International Journal on Advanced Science Engineering Information Technology

Vol.12 (2022) No. 3
ISSN: 2088-5334

An Empirical Validation of Foundation Models for Smart Government in Indonesia

Dana Indra Sensuse [a], Assaf Arief [a,b*], Petrus Mursanto [a]

[a] *Faculty of Computer Science, Universitas Indonesia, Depok, West Java 16424, Indonesia*
[b] *Faculty of Engineering, Universitas Khairun, Ternate, North Maluku 97719, Indonesia*
Corresponding author: [*] assaf.arief@ui.ac.id

***Abstract*— The implementation of digital government to improve the quality of public services requires transforming services from just "electronic" services to becoming more "smart" services. Therefore, the government needs a strategy and policy to prepare a foundation model to work properly to achieve this transformation goal. This study aims to develop and validate the foundation model for a smart government system suitable for Indonesia's government. The mixed-method based on the quantitative and qualitative approaches was used in this study to explore important dimensions and components of smart government, which further need to be validated based on the triangulation data sources. Data were collected from the literature review, in-depth interviews with experts, online surveys with Indonesia citizens, and focus group discussions. As a result, there are four dimensions, and eleven components founded important to design the models. Dimension one is infrastructure with two components, including ICT dan non-ICT. Dimension two is a structure with six components, including leadership, human resources, governance and management, structures bureaucracy, budget constraints, and planning and policy. Dimension three is a superstructure with two components, including Regulations and Laws dan Planning and Policy; dimension four is culture with two components, including organizational culture and individual culture. The structure dimension has been confirmed as the most important dimension for designing the foundation model, followed by infrastructure, superstructure, and cultural dimensions. This indicates that it is necessary to prepare the structure dimension and its components before adopting a smart government in Indonesia.**

***Keywords*— Empirical validation; smart government; foundations models; triangulation; factors analysis.**

Manuscript received 9 Oct. 2020; revised 12 Jun. 2021; accepted 29 Jul. 2021. Date of publication 30 Jun. 2022.

I. INTRODUCTION

The Digital Government concept is transforming the use of Information and Communication Technology (ICT) innovations to optimize government administration and public services by government agencies[1],[2]. Developed and developing country governments have advantages by initiating digital government such as efficiency, effectiveness, transparency, and accountability. Like the digital government, the idea of Smart Government is built as the idea of digitizing government to improve the quality of public services by government agencies that use innovation and technology[3]. Smart government is one of the domains of the smart city concept. The government can manage natural, human, and time resources efficiently, effectively, and innovatively to improve the quality of life and the environment and predetermine the organization's goals[3]–[5]. Meanwhile, smart governance is the governance of all stakeholders components that involve the government, the private sector or industry, and other organizations outside government institutions that collaborate and interact with each other[6]. Smart government and smart cities are complementary because a smart city is a smart government practice area[7], [1].

The smart government concept as a continuation of e-Government[1] is highly needed to improve government administration services and public services by government agencies[2], [9]. It is because the high number of failures in the implementation of e-Government has been recorded [10], [11]so that to overcome this problem, it is necessary to improve the quality of public services due to the misunderstanding of the concept of e-Government from being just an “electronic” service with the use of ICT becoming a more “smart” service that is effective, efficient, and sustainable[3]. According to the previous research [2], [3], the concept of smart government can be adopted to improve public services by government institutions. The main cause of

the e-Government system failure is due to unreadiness foundation or early-stage strategic errors during the e-Government practice or implementation [10], [12]. Foundation factors play an important role in the successful implementation of e-Government [5], [13], [14] because these factors are basic aspects that must exist as an initial stage of implementation. During the e-Government system's implementation, the wrong strategy is also becoming the main cause of failure in adopting the e-Government concept by the government[12]. Therefore, the creation and preparation of a foundation model as an initial strategy for implementing e-Government systems in public services is the main focus of this present study.

Smart government can also be interpreted as a strategy for implementing e-Government in a more effective, efficient, open, integrative, and sustainable[3], [15]. This concept is very important for the government in Indonesia because, since 2003 when the presidential decree number 3 on the implementation of e-Government in Indonesia was enacted, the government has started implementing e-Government but has still failed in its implementation compared to neighbor-countries based on e-Government ratings [10], [16]. A valid Smart Government model needs to be developed to see the success of e-Government implementation based on the implementation process. In 2017, the Indonesian government initiated the 100 Smart City Movement program in provincial and district/city governments. The program collaborates with the Ministry of Communication and Information Technology, the Ministry of Public Works and Public Housing Development Planning, and the Presidential Staff Office in Indonesia[17]. This initiative program aims to support provincial, city, and district governments in formulating Master Plans further to optimize the use of information and communication technology, improve public services, and accelerate the potential resources that exist in each region. However, the success of the 100 smart cities program implementation is still unclear and will be further discussed in this present study. To achieve this goal, further studies about the fundamental factors and components of a smart government model [18] in implementing smart cities in Indonesia are needed. Therefore, this study was conducted to determine the factors and components of the foundation model proposed for the smart government in Indonesia and determine the foundation models resulting from empirical validation using triangulation and associated factors.

The definition of a smart government system is assumed to be the next step of e-Government by using technology and innovation for a better system [3], [19]. A smart government idea aligns with the co-creative of technological developments and innovations that have emerged in the public sector. It is also defined as the strategic role of government in society used to develop the managerial capacity and increase the effectiveness of intergovernmental coordination, decentralization, participation, and renewal of organizational structure[20]. The interoperability or performance of a series of business processes and underlying information (I) and technology (T) capabilities enable the smooth flow of information across government agencies and programs to provide high-quality public services[15].

There is a connection between the definition and factors of smart city and smart government, according to Table I. Smart cities and smart governments complement each other as dimensions and practices of a service [36]. Smart government is a domain for providing public services in a smart city, which also acts as an important aspect of the smart city program implementation [37], [38]. Without a smart government, there will be no smart economy, smart mobility, smart people, smart environment, smart living, and urban innovation.

