significantly influences the relationship between perceived smart environmental protection and citizens' well-being.

*2.7 Well-being*

The pursuit of well-being has never ceased as human civilisation has evolved. Happiness has always been regarded as human behaviour's highest pursuit and ultimate goal (Martela & Sheldon, 2019). For many years, philosophers have devoted themselves to exploring the meaning and ultimate significance of well-being. In philosophy, the concept of happiness was first introduced by some ancient Greek thinkers such as Epicurus and Aristotle (O'Keefe, 2014). Early views assumed that happiness would be gained by living a rational and active life or defined happiness in terms of external criteria such as virtue and holiness. Aristotle introduced the concept of perfectionism, the idea that perfectionist happiness, i.e.rational happiness, could be attained through a good and moral life, an ideal state of affairs judged by particular values (McPherson, 2020). Below is the research framework of the study,

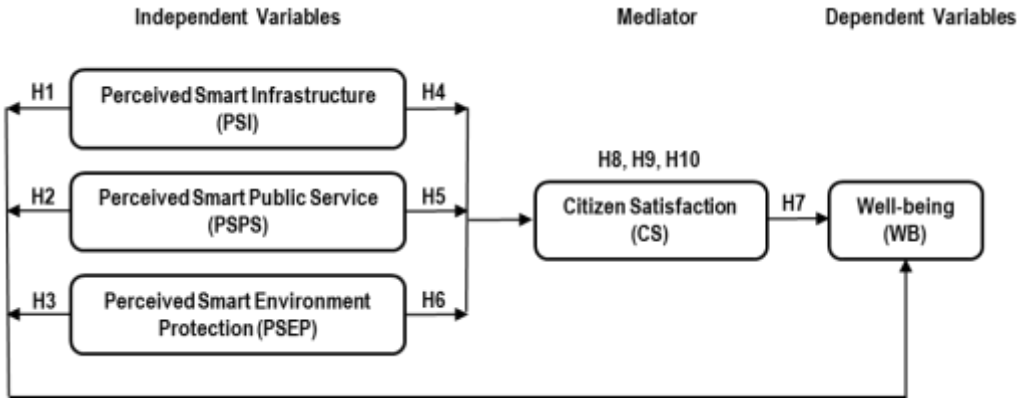


Fig. 1: The Research Framework
*(Source: Formulated based on authors' review of literature)*

## 3.0 Methodology

A self-administered survey was distributed using Google Forms in Malaysia and Questionnaire Star for China using a purposive sampling technique. Online survey questionnaires were sent to 245 respondents, where only 239 of them were usable; 105 were from Malaysia and 134 were from China. The data was analysed using PLS-SEM to identify the components that contribute to well-being. The constructs of smart cities based on the issue in the discussion include perceived smart environmental protection, perceived smart public service, and perceived smart infrastructure. The sections of the questionnaire were derived from the sources given in Table 1 below.

Table 1: Constructs and the source of adaptation of items

| Constructs | Studies |
|---|---|
| Perceived Smart Infrastructure | Yu, C., Ye, B., Lin, C., & Wu, Y. J. (2020) |
| Perceived Smart Public Service | Yu, C., Ye, B., Lin, C., & Wu, Y. J. (2020) |
| Perceived Smart Environment Protection | Yu, C., Ye, B., Lin, C., & Wu, Y. J. (2020) |
| Citizen Satisfaction | Chan, F. K., Thong, J. Y., Brown, S. A., & Venkatesh, V. (2021) |
| Well-being | Pontin, E., Schwannauer, M., Tai, S., & Kinderman, P. (2013) |

*(Source: Author)*

There were more female participants than males in both countries with Malaysia (56.2%) and China (70.9%). The majority of the respondents in both countries are between the ages of 21 and 30. 90.3 per cent of China's respondents are younger than 30 years old. The majority of the respondents are students. Most respondents earned a monthly income below RM8,000; in Malaysia (RM8,000) and China (RMB8,000). Among the smart cities in Malaysia, most respondents reside in Sarawak. While in China, the majority of the respondents stay in Jinan. The demographic profile for respondents is shown in Table 2 below.

