

## ARTICLE

# FACTORS IMPACTING TO SMART CITY IN VIETNAM WITH SMARTPLS 3.0 SOFTWARE APPLICATION

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## ABSTRACT

In recent times, the domestic and foreign economic sciences have done a lot of research on developing smart cities. However, the scientific argument for the solution remains open, especially the quantitative model of the factor that affect the development of smart cities. Therefore, we collected data for seeking practical evidence for the model, sample size is 314. The content of the article focuses on 2 main issues: theoretical framework of the quantitative model and the results of the application for building smart city model. The reliability and value of the scale are determined by Confirmatory factor analysis (CFA). The results of Structural equation modeling (SEM) by use Smart pls 3.0 Software show that smart city is influenced by 6 factors.

## INTRODUCTION

As we know, in the period of industrialization, modernization and social development, the emerging problem is "the development of smart cities" in Vietnam. By the end of 2016, the rate of urbanization nationwide is about 36.7%, equivalent to 33.62 million people, up from 1% in 2015 (equivalent to 1.35 million people). Urbanization and industrialization are always dependent, complementary. The clear evidence for this combination is reflected in the rapidly growing number of industrial parks in Vietnam coupled with the urbanization process. To better understand this issue, the group made this essay to better understand "Smart Urban Development in Vietnam during the Industrial Revolution 4.0".

A smart city must have smart defensive solutions to combat smart modern weapons. We need to learn the experiences of countries that have succeeded in the smart urban model in the world such as Korea, Japan and Singapore, as well as exchanging experiences with other countries (Sweden, Spain, Germany, etc.), and it is important to improve the policy institutions, while at the same time providing appropriate legal documents for management. To strive to put the urban centers of Vietnam into a smart urban center so as to raise the economic efficiency and help the living environment better and people are better served and facilitated. for people involved in urban management and government oversight.

### Hypothesis development

The concept "smart city" was introduced already in 1994. The smart city is the idea of environmental sustainability as its main aim is reducing greenhouse gas emissions in urban areas through the deployment of innovative technologies. The developing interest in the smart city concept and the needs to solve the challenges related to urbanization lead to several private and public investments in the technology development and deployment [1].

Petrolo, R., Loscri, V., & Mitton, N. (2017) suggested there were six factors affecting smart city: smart governance, smart people, smart economy, smart living and smart environment [2].

The smart city model typically integrates the economic, social and environmental components of the city in a way that sustainably maximizes the efficiency of the city's primary systems. Elhoseny, H., Elhoseny, M., Riad, A. M., & Hassanien, A. E. (2018) offered nine factors related smart city: smart government, smart living, smart business, smart education, smart mobility, smart utility and smart environment [3].

Talari, S., Shafie-khah, M., Siano, P., Loia, V., Tommasetti, A., & Catalão, J. P. (2017) gave five affected smart city: Smart Communities, Smart Homes, Smart Buildings, Responsive Customers, Smart Energy and Smart Grids.

Kumar, T. V., & Dahiya, B. (2017) emphasize A Smart City System comprises of six key building blocks: (i) smart people, (ii) smart city economy, (iii) smart mobility, (iv) smart environment, (v) smart living, and (vi) smart governance [4].

### Smart people

There are eleven observations in Smart people: (1) Smart people excel in what they do professionally. (2) Smart people have a high Human Development Index. (3) A smart city integrates its universities and colleges into all aspects of city life. (4) It attracts high human capital, for example knowledge workers. (5) A smart city maintains high Graduate Enrolment Ratio and has people with high level of qualifications and expertise. (6) Its inhabitants opt for lifelong learning and use e-learning models. (7) People in a smart city are highly flexible and resilient to the changing circumstances. (8) Smart city inhabitants excel in creativity and find unique solutions to challenging issues. (9) Smart people are cosmopolitan, are open-minded, and

### KEY WORDS

Vietnam, Smart city, Pvc, Pvc, SEM, Smartpls 3.0

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hold a multicultural perspective. (10) Smart people maintain a healthy lifestyle. (11) Smart people are actively involved in their city's sustainable development, its efficient and smooth functioning, its upkeep and management, and making it more live able [4].