TABLE I
SMART CITY, SMART GOVERNMENT, SMART GOVERNANCE AND SMART GOVERNMENT DEFINITIONS AND FACTORS/COMPONENTS

Term	Definition	Factors/Components	Source
Smart City	Smart City is built from the combination of endowed and independent activities of its citizens	1. Smart Economy 2. Smart Governance 3. Smart People 4. Smart Mobility 5. Smart Living 6. Smart Environment	[21]
	A city is called as 'smart' when its investments in human, social capital, transportation, and modern ICT communication infrastructure fuel sustainable economic growth and high quality of life, with a wise management of natural resources, through participatory governance	1. Per capita GDP in PPS 2. Employment in the entertainment industry 3. Multimodal accessibility 4. Length of the public transport network 5. e-Government 6. Human capital	[22]
	The smart city is defined by IBM as the use of information and communication technology to analyze and integrate the key information of core systems in running cities	1. Planning and Management Services 2. Human Services 3. Instrumentation 4. Interconnection (of data) 5. Intelligence	[23]
	The city's new intelligence is increasingly effective in combining digital telecommunications networks (nerves), the brain, sensory organs, and software (cognitive knowledge and competence)	1. Management and organization 2. Technology 3. Governance 4. Policy 5. People and communities, 6. The economy, 7. Built infrastructure, and	[24]

Term	Definition	Factors/Components	Source
		8. The natural environment.	
Smart Governance	A dimension of smart city, which measures local smart government performance with the following indexes: participation in decision making; public and social services; transparent governance, and political strategies and perspectives.	1. Smart government 2. Participation in decision making 3. Public and social services 4. Transparent governance 5. political strategies and perspectives	[25]
	Smart governance is generally defined as applying digital technologies and intelligent activities in processing information and decision-making.	1. Digital technologies 2. Intelligent activities 3. Information and decision-making	[6]
Smart Government	Extensive use of technology to perform government tasks	1. Technology 2. Government tasks	[26]
	The interoperability or performance of a series of business processes and underlying I and T capabilities enables the smooth flow of information across government agencies and programs to provide high-quality services.	1. Interoperability 2. Business processes 3. ICT 4. Citizen services	[27]
	The strategic role of government in society is used to develop the managerial capacity and increase the effectiveness associated with intergovernmental coordination, decentralization, participation, and renewal of the organizational structure	1. Strategy 2. Managerial 3. Effectiveness 4. Participation 5. Organization structure	[28]–[30]
	The evolution of the term '*Smart Government*' into '*Smart Governance*' is an effort to overcome the complexities and uncertainties of the environment to realize resilience. The various aspects of smart government include openness and decision making, sharing information, participation, and collaboration between stakeholders, improving government services, using smart technology, which acts as facilitators of innovation, competitiveness, livability, and sustainability	1. Openness and decision making 2. Sharing of information, participation, and collaboration between stakeholders 3. Improve government work and services, 4. Use of smart technology 5. Innovation, Sustainability, Competitiveness, and Livabilit	[3], [31]
	Smart government is in line with the co-creative of technological developments and innovations that have emerged in the public sector.	Technology Innovations in the public sector	[32], [33], [34]
	It is the next step for e-Government	e-Government	[3], [19], [35]

II. Materials and Method

In this section, the methods used to answer the questions about factors and empirical validation of the foundations model for smart government implementation in Indonesia. A mixed-method approach by combining qualitative and quantitative methods was used in this present study[39]. Qualitative data were obtained from literature studies, document reviews, in-depth interviews with experts in the local government circle. Data validation was analyzed using focus group discussion (FGD) and factor analysis. Quantitative data were obtained from 107 academic respondents who participated in the survey from citizens in the various citizen of Indonesia. The mixed-method preparation has been illustrated, as can be seen in Fig. 1.

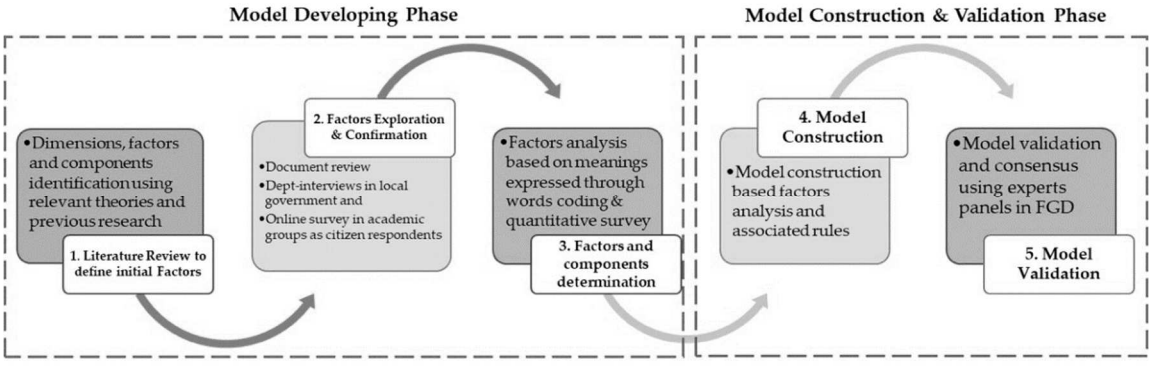

Fig. 1 Mixed-methods approach

This study was divided into two phases: the development phase model and the construction and validating phase model. The development phase model consists of 3 stages. The first stage is extracting initial factors and components from relevant theories, literature, and documents review of previous related studies. The second stage empirically explores and confirms factors and components through surveys in local government through document reviews, dept-interviews, and online surveys on academic groups as citizen respondents. The third stage is conducting an analysis of

factors and components based on the meaning expressed through words coding and quantitative survey and determining factors, dimensions, and components for the model development stage. The construction and validating phase model was done by factor analysis based on association rules techniques followed by validation with expert panels using FGD to determine the model.

A. Literature Review

The first stage in the developing model phase is used as a literature review to explore initial factors and components based on the Technologies, Organizations, and Environment (TOE) framework theories[40]. TOE was used as the basic concept for designing a foundation model used to extract the factors that play an essential role in making decisions regarding the smart government. Furthermore, these factors are classified into three categories: technology, organization, and environment[41]. Similarly, Nam and Pardo [42] used the dimensions of Technology, People, and Institution (TPI) to conceptualize Smart City. In this study, these two theoretical frameworks are used as the basic theories for constructing initial factors and components that can be used to create research instrumentation materials for the dept-interviews in local government and online questionaries for academic groups.