Table 2: Demographic profile for respondents in Malaysia and China

| Variables | Malaysia N (%) | China N (%) | Variables | Malaysia N (%) | China N (%) |
|---|---|---|---|---|---|
| **1) I am currently staying in (N=105 and 134)** | | | **4) Highest level of educational attainment (N=105 and 134)** | | |
| Kuala Lumpur / Beijing | 14 (13.3) | 3 (2.2) | Diploma | 26 (24.8) | 10 (7.5) |
| Putrajaya / Shanghai | 10 (9.5) | 4 (3.0) | Bachelor | 50 (47.6) | 86 (64.2) |

| | | | | | |
|---|---|---|---|---|---|
| Selangor / Zibo | 18 (17.1) | 2 (1.5) | Master | 23 (21.9) | 35 (26.1) |
| Johor / Jinan | 10 (9.5) | 61 (45.5) | DBA/PhD | 6 (5.7) | 3 (2.2) |
| Penang / Binzhou | 14 (13.3) | 1 (0.7) | **5) Marital Status (N=105 and 134)** | | |
| Sabah / Dezhou | 8 (7.6) | 3 (2.2) | Single | 70 (66.7) | 120 (89.6) |
| Sarawak / Dongying | 31 (29.5) | 2 (1.5) | Married | 35 (33.3) | 14 (10.4) |
| Guizhou | | 2 (1.5) | **6) Occupation (N=105 and 134)** | | |
| Heze | | 1 (0.7) | Academic | 14 (13.3) | 6 (4.5) |
| Jining | | 8 (6.0) | Private | 73 (69.5) | 10 (7.5) |
| Jinzhou | | 1 (0.7) | Government | 0 (0.0) | 4 (3.0) |
| Kaifeng | | 1 (0.7) | NGO | 0 (0.0) | 4 (3.0) |
| Laizhou | | 1 (0.7) | Student | 18 (17.1) | 110 (82.1) |
| Liaocheng | | 2 (1.5) | **7) Management Level (N=105 and 134)** | | |
| Linyi | | 4 (3.0) | Top Management | 12 (11.4) | 2 (1.5) |
| Qingdao | | 12 (9.0) | Middle Management | 23 (21.9) | 5 (3.7) |
| Rizhao | | 1 (0.7) | Executive | 16 (15.2) | 3 (2.2) |
| Shenyang | | 1 (0.7) | Non-Executive | 16 (15.2) | 7 (5.2) |
| Shijiazhuang | | 1 (0.7) | Others | 38 (36.2) | 117 (87.3) |
| Taiyuan | | 2 (1.5) | **8) Household Income level (monthly) (N=105 and 134)** | | |
| Taian | | 10 (7.5) | RM 1001 - RM 3000 / RMB 1001 - RMB 3000 | 18 (17.1) | 16 (11.9) |
| Tianjin | | 1 (0.7) | RM 3001 - RM 4000 / RMB 3001 - RMB 4000 | 25 (23.8) | 17 (66.0) |
| Weifang | | 6 (4.5) | RM 4001 - RM 6000 / RMB 4001 - RMB 6000 | 24 (22.9) | 25 (18.7) |
| Xinxiang | | 1 (0.7) | RM 6001 - RM 8000 / RMB 6001 - RMB 8000 | 12 (11.4) | 19 (14.2) |
| Yantai | | 2 (1.5) | RM 8001 - RM 10,000 / RMB 8001 - RMB 10,000 | 6(5.7) | 19 (14.2) |
| Zhuhai | | 1 (0.7) | RM 10,001 - RM 12,000 / RMB 10,001 - RMB 12,000 | 2 (1.9) | 12 (9.0) |
| **2) Age (years) (N=105 and 134)** | | | RM 12,001 - RM 15,000 / RMB 12,001 - RMB 15,000 | 2 (1.9) | 8 (6.0) |
| 21-30 | 53 (50.5) | 121 (90.3) | Above RM 15,000 / Above RMB 15,000 | 1 (1.0) | 15 (11.2) |
| 31-40 | 31 (29.5) | 2 (1.5) | Not Applicable | 15 (14.3) | 3 (2.2) |
| 41-50 | 17 (16.2) | 8 (6.0) | **9) Ethnicity (N=105 and 134)** | | |
| 51-60 | 1 (1.0) | 1 (0.7) | Malay / Han | 17 (16.2) | 129 (96.3) |
| 61 and above | 3 (2.9) | 2 (1.5) | Chinese / Others | 82 (78.1) | 5 (3.7) |
| **3) Gender (N=105 and 134)** | | | Indian | 3 (2.9) | |
| Male | 46 (43.8) | 39 (29.1) | Others | 3 (2.9) | |
| Female | 59 (56.2) | 95 (70.9) | **10) Do you have any children? (N=105 and 134)** | | |
| | | | Yes | 27 (25.7) | 13 (9.7) |
| | | | No | 78 (74.3) | 121 (90.3) |

*(Source: Author)*

## 4.0 Findings

The findings of the hypotheses testing are as shown in Table 3 below. There are six figures (Fig. 2 to Fig. 7) shown below including path analysis and bootstrapping results in Malaysia, China and a combination of both countries in the study. It is worth mentioning that in China the level of citizen satisfaction can be explained by perceived smart infrastructure, perceived smart public service and perceived smart environment protection with an $R^2$ of 0.864.