### Smart city economy

Smart City Economy has nineteen: (1) A smart city understands its economic DNA. (2) A smart city is driven by innovation and supported by universities that focus on cutting-edge research, not only for science, industry, and business but also for cultural heritage, architecture, planning, development, and the like. (3) A smart city highly values creativity and welcomes new ideas. (4) A smart city has enlightened entrepreneurial leadership. (5) A smart city offers its citizens diverse economic opportunities. (6) A smart city knows that all economics works at the local level. (7) A smart city is prepared for the challenges posed by and opportunities of economic globalization. (8) A smart city experiments, supports, and promotes sharing economy. (9) A smart city thinks locally, acts regionally, and competes globally. (10) A smart city makes strategic investments on its strategic assets. (11) A smart city develops and supports compelling national brand/s. (12) A smart city insists on balanced and sustainable economic development (growth). (13) A smart city is a destination that people want to visit (tourism). (14) A smart city is nationally competitive on selected and significant factors. (15) A smart city is resourceful, making the most of its assets while finding solutions to problems. (16) A smart city excels in productivity. (17) A smart city has high flexibility of labour market. (18) A smart city welcomes human resources that enhance its wealth. (19) A smart city's inhabitants strive for sustainable natural resource management and understand that without this its economy will not function indefinitely [4].

### Smart mobility

Smart Mobility includes: (1) A smart city focuses on the mobility of people, and not only that of vehicles. (2) A smart city will advocate walkability and cycling. (3) A smart city has vibrant streets (at no additional cost). (4) A smart city effectively manages vehicular and pedestrian traffic, and traffic congestion. (5) A smart city has pleasurable (bicycle) routes. (6) A smart city has balanced transportation options. (7) A smart city will have mass rapid transit system, such as metro rail, light metro, monorail, or 'skytrain' for high-speed mobility. (8) A smart city will have integrated high-mobility system linking residential areas, work places, recreational areas, and transport nodes (e.g. bus/railway station/s and airport). (9) A smart city will practice high-density living, such that benefit of high-speed mobility is uniformly available. (10) A smart city has seamless mobility for differently-abled (often incorrectly called, disabled) people.

### Smart environment

Smart Environment is such as: (1) A smart city lives with and protects the nature. (2) A smart city is attractive and has a strong sense of place that is rooted in its natural setting. (3) A smart city values its natural heritage, unique natural resources, biodiversity, and environment. (4) A smart city conserves and preserves the ecological system in the city region. (5) A smart city embraces and sustains biodiversity in the city region. (6) A smart city efficiently and effectively manages its natural resource base. (7) A smart city has recreational opportunities for people of all ages. (8) A smart city is a green city. (9) A smart city is a clean city. (10) A smart city has adequate and accessible public green spaces. (11) A smart city has an outdoor living room. Unlike the indoor living room in houses where we meet others, outdoor living rooms are aesthetically designed intimate, active, and dynamic urban realms where people meet face to face for a culturally and recreationally rich and enjoyable contact as part of living and work. (12) A smart city has distinctive and vibrant neighborhoods that encourage neighborliness and a spirit of community. (13) A smart city values and capitalizes on scenic resources without harming the ecological system, natural resources, and biodiversity. (14) A smart city has an integrated system to manage its water resources, water supply system, wastewater, natural drainage, floods and inundation, especially in the watersheds where it is located, especially in view of the (impending) climate change. (15) A smart city focuses on water conservation and minimizes the unnecessary consumption of water for residential, institutional, commercial, and industrial use, especially in the arid and semi-arid areas. (16) A smart city has an efficient management system for the treatment and disposal of wastewater, and reuse of treated wastewater, particularly in the arid and semi-arid areas. (17) A smart city has an efficient management system for the collection, treatment, and disposal of industrial wastewater. (18) A smart city has an integrated and efficient management system for the collection, transfer, transportation, treatment, recycling, reuse, and disposal of municipal, hospital, industrial, and hazardous solid waste. (19) A smart city has an efficient system to control air pollution and maintain clear air, especially in the air sheds where it is located. (20) A smart city has an efficient and effective system for disaster risk reduction, response, recovery, and management. (21) A smart city has and continually upgrades its urban resilience to the impacts of climate change. (22) A smart city can create a low-carbon environment with focus on energy efficiency, renewable energy, and the like.