We reviewed some information from publications that can be accessed through the open website using specific keywords including ("Smart Government OR e-Government * OR Smarter Government * OR Smarter City * OR Smart City" and "Measurement * OR Factors * OR Indicators * OR Models * OR Components") and the year publication was set to the period of 2010-2020. Secondly, the inclusion and exclusion criteria were determined based on indicators, models, factors, components, and implementation strategies of the e-Government service related to this present study. The inclusion criteria used are journal and conference publications, while the exclusion are double publications of the newest and most complete similar data on the study[43].

B. Factors Exploration and Confirmation

The second stage is exploration and confirmation through document review, empirical survey, and dept-interviews with experts in the local government and validated it with online survey data from citizens (triangulation data resources) to explore and validate draft initial factors components from the literature review results. Three best cities implementing e-Government were selected as samples for an empirical survey, including Surabaya, Semarang, and Yogyakarta, based on the e-Government index data [44]. The in-depth interview process was determined under the local government's structure and based on the job description of the Department of Communication and Information from Surabaya, Semarang, and Yogyakarta. The in-depth interview data were obtained from face-to-face interviews and online questionnaires. Furthermore, exploration and confirmation factors quantitative data were obtained from online questionnaires that were distributed to the academic groups via WhatsApp application and there were 107 participants recorded.

C. Factors and components determination

The third stage is factors and components determination based on data obtained from the second stage, as shown in Fig.1. The data was then analyzed qualitatively and quantitatively using content analysis and a correlation matrix [45]. Content analysis is used to observe the data gathering process from texts and documents, then determine its specific patterns or factors and further can be used to explore, confirm, and validate the factors and components obtained from recording interviews as well as survey agreement of local government areas. The content analysis result is from factors and components taken for further research instrument materials through an online questionnaire of citizen satisfaction with e-government services. An online questionnaire survey was carried out to confirm the factors and component foundations of the model on public service satisfaction from the 107 citizens participants from various cities in Indonesia. Some criteria are determined before providing judgment on the content of research questions on local governments' fundamental factors related to online services. We also formulated the questions in questionaries to determine the right respondent in assessing the smart government's factors or components on electronic-based public services.

D. Foundation Models Construction

At the fourth stage, the model was constructed based on the association rules method of factors and components that have been obtained and validated in the second and third stages. Association rules are used to determine the relationship between one factor to another to be considered to create a proper foundation model of the Smart Government in Indonesia. Constructed models will be validated using the expert's judgment in the FGD to avoid subjectivity and misperception. Focus Group Discussion (FGD) was aimed to summarize the results of thoughts and mutual agreement from experts and practitioners of specific majors. The FGD of this present study consisted of nine academic doctors and professors with credibility and experts in the e-Government and smart city in Indonesia with a minimum of 10 years of working experience in academic, government, and business fields.

E. Model Validation

In the last stages, we used data triangulation as a validation strategy that uses a pattern matching method based on a minimum of three data sources, or called triangulation[46]. It also uses the same approach to conduct diagnosis and conclusions while carrying out more than one activity at a time. Data triangulation refers to the perusing and relating of multiple sources of evidence on a particular phenomenon or topic [47]. A more nuanced picture of the situation is obtained through this process, which increases the reliability and validity of research findings. The triangulation method involves several qualitative and quantitative approaches that are used to investigate theories, documents, and sources.

This present study investigates the factors and components used to validate triangulation data sources in each phase based on mixed methods through qualitative and quantitative approaches, as shown in Table II.

TABLE II
MIXED METHODS APPROACH USED IN THIS STUDY

Step	Research approach	Objective	Methods
1	Qualitative	Define initial factors and components	Literature review and documents analysis
2	Qualitative	Factors and components exploration and confirmation based on the empirical study	Expert judgment and structural interviews
3	Quantitative	Factors and components validation	Respondents survey
4	Quantitative	Categorization and analysis inter-relationship among factors/components	Model construction using association rules
5	Qualitative	Model determination and validation, verification and consensus	Experts panels in focus group discussion

III. RESULTS AND DISCUSSION

A. Respondents Demographics

The samples of respondents' demographics from dept-interviews and survey in government is shown in Table III. Table III describes the respondent's demography from three samples of local government practice in Indonesia, including Surabaya, Semarang, and Yogyakarta governments. All respondents were selected from the city government institutions, especially the ICT department, located in Java island, Indonesia. The selection of these three governments and the data collection methods used in this study have been described in section II.B. The demography of 107 participants in an online survey from various cities in Indonesia was shown in Table IV.

Table III and Table IV show demographic data from empirical surveys through structural's dept-interviews in local government and online questionaries via WhatApp and Facebook groups from various cities in Indonesia. In Table III, there are 7 variables used to explore, confirm, and judge factors and components needed in the implementation of local government e-Government services to citizens. The e-Government service experiences variable is the key question that becomes an absolute requirement for a respondent to assess citizen satisfaction with the smart government foundations model's factors and components, confirmed through the questionaries' questions.

TABLE III
RESPONDENTS DEMOGRAPHY

Variables	Categories	Frequencies	Percentage
Government level	City's government	7	100
Gender	Male	5	71
	Female	2	29
Age	31-40 years old	5	71
	41-50 years old	2	29
Education	Bachelor's degree	5	5
	Master's degree	2	2
Location	Java Island, Indonesia	7	100
Position	Head of Division	5	71
	Section Chief	2	29
Department	ICT	7	100

Meanwhile, the other six variables show the respondents' qualifications to confirm and validate the questions about the factors and components for the smart government in Indonesia. The evaluation of 107 respondent's responses to smart government dimensions and factors is shown in Fig. 2. It can be clearly seen that five dimensions of the smart government model can be selected to further step of judgment in this study to determine the factors and components of the smart government model through construction and validation of the model.