Table 3: Results of hypothesis testing in Malaysia, China and the Combination of Two Countries

| Hypothesis | Relationship | T statistics | P-values | Results |
|---|---|---|---|---|
| H1 | Perceived Smart Infrastructure → Well-Being | MAL: 0.224<br>CHI: 0.194<br>COM: 0.027 | MAL: 0.412<br>CHI: 0.423<br>COM: 0.489 | MAL: Rejected<br>CHI: Rejected<br>COM: Rejected |
| H2 | Perceived Smart Public Service → Well-Being | MAL: 1.962<br>CHI: 0.784<br>COM: 1.899 | MAL: 0.025<br>CHI: 0.216<br>COM: 0.029 | MAL: Accepted<br>CHI: Rejected<br>COM: Accepted |
| H3 | Perceived Smart Environment Protection → Well-Being | MAL: 1.312<br>CHI: 0.453<br>COM: 0.238 | MAL: 0.095<br>CHI: 0.325<br>COM: 0.406 | MAL: Rejected<br>CHI: Rejected<br>COM: Rejected |
| H4 | Perceived Smart Infrastructure →Citizen Satisfaction | MAL: 0.721<br>CHI: 1.339<br>COM: 1.326 | MAL: 0.236<br>CHI: 0.090<br>COM: 0.093 | MAL: Accepted<br>CHI: Rejected<br>COM: Rejected |
| H5 | Perceived Smart Public Service →Citizen Satisfaction | MAL: 2.458<br>CHI: 2.382<br>COM: 3.838 | MAL: 0.007<br>CHI: 0.009<br>COM: 0.000 | MAL: Accepted<br>CHI: Accepted<br>COM: Accepted |
| H6 | Perceived Smart Environment Protection → Citizen Satisfaction | MAL: 5.676<br>CHI: 5.215<br>COM: 7.921 | MAL: 0.000<br>CHI: 0.000<br>COM: 0.000 | MAL: Accepted<br>CHI: Accepted<br>COM: Accepted |
| H7 | Citizen Satisfaction → Well-Being | MAL: 0.170<br>CHI: 2.361<br>COM: 1.676 | MAL: 0.433<br>CHI: 0.009<br>COM: 0.047 | MAL: Rejected<br>CHI: Accepted<br>COM: Accepted |
| H8 | Perceived Smart Infrastructure →Citizen Satisfaction → Well-Being | MAL: 0.090<br>CHI: 1.097<br>COM: 0.939 | MAL: 0.464<br>CHI: 0.136<br>COM: 0.174 | MAL: Rejected<br>CHI: Rejected<br>COM: Rejected |
| H9 | Perceived Smart Public Service →Citizen Satisfaction → Well-Being | MAL: 0.153<br>CHI: 1.683<br>COM: 1.416 | MAL: 0.439<br>CHI: 0.046<br>COM: 0.078 | MAL: Rejected<br>CHI: Accepted<br>COM: Rejected |
| H10 | Perceived Smart Environment Protection → Citizen Satisfaction → Well-Being | MAL: 0.173<br>CHI: 2.087<br>COM: 1.692 | MAL: 0.431<br>CHI: 0.018<br>COM:0.045 | MAL: Rejected<br>CHI: Accepted<br>COM: Accepted |