### Smart living

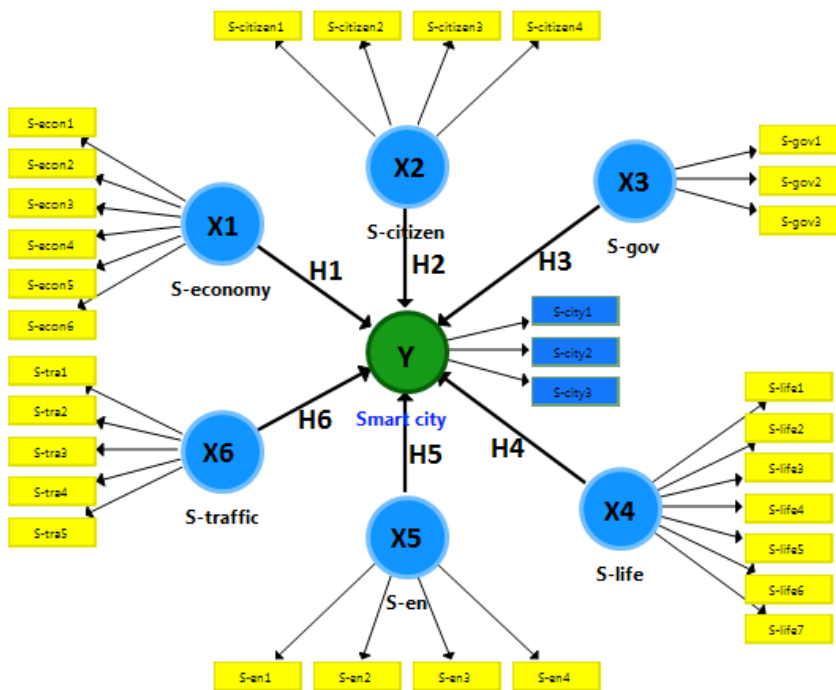
There are fourteen in Smart Living: (1) A smart city has strong and shared values. (2) A smart city records and celebrates local history, culture, and nature. (3) A smart city has a vibrant downtown, 24 h and 7 days a week. (4) A smart city can provide the necessary safety and security to women, children, and senior citizens. (5) A smart city improves the urban way of life. (6) A smart city builds natural and cultural assets to build a good quality of life. (7) A smart city not only understands the big picture of urban liveability, but also pays attention to small details. (8) A smart city has high-quality open and accessible public spaces. (9) A smart city has high-quality public services and amenities. (10) A smart city is an ideal place of living, especially for women, children, and senior citizens. (11) A smart city organizes festivals that celebrate people, life, and nature in city. (12) A smart city has a ritual event (or more) that symbolizes the values and aspirations of the community. (13) A smart city celebrates and promotes art, cultural, and natural heritage in the city. (14) A smart city engages artists to improve and enrich the aesthetics of daily life of the city.

**Smart governance**

Finally, Smart Governance has (1) A smart city practices accountability, responsiveness, and transparency (ART) in its governance. (2) A smart city uses big data, spatial decision support systems and related geospatial technologies in urban and city regional governance. (3) A smart city constantly innovates e-governance for the benefit of all its residents. (4) A smart city constantly improves its ability to deliver public services efficiently and effectively. (5) A smart city practices participatory policy-making, planning, budgeting, implementation, and monitoring. (6) A smart city has a clear sustainable urban development strategy and perspectives known to all. (7) A smart city utilizes creative urban and regional planning with focus on the integration of economic, social, and environmental dimensions of urban development. (8) A smart city features effective, efficient, and people-friendly urban management. (9) A smart city practices E-Democracy to achieve better development outcomes for all. (10) A smart city embraces a Triple Helix Model in which government, Academia and Business/Industry practice changing roles in Governance.