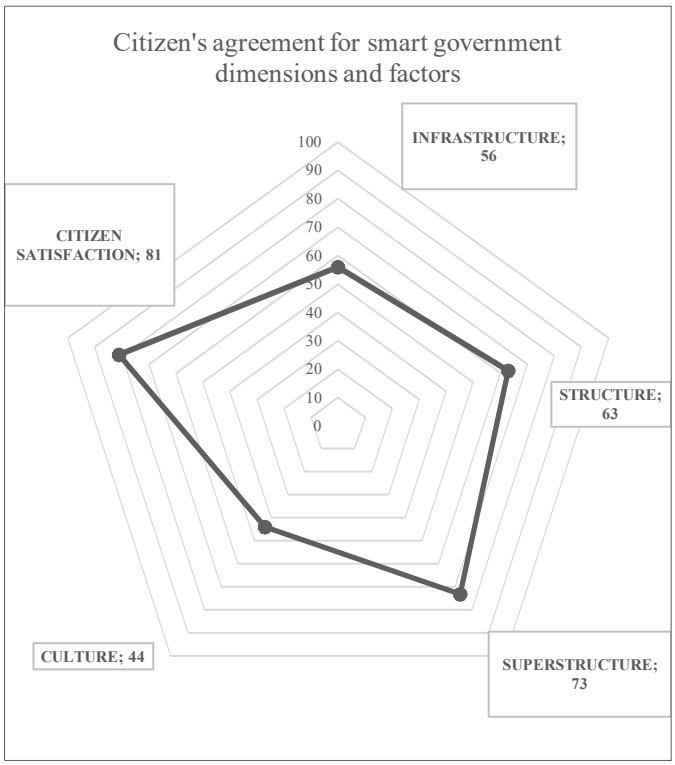

Fig. 2 Citizen responses to dimensions and factors for smart government in Indonesia

TABLE IV
DATA DEMOGRAPHY OF 107 PARTICIPANTS FROM VARIOUS CITIES IN INDONESIA

Variables	Categories	Frequencies	Percentage
Use of e-Government service	Yes	107	100
	No	0	0
Gender	Male	70	65
	Female	37	35
Age	Less than 17 years old	0	0
	17-30 years old	25	23
	31-40 years old	47	44
	41-50 years old	26	24
	More than 50 years old	9	8
Education	Secondary school	4	4
	Diploma/Bachelor's degree	33	31
	Master's degree	56	52
	PhD	14	13
Location	Jabodetabek (Jakarta, Bogor, Depok, Tangerang, and Bekasi)	69	64
	Cities include in Java Island (Non-Jabodetabek)	13	12
	Sumatra Island	7	7
	Kalimantan Island	0	0
	Sulawesi Island	2	2
	Eastern Indonesia (Papua and Maluku Islands)	16	15
Work profession	Government employees	51	48
	Private/non-Government employees	38	36
	College student	15	14
	Senator	2	2
	Unemployment	1	1
Citizen awareness of e-Government regulation	Yes	107	100
	No	0	0

B. *Factors and components determination result*

Based on the research questions formulated at the beginning of this study, the goal is to determine factors and components to develop a foundation model for the smart government in Indonesia. Therefore, step-by-step methods were prepared to achieve this goal with the detail as follows.

1) *Initial factors and components identification:*

Based on the literature review stage, some theories or principles in previous studies were obtained from literature finding to identify a smart government foundation model's factors and components. This point is the basis of the arguments in this study and the summary of literature findings related to identifying factors and components of foundation models (Table V).

Table V shows the initial factors and components obtained from the literature review. The next research stage is the confirmation and validation factor by expert judgment and local government dept-interviews. As earlier explained, the formulation of the categorization is based on the hybrid categorization adoption of TOE [40] and TPI framework[42].

The literature review used to determine the key dimensions of smart government factors based on the TOE and TPI framework includes the ICT and Non- ICT infrastructures, government institution structure, a dimensional environment, and the socio-technical aspects of e-Government.

TABLE V
IDENTIFICATION FACTORS AND DIMENSIONS BASED ON TOE AND TPI FRAMEWORK

TOE and TPI Theories	Initial factors/components	References
Technology and Infrastructures	ICTs/Digital's infrastructure	[32], [48]–[51]
	Non-ICT Infrastructure	[52]–[54]
Organization or Institutions	Leadership	[10], [52]
	Human Resources	[18], [55], [56]
	Governance and Management	[55]–[60]
	Structures Bureaucracy	[14], [32], [61]
	Budget Constraints	[4], [56], [62]
	Planning and Policy	[14], [56], [63]
Environment and People	Superstructures	[62][56]
	Regulations and Laws	
	Organizational culture	[28], [35], [64]
	People/individual culture	[14], [35], [60], [64]–[66]

2) *Factors and components determination:*

The factors and components determination based on the literature review, in-depth interviews, and online survey (triangulation data) are shown in Table VI.

TABLE VI
KEY DIMENSIONS AND COMPONENTS OF FOUNDATIONS MODEL FOR SMART GOVERNMENT IN INDONESIA

Dimensions	Components	Descriptions	Resources
Infrastructures	ICTs/Digital	i.e., Computers, high-speed broadband, fiber optic cables, ICTs networks, servers, storages, cloud, electricity, and energy supply, wireless technology, sensors and devices, so on.	Triangulations
	Non-ICT	i.e., Offices' buildings, utilities, spaces, vehicles, common room, offices' facilities, so on.	Triangulations
Structures	Leadership	Strong leadership with high commitment	Triangulations
	Human Resources	i.e., Competence, Knowledge, Human Capital, Skilled, so on.	Triangulations
	Governance and Management	Governance and Management	Triangulations
	Bureaucracy	Standard Operating Procedures (SOP), task, functions, and organizational structures	Triangulations
	Budget Constraints	Budget allocation and financial capacity	Triangulations
Superstructures	Regulations and Laws	Regulations, laws, statutes, rules, so on. as legal protection	Triangulations
	Planning and Policy	Planning and Policy	Triangulations
Culture	Organizational culture	Work culture, disciplinary culture, innovation and service culture, political culture, knowledge-sharing culture, literacy culture, and a supportive ecosystem promote innovation and learning to create.	Triangulations
	Individual culture	Motivations, habits, morality, religion traditions, integrity, ICT/digital's culture.	Triangulations

The analysis result has defined four dimensions, 11 factors, and obtains components from data triangulation such as literature and document review, depth interview, and expert judgment associated with Infrastructures, Structure, Superstructure, and Culture. The infrastructures components comprise of ICT and Non-ICT components. The structure has five components: leadership, human resources, governance and management, bureaucracy, and budget constraints. Superstructures dimensions comprise regulations and laws, planning, and policy, while the culture is either organization or individual.