*(Source: Author)*

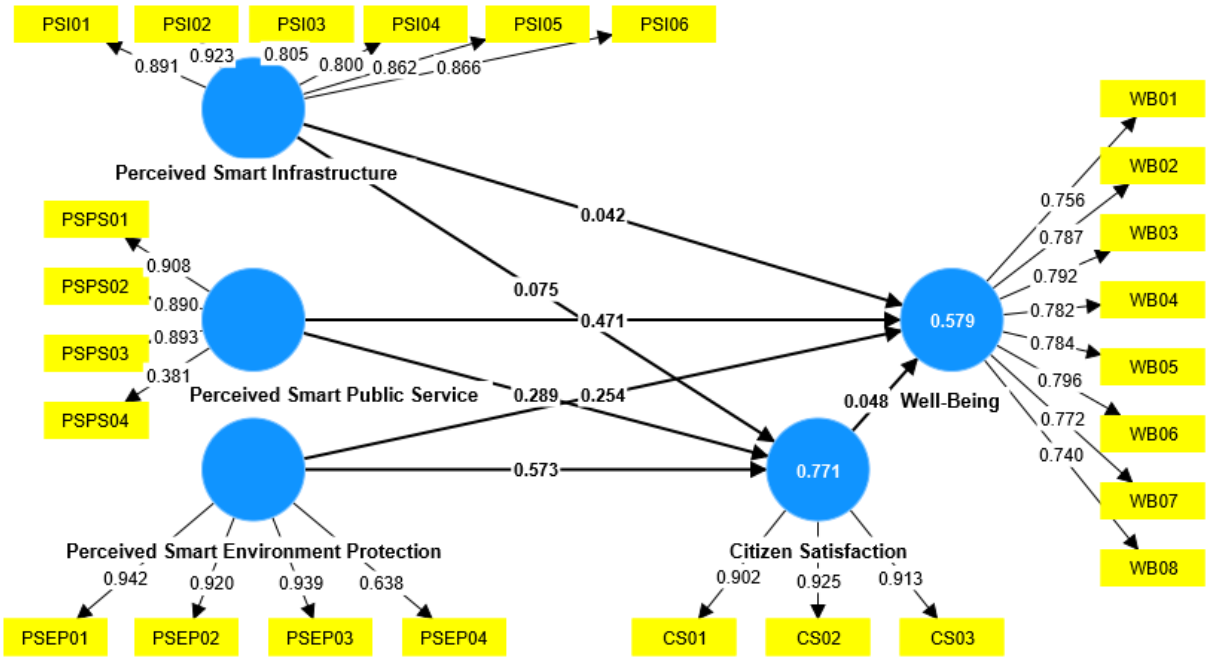


Fig. 2: Results of the path analysis: Malaysia (N=105)
*(Source: Authors)*

In Figure 2, the $R^2$ for perceived smart infrastructure (PSI01- PSI06), perceived smart public service (PSPS01 – PSPS04) and perceived smart environment protection (PSEP01-PSEP04) towards well-being (WB01-WB08) is 0.579 whereas citizen satisfaction

(CS01-CS03) is 0.771 which is higher than the well-being effect. The model is able to explain 77.1% of citizen satisfaction in Malaysia and 57.9% of the well-being effect.