So, we gave the proposed research hypotheses as following:

- “Hypothesis 1 (H1). There is a positive impact of Smart Economy on smart city.
  - “Hypothesis 2 (H2). There is a positive impact of Smart citizen on smart city.
  - “Hypothesis 3 (H13). There is a positive impact of Smart governance on smart city.
  - “Hypothesis 4 (H4). There is a positive impact of Smart life on smart city.
  - “Hypothesis 5 (H5). There is a positive impact of Smart Environment on smart city.
  - “Hypothesis 6 (H6). There is a positive impact of Smart Traffic on smart city
- All hypotheses and factors are modified as [Fig. 1].



**Fig 1:** Research model (Source: Designed by author)

S-economy (X1): Smart economy

(1) A smart city highly values creativity and welcomes new ideas. (2) A smart city offers its citizens diverse economic opportunities. (3) A smart city is prepared for the challenges posed by and opportunities of economic globalization. (4) A smart city insists on balanced and sustainable economic development (growth). (5) A smart city excels in productivity (6) A smart city's inhabitants strive for sustainable natural resource management and understand that without this its economy will not function indefinitely.

#### S-citizen (X2): Smart citizen

(1) Smart people excel in what they do professionally. (2) Smart people have a high Human Development Index. (3) Smart city inhabitants excel in creativity and find unique solutions to challenging issues. (4) Smart people are actively involved in their city's sustainable development, its efficient and smooth functioning, its upkeep and management, and making it more liveable

#### S-gov (X3): Smart governance

(1) A smart city uses big data, spatial decision support systems and related geospatial technologies in urban and city regional governance. (2) A smart city constantly innovates e-governance for the benefit of all its residents. (3) A smart city utilizes creative urban and regional planning with focus on the integration of economic, social, and environmental dimensions of urban development.

#### S-life (X4): Smart life

(1) A smart city has strong and shared values. (2) A smart city records and celebrates local history, culture, and nature. (3) A smart city can provide the necessary safety and security to women, children, and senior citizens. (4) A smart city builds natural and cultural assets to build a good quality of life. (5) A smart city not only understands the big picture of urban liveability, but also pays attention to small details. (6) A smart city has high-quality open and accessible public spaces. (7) A smart city has high-quality public services and amenities.

#### S-en (X5): Smart environment

(1) A smart city lives with and protects the nature. (2) A smart city has an efficient management system for the collection, treatment, and disposal of industrial wastewater. (3) A smart city has an efficient and effective system for disaster risk reduction, response, recovery, and management. (4) A smart city can create a low-carbon environment with focus on energy efficiency, renewable energy, and the like.

#### S-traffic (X6): Smart traffic

(1) A smart city focuses on the mobility of people, and not only that of vehicles. (2) A smart city effectively manages vehicular and pedestrian traffic, and traffic congestion. (3) (4) A smart city will have mass rapid transit system, such as metro rail, light metro, monorail, or 'skytrain' for high-speed mobility. (5) A smart city will practice high-density living, such that benefit of high-speed mobility is uniformly available.

(Y): Smart city,

(1) Smart city is affected by six factors. (2)

## METHOD

We followed the methods of Ly H. Anh, Le Si Dong, Vladik Kreinovich, and Nguyen Ngoc Thach (2018) [5]. Research methodology is implemented through two steps: qualitative research and quantitative research. Qualitative research was conducted with a sample of 57 people. Quantitative research was carried out as soon as the question was edited from the test results with a sample of 314 people. According to Hair et al [6], the sample size must be at least  $\geq m \times 5$ , in which  $m$  is the number of observed variables. So, with 29 variables observed in this study, the sample size should be at least  $\geq 145$ . Therefore, 314 people are surveyed by face-to-face method in Ho Chi Minh City. Respondents were selected by convenient methods with a sample size of 314 people in Hochiminh City in Vietnam in [Table 1]. Samples of 52 people was incorrect because they did not have full information in this questionnaire. There were 68 (26%) males and 194 (74%) females in this survey in [Table 1]. The questionnaire answered by respondents is the main tool to collect data.