C. Model Construction and Validations Result

1) Model construction:

A model construction-based result from associated factors used the correlation matrix from the four dimensions founded by data analysis from 107 participants based on the Likert scale (from 1 to 5). This aims to determine the relationship between one factor or dimension and other dimensions in Indonesia's smart government model. According to a previous study by Dziuban et al.[67], to find out how matrix correlation is used for factor analysis and how significant the correlation of factors is to one another. The results of the associated factors can be seen in Fig. 3.

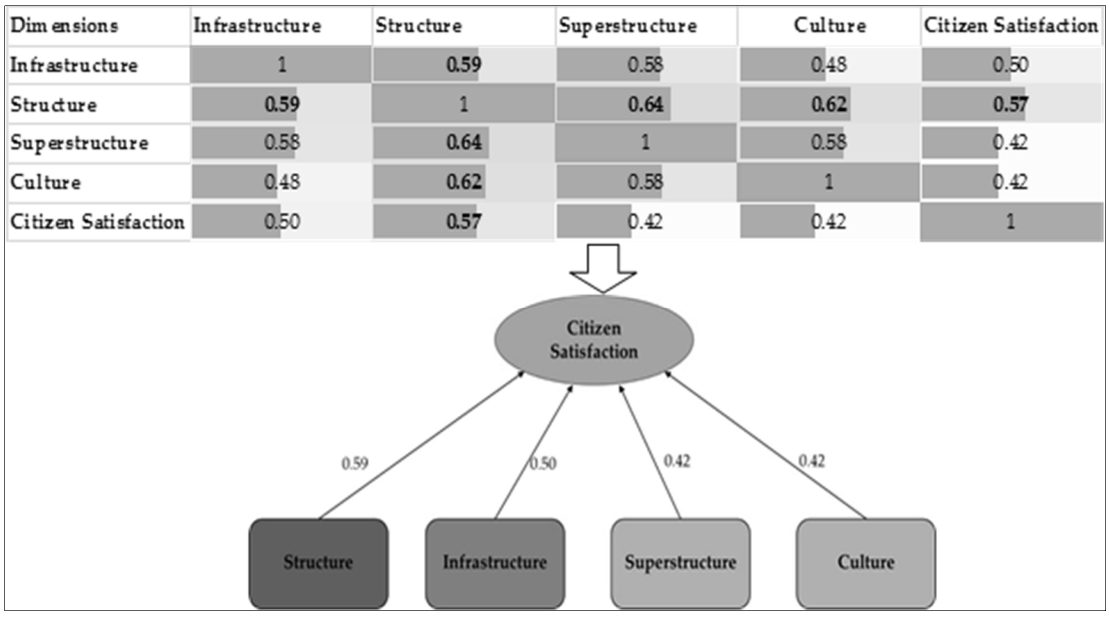

Fig. 3 The result of the associated factors using the correlation matrix

Fig. 3 describes the relationship between the four dimensions of smart government foundation models to citizen satisfaction with e-government services. The results show that the factors and correlation numbers that significantly affect citizen satisfaction are the structure (0.59), and was followed by infrastructure (0.52), superstructure (0.42), and culture (0.42). Fig. 3 also explains the correlation values among these dimensions, as shown in Fig. 4. This indicates that the structure dimension has the most significant effect on citizen satisfaction, followed by the infrastructure, superstructure, and culture, respectively. Afterward, this result was used to design the foundation model, as shown in Fig. 4

Fig. 4 Proposed foundation model for smart government based on model constructions

There is an interconnection between the four dimensions used as a foundation model for smart government in Indonesia: middle, above, right, and left. This is because the highest correlation value and position of drawing are in the middle. The superstructure dimension is above the structure based on the influences of the most significant correlation value. Furthermore, the Culture and Infrastructure dimensions were the most affected by the structure dimensions on the right and left.

2) Model validation:

The validation process's final stage is model validation using expert Judgment panels in FGD, which the proposed foundation model uses to validate joint consensuses based on ten expert panels, as illustrated in Section II.E. The final foundation model for smart government in Indonesia is shown in Fig. 5.

There are three layers for smart government consensus model based on FGD, namely the foundation layer, the service layer consisting of G2G (Government to Government), G2E (Government to Employee), G2B (Government to Business), and G2C (Government to Citizen) and goal layer services as shown in Fig. 5. However, this study focused on the foundation layer, while the remaining two layers are used to complete Indonesia's smart government model. The experts concluded from the FGD agreement that it is necessary to develop further models for modeling smart government in Indonesia by proposing services and goal layers to achieve a complete model. The expert panel agreement obtained from the FGD forum regarding the foundations model for smart governance can be seen in Fig. 6.