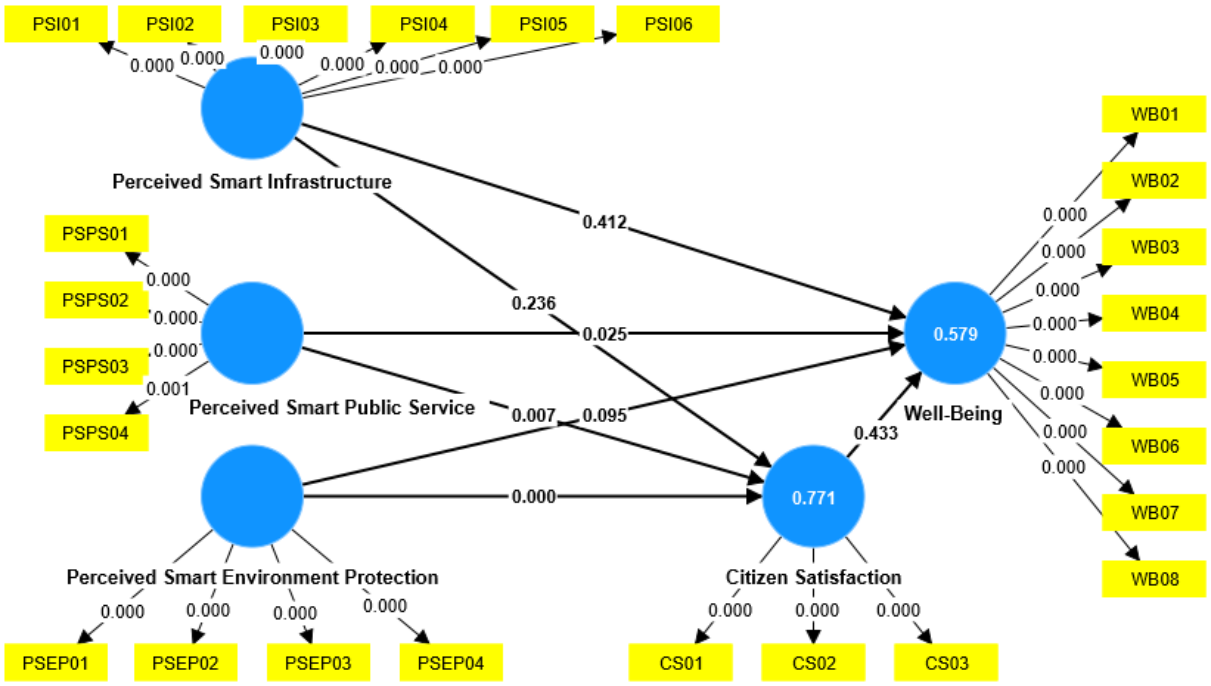


Fig. 3: Results of bootstrapping: Malaysia (N=105)
*(Source: Authors)*

The bootstrapping results show the T-values of perceived smart infrastructure (PSI01- PSI06), perceived smart public service (PSPS01 – PSPS04) and perceived smart environment protection (PSEP01-PSEP04) towards well-being (WB01-WB08) and the mediating effect of citizen satisfaction (CS01-CS03) towards well-being in Malaysia.

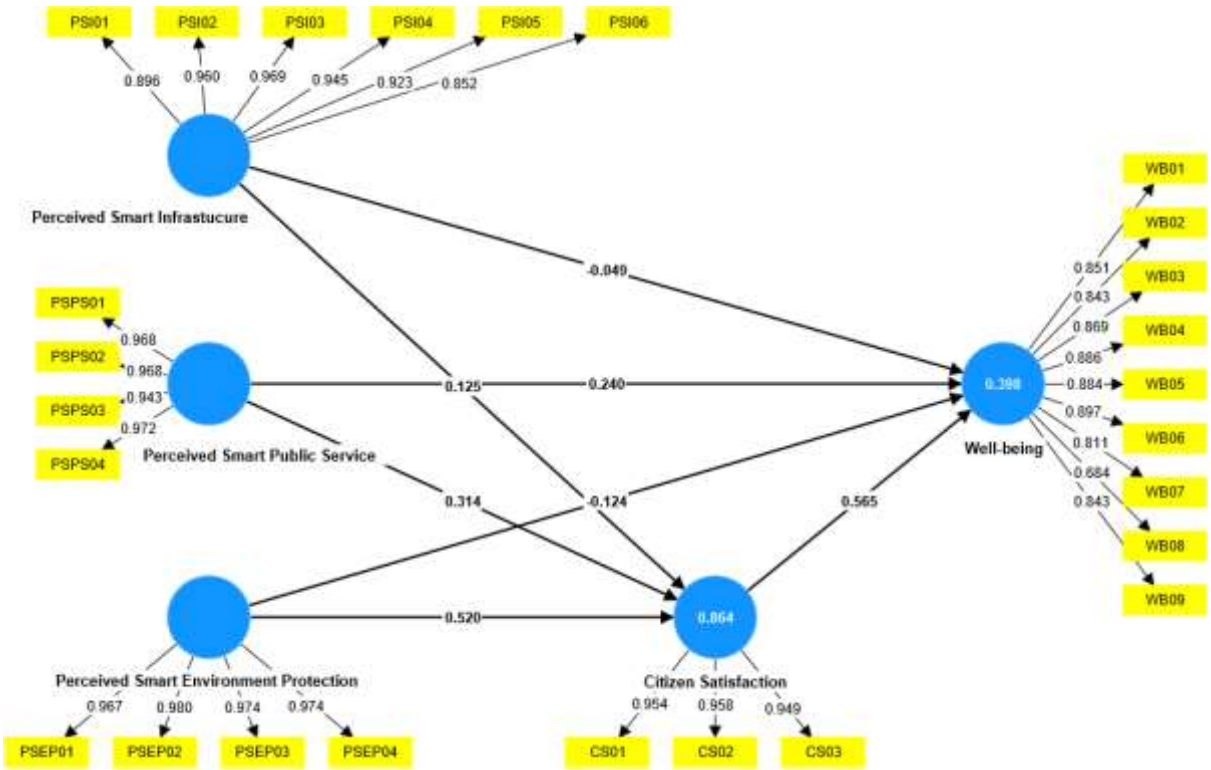


Fig. 4: Results of the path analysis: China (N=134)
*(Source: Authors)*

In Figure 4, the $R^2$ for perceived smart infrastructure (PSI01- PSI06), perceived smart public service (PSPS01 – PSPS04) and perceived smart environment protection (PSEP01-PSEP04) towards well-being (WB01-WB08) is 0.398 whereas citizen satisfaction (CS01-CS03) is 0.864 which is higher than the well-being effect. The model is able to explain 86.4% of citizen satisfaction in China and 39.8% of the well-being effect.