The survey was conducted in May 2018 in Hochiminh City, Vietnam. Data processing and statistical analysis software is used by Smartpls 3.0 developed by SmartPLS GmbH Company in Germany. The reliability and validity of the scale were tested by Cronbach's Alpha, Average Variance Extracted (Pvc) and Composite Reliability (Pc). Cronbach's alpha coefficient greater than 0.6 would ensure the scale reliability [7].

Composite Reliability (Pc) is better than 0.6 and Average Variance Extracted must be greater than 0.5 [6, 8]. Followed by a linear structural model SEM was used to test the research hypotheses [5, 9].

**Table 1:** Sample demographic characteristics

Sample	Amount	Percent (%)	
<b>SEX</b>	Male	68	26
	Female	194	74
	Total	262	100
<b>QUALIFICATION</b>	Bachelor	228	87
	Master	10	3.8
	Other	24	9.2
	Total	262	100

Source: Calculated by SPSS.sav and Excel.csv

**Datasets**

We validate our model on three standard datasets for smart city in Vietnam: SPSS. sav, Excel.csv and Smartpls. splsm. Dataset has seven variables: six independent variables and one variable. There are 314 observations and 29 factors in dataset. SPSS. sav and Excel.csv were used for descriptive statistics and Smartpls. splsm for advanced analysis.

Data Availability can receive from author by email.

**MEASURES**

Structural Equation Modeling (SEM) is used on the theoretical framework. Partial Least Square method can handle many independent variables, even when multi collinearity exists. PLS can be implemented as a regression model, predicting one or more dependent variables from a set of one or more independent variables or it can be implemented as a path model. Partial Least Square (PLS) method can associate with the set of independent variables to multiple dependent variables [5, 9].

**Consistency and reliability**

In this reflective model convergent validity is tested through composite reliability or Cronbach’s alpha. Composite reliability is the measure of reliability since Cronbach’s alpha sometimes underestimates the scale reliability [5, 9-11]. [Table 2] shows that composite reliability varies from 0.704 to 0.820 which is above preferred value of 0.5. This proves that model is internally consistent. To check whether the indicators for variables display convergent validity.

Cronbach’s alpha is used. From [Table 2], it can be observed that all the factors are reliable (Cronbach’s alpha > 0.60 and Pvc > 0.5). Some factors have Cronbach’s alpha < 0.60 and Pvc < 0.5 but they have composite reliability (Pc) better than 0.6. So they will be supported and analyze next steps.

**Table 2:** Cronbach's alpha, composite reliability (Pc) and AVE values (Pvc)

Factor	Cronbach's Alpha	Average Variance Extracted (Pvc)	Composite Reliability (Pc)	p Value	Findings
<b>S-citizen</b>	0.584	0.443	0.751	0.000	Supported
<b>S-economy</b>	0.586	0.358	0.750	0.000	Supported
<b>S-en</b>	0.710	0.524	0.814	0.000	Supported
<b>S-gov</b>	0.673	0.602	0.820	0.000	Supported
<b>S-life</b>	0.522	0.268	0.704	0.000	Supported
<b>S-traffic</b>	0.631	0.415	0.771	0.000	Supported

$$P_{vc} = \frac{\sum_{i=1}^p \gamma_i^2}{\sum_{i=1}^p \gamma_i^2 + \sum_{i=1}^p (1 - \gamma_i^2)}; P_c = \frac{(\sum_{i=1}^p \gamma_i)^2}{(\sum_{i=1}^p \gamma_i)^2 + \sum_{i=1}^p (1 - \gamma_i^2)} \quad \alpha = \frac{k}{k - 1} \left[ 1 - \frac{\sum \sigma^2(x_i)}{\sigma_x^2} \right]$$

Source: Calculated by Smartpls software 3.0.