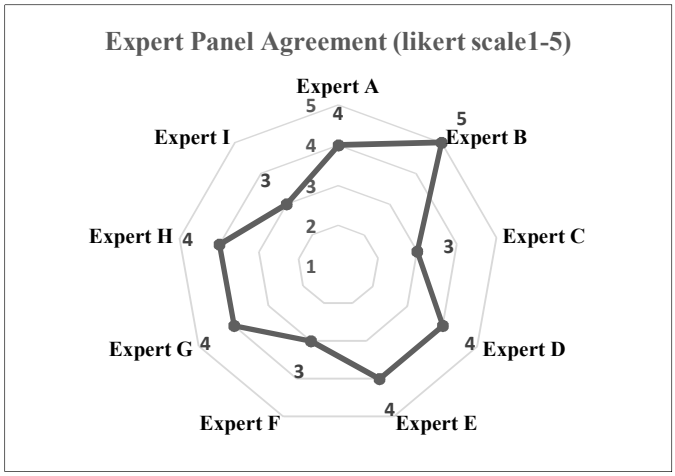

Fig. 6 The expert's panel agreement for foundations model in FGD

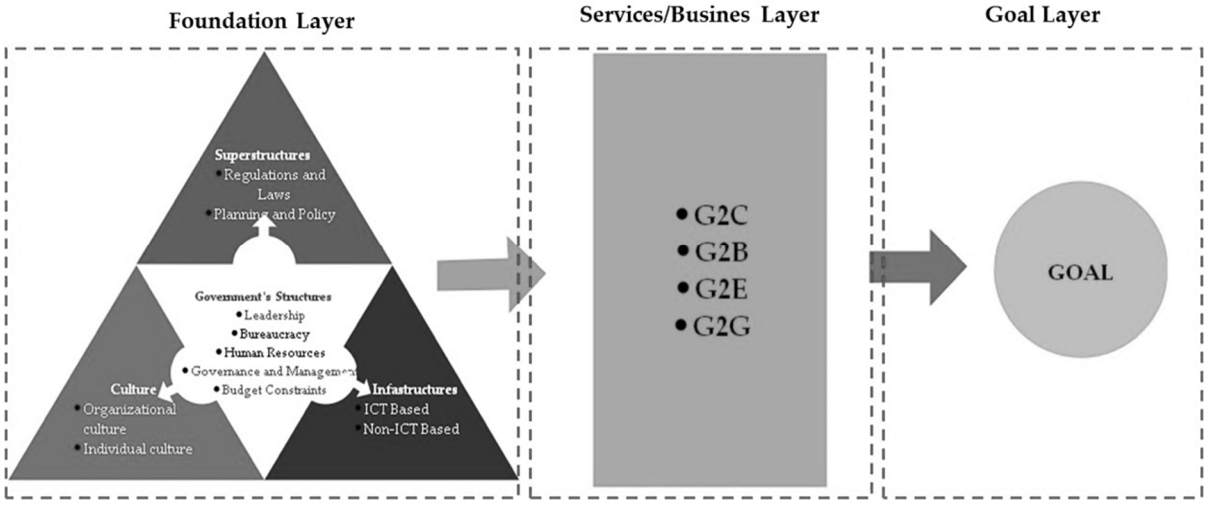

Fig. 5 The proposed foundation model for smart government is based on FGD

This expert panel agreement is prepared by using the Linkert scale (1-5 scales) with the detail of scale 1 for strongly disagree; scale 2 for disagree; scale 3 for neutral; scale 4 for agree; and scale 5 for strongly agree. As the final result, it is obtained that 73 % of experts involve in FGD agree to accept the proposed foundation model based on the mean Likert scale, which is 3.67 (scale ~ 4 indicating agree). Therefore, the proposed foundation model for smart government in Indonesia has been accepted and validated.

IV. Conclusions

The experiments and evaluation results concluded that the foundation model for the smart government in Indonesia using the triangulation and associated factors methods has been founded and considered for further construction. There are four dimensions and 11 components needed to build the foundation model for smart government in Indonesia. Dimension 1 is infrastructure providing two components, including ICT and non-ICT components. Dimension 2 is a structure or organization dimension providing six components: leadership, human resources, governance and management, structures bureaucracy, budget constraints, and planning and policy. Dimension 3 is superstructure providing two components, including Regulations and Laws; and Planning and Policy. Dimension 4 is the cultural dimension providing two components, including organizational culture and individual culture. In addition, the proposed foundation model has been accepted and validated by smart government experts.

Moreover, the structural dimension has been confirmed as the most significant effect on the proposed foundation model, followed by infrastructure, superstructure, and cultural dimensions. This result indicating that it is necessary to prepare the structure dimension first during the implementation of foundation model for smart government in Indonesia.

For future work, it is important to validate further and explore factors of the smart government ecosystem. Furthermore, the analysis should be done based on the multi-criteria decision-making method such as Fuzzy AHP to determine the weighting of work priorities and other methods to analyze business process analysis then enrich the comprehensive of this project so that the implementation of this smart government idea in Indonesia can work as expected.

Acknowledgment

The authors are grateful to Laboratory e-Government and e-Business Faculty of Computer Science, Universitas Indonesia. This research was funded by PUTI (Publikasi Terindeks Internasional), Universitas Indonesia, Research Grant Number: NKB-1476/UN2.RST/HKP.05.00/ 2020.

References

[1] Y. Gong, J. Yang, and X. Shi, "Towards a comprehensive understanding of digital transformation in government: Analysis of flexibility and enterprise architecture," *Gov. Inf. Q.*, vol. 37, no. 3, 2020.

[2] J. R. Gil-Garcia and M. Flores-Zúñiga, "Towards a comprehensive understanding of digital government success: Integrating implementation and adoption factors," *Gov. Inf. Q.*, vol. 37, no. 4, p. 101518, 2020.

[3] J. R. Gil-Garcia, J. Zhang, and G. Puron-Cid, "Conceptualizing smartness in government: An integrative and multi-dimensional view," *Gov. Inf. Q.*, vol. 33, no. 3, pp. 524–534, 2016.

[4] R. P. Damiri, *Smart City Implementation; Creating Economic and Public Value in Innovative Urban Systems*. Springer International Publishing, 2017.

[5] L. G. Anthopoulos, "Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick?," in *Public Administration and Information Technology*, Volume 22., U. Christopher G. Reddick, San Antonio, TX, Ed. Greece: Springer, 2017, pp. 1–293.

[6] G. V. Pereira, P. Parycek, E. Falco, and R. Kleinhans, "Smart governance in the context of smart cities: A literature review," *Inf. Polity*, vol. 23, no. 2, pp. 143–162, 2018.

[7] L. Anthopoulos, "Smart utopia VS smart reality: Learning by experience from 10 smart city cases," *Cities*, vol. 63, pp. 128–148, 2017.

[8] Y. Gong, J. Yang, and X. Shi, "Towards a comprehensive understanding of digital transformation in government: Analysis of flexibility and enterprise architecture," *Gov. Inf. Q.*, vol. 37, no. 3, p. 101487, 2020.