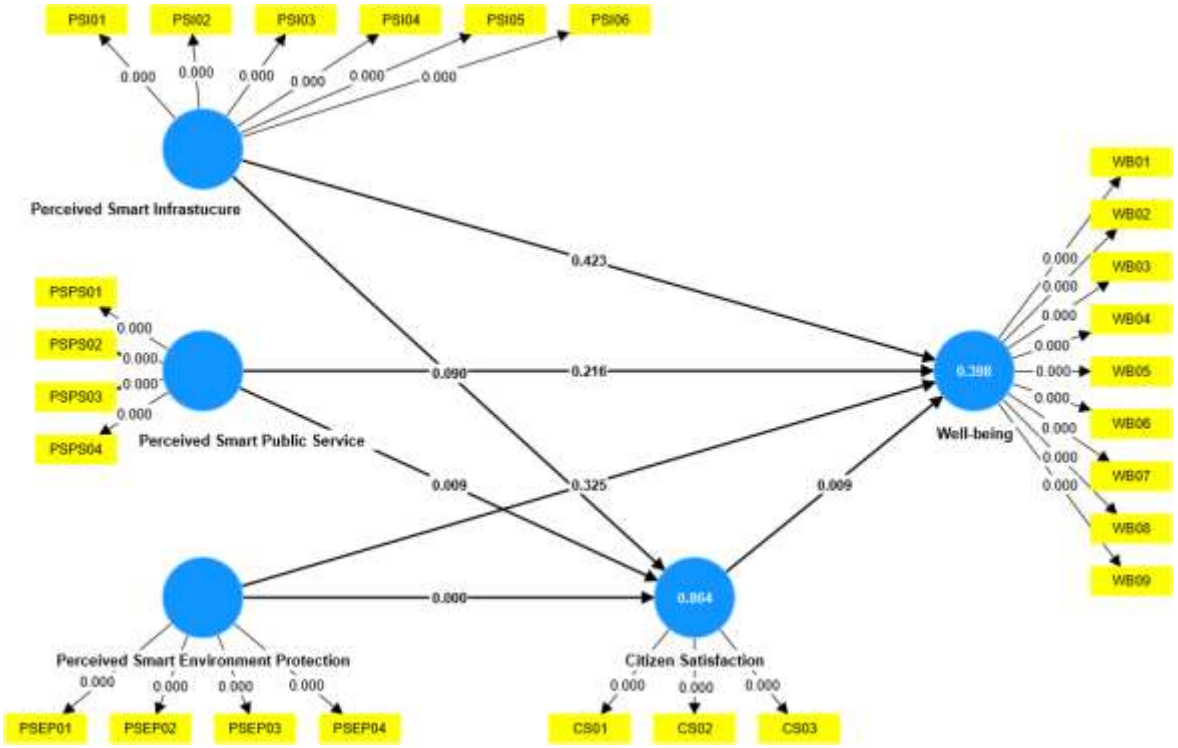


Fig. 5: Results of bootstrapping: China (N=134)
*(Source: Authors)*

The bootstrapping results show the T-values of perceived smart infrastructure (PSI01- PSI06), perceived smart public service (PSPS01 – PSPS04) and perceived smart environment protection (PSEP01-PSEP04) towards well-being (WB01-WB08) and the mediating effect of citizen satisfaction (CS01-CS03) towards well-being in China.