**Structural equation modeling (SEM)**



SEM results in the [Fig. 2] showed that the model is compatible with data research. The Smart city is affected by six factors about 73.3%. The six hypotheses are supported because their p-value is greater than 0.05 as [Table 3].

Table 3: Structural Equation Modeling (SEM)

Relation	Beta	SE	T Value	p Value	Findings
S-citizen -> Smart city	0.198	0.042	4.739	0.000	Supported
S-economy -> Smart city	0.293	0.053	5.531	0.000	Supported
S-en -> Smart city	0.275	0.038	7.196	0.000	Supported
S-gov -> Smart city	0.218	0.045	4.873	0.000	Supported
S-life -> Smart city	0.306	0.045	6.792	0.000	Supported
S-traffic -> Smart city	0.291	0.043	6.765	0.000	Supported

Beta (r): SE = SQRT(1-r<sup>2</sup>)/(n-2); CR= (1-r)/SE; P-value =TDIST(CR, n-2, 2).

Source: Calculated by Smartpls software 3.0.

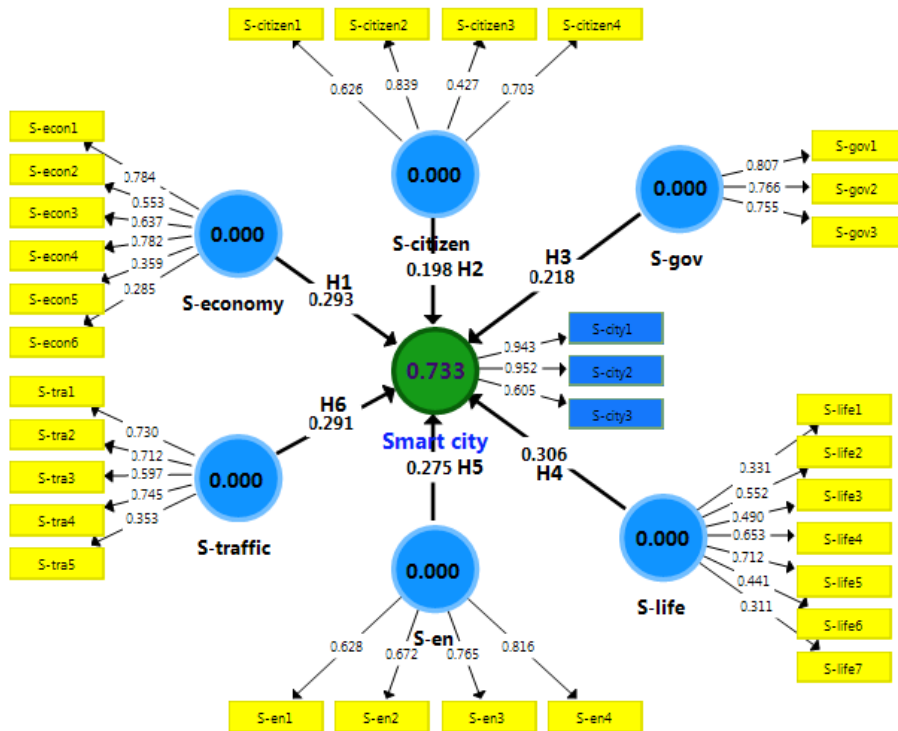


Fig. 2: Structural Equation Modeling (SEM) (Source: Calculated by Smartpls software 3.0.)

SEM results showed that the model is compatible with data research: SRMR has p-value ≤ 0.001 (<0.05) [11, 12] in [Table 4].

Hypotheses H1, H2, H5, H7, H9, H11 and H12 were supported. The results indicated H3, H4, H6, H8, H10 and H13 unsupported.

Table 4: Standard of model SEM

Standard	Beta	SE	T-Value	p	Findings
SRMR	0.067	0.005	12.674	0.000	Supported

Source: Calculated by Smartpls software 3.0.