[9] D. Napitupulu, "A Conceptual Model Of E-Government Adoption in Indonesia," *Int. J. Adv. Sci. Eng. Inf. Technol.*, vol. 7, no. 4, p. 1471, 2017.

[10] R. Meiyanti, B. Utomo, D. I. Sensuse, and R. Wahyuni, "E-Government Challenges in Developing Countries: A Literature Review," *2018 6th Int. Conf. Cyber IT Serv. Manag. CITSM 2018*, no. Citsm, pp. 1–6, 2019.

[11] P. Gunawong and P. Gao, "Understanding e-government failure in the developing country context: a process-oriented study," *Inf. Technol. Dev.*, vol. 23, no. 1, pp. 153–178, 2017.

[12] M. P. Rodríguez-Bolívar, *Transforming City Governments for Successful Smart Cities*, vol. 12, no. 3. Springer, 2015.

[13] M. P. Rodriguez Bolivar, "Setting Foundations for the Creation of Public Value in Smart Cities," in *Public Administration and Information Technology*, M. P. Rodriguez Bolivar, Ed. Springer Nature Switzerland, 2019.

[14] J. I. Criado and J. R. Gil-Garcia, "Creating public value through smart technologies and strategies: From digital services to artificial intelligence and beyond," *Int. J. Public Sect. Manag.*, vol. 32, no. 5, pp. 438–450, 2019.

[15] United Nations, "UN E-Government Survey 2018," 2018.

[16] Kemkominfo RI, "Guideline Masterplan Smart City Gerakan Menuju 100 Smart City," 2017.

[17] A. Arief and D. I. Sensuse, "Designing A Conceptual Model for Smart Government in Indonesia using Delphi 2 nd Round Validity," in *2018 International Conference on Advanced Computer Science and Information Systems (ICACSIS)*, 2018, pp. 93–98.

[18] J. R. Gil-Garcia, S. S. Dawes, and T. A. Pardo, "Digital government and public management research: finding the crossroads," *Public Manag. Rev.*, vol. 20, no. 5, pp. 633–646, 2018.

[19] J. R. Gil-Garcia, M. Gasco-Hernandez, and T. A. Pardo, "Beyond Transparency, Participation, and Collaboration? A Reflection on the Dimensions of Open Government," *Public Perform. Manag. Rev.*, vol. 43, no. 3, pp. 483–502, 2020.

[20] R. Giffinger, C. Fertner, H. Kramar, R. Klasek, N. Pichler-Milanovic, and E. Maijers, "Smart cities Ranking of European medium-sized cities," 2007.

[21] A. Caragliu, C. del Bo, and P. Nijkamp, "Smart cities in Europe," *J. Urban Technol.*, vol. 18, no. 2, pp. 65–82, 2011.

[22] C. Harrison *et al.*, "Foundations for Smarter Cities," *IBM J. Res. Dev.*, vol. 54, no. 4, pp. 1–16, 2010.

[23] H. Chourabi *et al.*, "Understanding smart cities: An integrative framework," in *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2012, pp. 2289–2297.

[24] R. Giffinger, "Smart cities ranking: an effective instrument for the positioning of the cities?," *ACE Archit. City Environ.*, no. February 2010, 2010.

[25] S. Mellouli, L. F. Luna-Reyes, and J. Zhang, "Smart government, citizen participation and open data," *Inf. Polity*, vol. 19, no. 1–2, pp. 1–4, 2014.

[26] N. Netten, M. S. Bargh, S. van den Braak, S. Choenni, and F. Leeuw, "On Enabling Smart Government," *Proc. 17th Int. Digit. Gov. Res. Conf. Digit. Gov. Res. - dg.o '16*, pp. 293–302, 2016.

[27] R. Paola, C. Benevolo, E. Veglianti, and Y. Li, "Technological Forecasting & Social Change Understanding smart cities as a glocal strategy : A comparison between Italy," *Technol. Forecast. Soc. Chang.*, vol. 142, no. July 2018, pp. 26–41, 2019.

[28] V. Fernandez-Anez, J. M. Fernández-Güell, and R. Giffinger, "Smart City implementation and discourses: An integrated conceptual model. The case of Vienna," *Cities*, no. November, 2018.

[29] P. Venkat Reddy, A. Siva Krishna, and T. Ravi Kumar, "Study on concept of smart city and its structural components," *Int. J. Civ. Eng. Technol.*, vol. 8, no. 8, pp. 101–112, 2017.

[30] M. Romero, W. Guédria, H. Panetto, and B. Barafort, "Towards a Characterisation of Smart Systems: A Systematic Literature Review," *Comput. Ind.*, vol. 120, 2020.

[31] M. P. Rodríguez Bolívar, "Smart Technologies for Smart Governments," in *Public Administration and Information Technology*, Springer, 2018.

[32] M. Calderon, G. Lopez, and G. Marin, "Smartness and technical readiness of Latin American Cities: A critical assessment," *IEEE Access*, vol. 6, pp. 56839–56850, 2018.

[33] B. Allen, L. E. Tamindael, S. H. Bickerton, and W. Cho, "Does citizen coproduction lead to better urban services in smart cities projects? An empirical study on e-participation in a mobile big data platform," *Gov. Inf. Q.*, vol. 37, no. 1, p. 101412, 2020.

[34] J. R. Gil-Garcia, T. A. Pardo, and M. De Tuya, "Information Sharing as a Dimension of Smartness: Understanding Benefits and Challenges in Two Megacities," *Urban Aff. Rev.*, 2019.

[35] L. Anthopoulos and C. G. Reddick, "Smart City and Smart Government : Synonymous or Complementary?," in *International World Wide Web Conference Committee (IW3C2)*, 2016, pp. 351–355.

[36] H. J. Scholl and S. AlAwadhi, "Smart governance as key to multi-jurisdictional smart city initiatives: The case of the eCityGov Alliance," *Soc. Sci. Inf.*, vol. 55, no. 2, pp. 255–277, 2016.