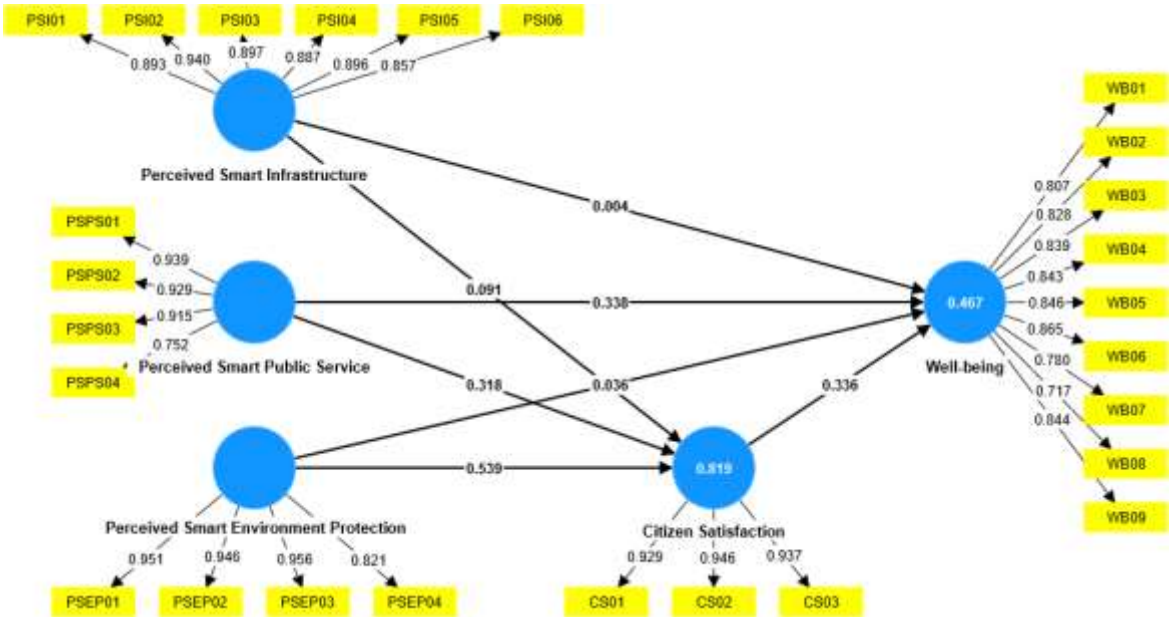


Fig. 6: Results of the path analysis: Combination of Two Countries (N=239)
*(Source: Authors)*

In Figure 6, the $R^2$ for perceived smart infrastructure (PSI01- PSI06), perceived smart public service (PSPS01 – PSPS04) and perceived smart environment protection (PSEP01-PSEP04) towards well-being (WB01-WB08) is 0.467 whereas citizen satisfaction (CS01-CS03) is 0.819 which is higher than the well-being effect. The model is able to explain 81.9% of citizen satisfaction in both countries, Malaysia and China and 46.7% of the well-being effect.

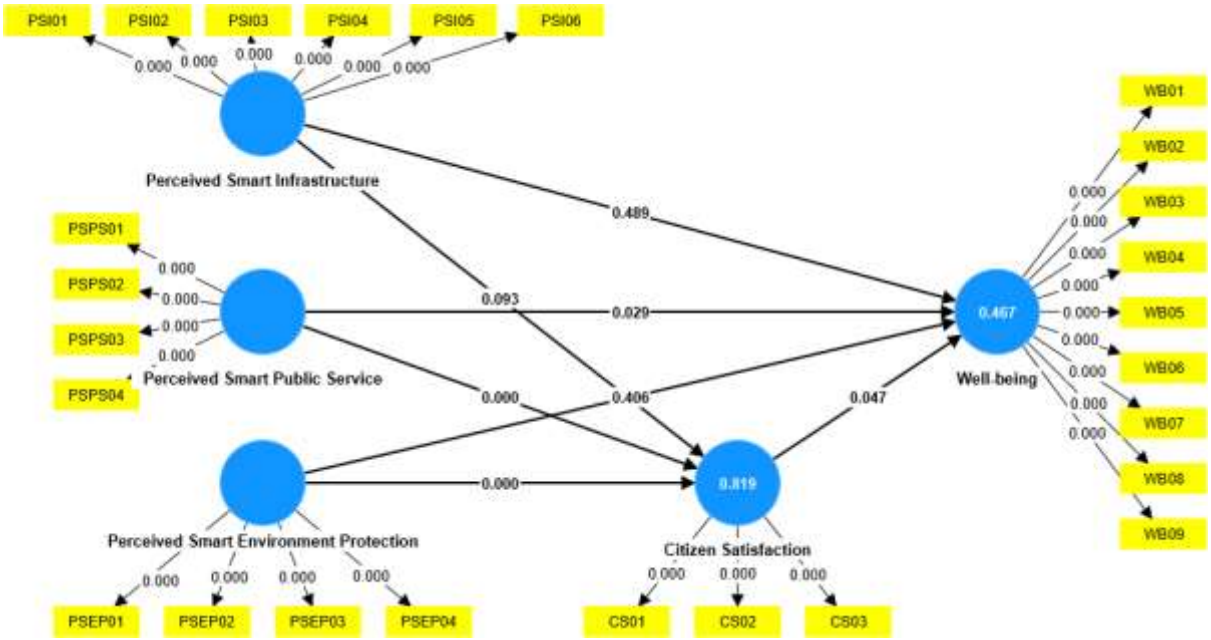


Fig. 7: Results of bootstrapping: Combination of Two Countries (N=239)
*(Source: Authors)*

The bootstrapping results show the T-values of perceived smart infrastructure (PSI01- PSI06), perceived smart public service (PSPS01 – PSPS04) and perceived smart environment protection (PSEP01-PSEP04) towards well-being (WB01-WB08) and the mediating effect of citizen satisfaction (CS01-CS03) towards well-being in both countries, Malaysia and China.