In bootstrapping, resampling methods are used to compute the significance of PLS coefficients. Output of significance levels can be retrieved from bootstrapping option. [Table 4] shows the results of hypotheses testing; all the t values above 1.96 are significant at the 0.05 level [5, 9].

## DISCUSSION

## Advantages

Viet Nam is a little behind compared to the other countries in the world but it has many comparative advantages. Viet Nam has great access to modern technology and we received a lot of help from international experts and organizations. In addition, big corporations like CISCO and IBM and providers of software to manage smart cities have lent the hand in a number of sectors in Viet Nam, such as environment, construction and land management.

Many models are also being applied in some cities such as the Triple Helix Model, connecting government, businesses and scientists. Meanwhile, other models incorporate different sectors. For newly developed cities and localities, they can develop and integrate smart city management from the beginning, which will benefit different groups. This means that different groups in the city will all contribute to the model and benefit from it.

## Disadvantages and challenges

Vietnam is facing many challenges stemming from the urban explosion and rapid urbanization in the country. Therefore, smart urban development is one of the urgent requirements, contributing to control of the environment, infrastructure and social security.

However, planning is slow when there are many challenges in terms of human resources, capital, and lack of a vision of urban planning. Thereby, it can be seen, applying hi-tech system to bring into the urban development concealed many challenges. The development of each urban area is different, the construction and development of Vietnam's construction is not synchronous, the technical infrastructure has not been fully developed. Therefore, when integrating hi-tech systems into urban areas, there will be some difficulties.

- The major difficulties in deploying Smart City in Vietnam include: the cost is too large; The ability to connect information between units is limited; The government has no policies, incentives and human resources. And the biggest barrier to building Smart City is the determination, inertia of the system, psychological hesitation to change due to issues related interests.
- Resources are hindering the Smart City development process. Although TP. Ho Chi Minh City is more convenient than other provinces in terms of economic and human resources, but still have difficulty applying, the order of investment resources can cause waste as technology changes very quickly. In addition, the policy is a barrier, and hope in the future can be resolved to solve problems between the ministries and localities.
- The construction of smart cities is still facing many difficulties due to the technical infrastructure has not kept pace with the development of the city, leading to the consequences such as traffic congestion, lack of water, waste and rain waterlogging, environmental pollution waste.
- Another difficulty, which is the biggest challenge for planning and building smart cities, is a matter of perception. From the needs, awareness of information technology of the people to the awareness of managers. If not aware, look ahead to the development of smart urban and the development of technology will be how, to meet the practical needs in the next years, the quality of life of people is difficult to improve. Urban Vietnam is hardly able to keep up with the modern, intelligent development of cities around the world.
- Participation of people is impossible when they have to live in difficult conditions, without technology ... when deploying smart cities.
- Smart city does not require much labor, so many workers lose their jobs, such as traffic police, tourist police. This has led to high unemployment, redundant labor markets, resulting in social evils; Social welfare is burdensome.
- At Smart city, it seems that all basic information of individuals, families and organizations is stored in a center for the purpose of living activities such as security, taxation, employment and residence. The possibility of leakage due to technical errors, as information is sold out, is used in the bad is possible. This information can be used for black business, terrorism, exploitation on the harm each other.

The challenge is to make people believe in Smart City is reasonable, the trend of the times, so that everyone cooperates with each other. In addition, how to find the right direction, when there are resources, there is unity, where should I invest in to press the correct opening of many doors, is the lever of social economy, not wasted resources.

## CONCLUSION

The research question was built from the legacy of questions from previous studies, and surveys in developing countries, more specific is Vietnam. The results from the data collected is then analyzed Smartpls 3.0.

- Raising people's awareness to help people come closer to modern and advanced technology.
- Encourage startup projects to attract investment from outside.

- For us, we should be self-conscious of updating new knowledge, cultivating and learning human knowledge.
- The state as well as the managers have to make plans for the city, so that people can trust a smart city in the future. From there, get the support from citizens.

#### CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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#### FINANCIAL DISCLOSURE

None

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