[37] N. V. Lopes, "Smart governance: A key factor for smart cities implementation," *2017 IEEE Int. Conf. Smart Grid Smart Cities, ICSGSC 2017*, pp. 277–282, 2017.

[38] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE, 2009.

[39] L. G. Tornatzky, M. Fleischer, and A. K. Chakrabarti, *Technological Innovation As a Process*, no. January. Lexington Books, 1990.

[40] A. N. Hidayanto, "Smart City Readiness Model based on Technology-Organization- Environment (TOE) Framework and Its Effect on Adoption Decision Completed Research Paper," no. June, 2018.

[41] T. Nam and T. A. Pardo, "Conceptualizing smart city with dimensions of technology, people, and institutions," in *Proceedings of the 12th Annual International Digital Government Research Conference on Digital Government Innovation in Challenging Times - dg.o '11*, 2011, p. 282.

[42] B. Kitchenham and S. Charters, "Guidelines for performing Systematic Literature Reviews in Software Engineering," 2007.

[43] Kementerian PANRB, "SPBE Index 2018," 2018. [Online]. Available: https://spbe.menpan.go.id/. [Accessed: 03-Jun-2019].

[44] M. Sounders, P. Lewis, and A. Thornhill, *Research Methods for Business Students*, vol. 7, no. September. 2016.

[45] M. B. Miles, A. M. Huberman, and J. Saldana, *Qualitative Data Analysis A Methods Sourcebook*. SAGE, 2014.

[46] J. Recker, *Scientific Research in Information Systems*. Springer, 2013.

[47] A. Aldegheishem, "Success Factors of Smart Cities," *J. L. Use, Mobil. Environ.*, vol. 12, no. 1, pp. 53–64, 2019.

[48] M. P. Rodríguez-Bolívar and L. A. Munoz, *E-Participation in Smart Cities: Technologies and Models of Governance for Citizen Engagement*, vol. 34. 2019.

[49] T. Yigitcanlar and M. Kamruzzaman, "Does smart city policy lead to sustainability of cities?," *Land use policy*, vol. 73, no. November 2017, pp. 49–58, 2018.

[50] X. Li, P. S. W. Fong, S. Dai, and Y. Li, "Towards sustainable smart cities: An empirical comparative assessment and development pattern optimization in China," *J. Clean. Prod.*, vol. 215, pp. 730–743, 2019.

[51] S. Myeong, Y. Jung, and E. Lee, "A study on determinant factors in smart city development: An analytic hierarchy process analysis," *Sustain.*, vol. 10, no. 8, 2018.

[52] J. Heaton and A. K. Parlikad, "A conceptual framework for the alignment of infrastructure assets to citizen requirements within a Smart Cities framework," *Cities*, vol. 90, no. January, pp. 32–41, 2019.

[53] M. Pedro Rodriguez and M. P. Rodríguez-Bolívar, *Transforming City Governments for Successful Smart Cities*, vol. 12, no. 3. Springer Internasional Publishing Switzerland, 2015.

[54] A. K. Darmawan, D. Siahaan, T. D. Susanto, Hoiriyah, and B. Umam, "Identifying Success Factors in Smart City Readiness using a Structure Equation Modelling Approach," in *Proceedings - 2019 International Conference on Computer Science, Information Technology, and Electrical Engineering, ICOMITEE 2019*, 2019, vol. 1, pp. 148–153.

[55] S. Y. Tan and A. Taeihagh, "Smart City Governance in Developing Countries: A Systematic Literature Review," *Sustainability*, vol. 12, no. 3, p. 899, 2020.

[56] N. Ben, W. Eljaoued, N. Bellamine, B. Saoud, and R. Colomo-palacios, "Towards sustainable collaborative networks for smart cities co-governance," *Int. J. Inf. Manage.*, no. October, p. 102037, 2019.

[57] A. Faber, S. V. Rehm, A. Hernandez-Mendez, and F. Matthes, "Modeling and visualizing smart city mobility business ecosystems: Insights from a case study," *Inf.*, vol. 9, no. 11, 2018.

[58] M. J. R. Rotta, D. Sell, R. C. dos S. Pacheco, and T. Yigitcanlar, "Digital Commons and Citizen Coproduction in Smart Cities : Assessment of Brazilian Municipal E-Government Platforms," *Energies*, pp. 1–18, 2019.

[59] Z. Tomor, A. Meijer, A. Michels, and S. Geertman, "Smart Governance For Sustainable Cities : Findings from a Systematic Literature Review," *J. Urban Technol.*, vol. 0732, 2019.

[60] J. R. Gil-Garcia, T. A. Pardo, and T. Nam, "Smarter as the New Urban Agenda," in *Public Administration and Information Technology*, T. Nam, Ed. Springer, 2016, pp. 1–392.

[61] J. R. Gil-Garcia and T. A. P. Pardo, "E-government success factors : Mapping practical tools to theoretical foundations," *Gov. Inf. Q.*, vol. 22, pp. 187–216, 2005.

[62] K. A. Achmad, L. E. Nugroho, A. Djunaedi, and Widyawan, "Smart city readiness based on smart city council's readiness framework," *Int. J. Electr. Comput. Eng.*, vol. 8, no. 1, pp. 271–279, 2018.

[63] S. I. Haini, N. Z. Ab. Rahim, N. M. Mohd. Zainuddin, and R. Ibrahim, "Factors Influencing the Adoption of Open Government Data in The Public Sector: A Systematic Literature Review," *Int. J. Adv. Sci. Eng. Inf. Technol.*, vol. 10, no. 2, p. 611, 2020.

[64] M. Razaghi and M. Finger, "Smart Governance for Smart Cities," in *Proceedings of the IEEE*, 2018, vol. 106, no. 4, pp. 680–689.

[65] T. Yigitcanlar *et al.*, "Understanding 'smart cities': Intertwining development drivers with desired outcomes in a multidimensional framework," *Cities*, vol. 81, no. April, pp. 145–160, 2018.

[66] C. D. Dziuban and E. C. Shirkey, "When is a correlation matrix appropriate for factor analysis? Some decision rules," *Psychol. Bull.*, vol. 81, no. 6, pp. 358–361, 1974.