## *5.0* Discussion

From the findings, the perceived smart cities' infrastructure, public service and environmental protection do not show a significant relationship with well-being. However, when these dimensions are mediated by citizen satisfaction, well-being shows a significant relationship with these constructs. This implies that the citizen's well-being only becomes meaningful and relevant in smart cities after they reach a certain level of satisfaction. Such findings are in line with McPherson's (2020) claim that a good and moral life will lead to the feeling of happiness as suggested by Aristotle. In this case, the most apparent aspect is in the perceived smart environment protection. Environment protection will not lead to better citizens' well-being in both countries. As for Malaysia, only the smart cities' public services show a significant relationship with the citizens' well-being. And it is worth noting that in both countries smart infrastructure alone does not contribute to the citizen's well-being. The same notion applies to smart environment protection. One apparent outcome is that even though smart city infrastructure was mediated by citizen satisfaction, there were no significant effects on the citizen's well-being. It highlights the issues of relevancy of such infrastructure in the citizen's daily life, as these infrastructures were probably perceived by them as fundamentals and necessities, thus, enhancing the infrastructure will not lead to a better sense of well-being in the smart cities. Moreover, the findings support Khalil et al.'s (2022) assertions that smart public services play a vital role in smart cities' citizens' satisfaction and well-being. This study proves the importance of smart cities' public services and environmental protection which directly affects citizen satisfaction. Both constructs in Malaysia and China have been accepted with high correlation, especially on the combined data for smart environmental protection (t-value=7.921).

## 6.0 Conclusion & Recommendations

This study achieved the research objectives of the study; namely investigating the citizens' perceived smart infrastructure, public service, and environment protection effects on the well-being of its citizens. It further successfully measured the significant relationship between the citizen's level of satisfaction which acts as the mediator in affecting the citizen's well-being. In conclusion, PLS-SEM analysis shows that the smart infrastructure has no direct effect on the contribution to citizens' well-being in both Malaysia and China. While smart infrastructure may signify the revamping of old infrastructure to new ones, this may not necessarily lead to the creation of happiness for its citizens. Also, results concerning smart environment protection do not contribute towards the citizens' well-being in both countries which implies that the reduction of pollution and use of renewable energy does not have any direct impact on the well-being or happiness

of the citizens. Well-being or happiness is very subjective and does not entirely rely on the external environment. In citizen satisfaction, both countries' citizens perceived that smart public service and environmental protection significantly affect the level of citizen satisfaction.

The results of the findings provide insights into the importance of systematic and smart public service and environment protection in ensuring the happiness and satisfaction level of its citizens. As smart city initiatives can influence citizens' emotions as an important urbanisation process, these initiatives can affect citizen satisfaction through the matching of their expectations and reality. On the other hand, interestingly, citizen satisfaction level has no significant effect on well-being in both countries in the context of smart infrastructure. In line with SDG 11 – towards a more sustainable city, and SDG 3 – on good health and wellbeing the study provides micro-level data to show the significance of smart city initiatives in ensuring the happiness and well-being of its citizens.

## 7.0 Suggestion for Future Research

This study is limited to two countries in Asia; thus, demographic factors might influence the outcome of the research. Furthermore, this research is limited to quantitative data collection which lacks explanatory power to explain the outcome of the research. Since this research did not include control variables due to resource constraints, the reliability of the findings cannot be guaranteed in some circumstances. It is recommended that future research could focus on the collection of qualitative data from the citizens followed by a questionnaire survey to triangulate the generalisability of the data. The future direction of smart cities research should include a comparison of data between Asia and Western countries. The topic of well-being should be investigated with other dimensions such as a sense of security, health and happiness among the citizens.

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## Paper Contribution to Related Field of Study

Policymakers should focus on the well-being and happiness of their citizens as these are very crucial elements in the development of an urban environment. Academic scholars will benefit from these findings as the survey focused on the well-being and citizen's level of satisfaction; where there is limited literature. These findings contribute to the discovery of the significant relationship between perceived smart public service and perceived smart environment protection towards the well-being of citizens in smart cities in both countries.

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