A scale for measuring perceived bureaucratic readiness for smart cities in Indonesia

Arif Budy Pratama
Universitas Tidar, Kota Magelang, Indonesia, and
Satria Aji Imawan
Universitas Gadjah Mada, Yogyakarta, Indonesia

Received 14 January 2019
Revised 28 February 2019
Accepted 8 March 2019

Abstract

Purpose – The purpose of this paper is to develop and validate a scale for measuring perceived bureaucratic readiness for smart city initiatives.
Design/methodology/approach – The present study employs a mixed method approach to achieve its research objectives. An exploratory study, consisting of literature review and qualitative interviews with key informants, was conducted to develop an initial instrument for measuring bureaucratic readiness. An online survey of 40 civil servants involved in smart city programmes in the Yogyakarta City government was then administered to test the instrument's validity and reliability.
Findings – Perceived bureaucratic readiness can be measured through four dimensions: commitment of the upper echelons, legal support, information technology resources and governance.
Research limitations/implications – The proposed scale provides an alternative instrument for measuring perceived bureaucratic readiness for smart city initiatives. However, as data were only derived from one city government, they are relatively small in scope. Future research can be conducted for generalisation by replicating this study in other cities, thereby measuring its effectiveness in other contexts and settings.
Practical implications – This study not only provides a better understanding of bureaucratic readiness for smart city initiatives, but also proposes an assessment tool as a practical means of assessing bureaucratic readiness. The quantification of readiness is beneficial to putting smart city programmes into practice, as it allows smart city managers to assess the internal bureaucracy's level of readiness. It also allows managers to mitigate and further policy agendas and thereby improve the bureaucracy's support for smart city programmes.
Originality/value – Literature sometimes underestimates the role of bureaucracy in smart city implementation while overly stressing stakeholders, vendors and technology. This paper attempts to contribute to smart city research by reaching beyond the technological perspective and focusing on local government bureaucracy. None of the extant literature provides a scale for measuring bureaucratic readiness. The study thus proposes a systematic way to develop a means of measuring perceived bureaucratic readiness for smart city programmes.

Keywords Scale development, Smart city, Perceived bureaucratic readiness

Paper type Research paper

Introduction

The rapid development of cities may result in such complicated urban problems as housing, sanitation, pollution and environmental issues, as well as congestion, crime, etc. Recently, smart city initiatives have emerged to overcome these negative effects of urban development. However, implementing smart city programmes is not an easy task; rather, it is dilemmatic as cities often face challenges during the process. One obstacle commonly found in smart city initiatives is a lack of governance arrangement (Praharaj *et al.*, 2017), as well as technological

Public Administration and Policy
Vol. 22 No. 1, 2019
pp. 25-39
Emerald Publishing Limited
1727-2645
DOI 10.1108/PAP-01-2019-0001

determinism in which information and communication technology (ICT) is regarded as the central tenet of smart city implementation (Hollands, 2008).

High-tech features of ICT, such as internet of things (IoT) (Hui *et al.*, 2017), big data (Lim *et al.*, 2018) and artificial intelligence (Kumar *et al.*, 2018), have significantly influenced smart city development. Indeed, digital technology – especially information technology infrastructure and expertise (Yarime, 2017; Yeh, 2017) – has contributed much to the development of smart cities. However, too much reliance on technology tends to result in non-technical aspects, which are also important during smart city planning and implementation, being neglected.

This paper attempts to scrutinise smart city initiatives by reaching beyond the technological perspective and focusing on government bureaucracy as an important actor in smart city initiatives. To date, little effort has been made to examine how ready city government bureaucracies are to execute smart city policies. The implementation of smart city programmes can be considered as a transformational process, through which changes are applied to promote a better and higher quality of life (Ibrahim *et al.*, 2018). Many empirical studies show that organisational readiness matters in the process of change (Oreg *et al.*, 2011; Vakola, 2013), and that failed organisational transformations sometime happen due to unreadiness and inertia (Armenakis *et al.*, 1993). Thus, it is important to assess organisations' level of readiness when they attempt organisational transformation.

In the context of change management, negative reactions and limited acceptance from staff and organisation are likely to hinder change programmes (Hwang *et al.*, 2016). The link between technology and successful programmes indicates that employees' acceptance is a predictor of successful implementation. A study by Yeo and Gold (2015) showed that organisational actors interpret and enact technology in a cross-boundary context during e-government implementation. They find that actors' acceptance, avoidance, adaptation and interpretation of technological complexities and task interdependency are related to e-government implementation.

This study proposes the development of a systematic scale to measure perceived bureaucratic readiness for smart city initiatives. Perceived bureaucratic readiness for smart city initiatives is defined as civil servants' beliefs, attitudes and intentions regarding the extent to which smart city programmes can be implemented in their jurisdiction. To determine readiness level, a quantitative measurement for bureaucratic readiness may offer a valuable instrument for assessment. Since organisation members are among the most important agents in organisational activities (Armenakis *et al.*, 1993; Todnem By, 2007; Oreg *et al.*, 2011; Vakola, 2014), this scale will draw on bureaucrats' perceptions of readiness. In other words, it will focus on the internal perceptions of the civil servants who execute smart city policies at the local government level. As such, the research question can be formulated as follows:

RQ. What dimensions shape perceived bureaucratic readiness for smart city initiatives and how can they be measured?

An empirically tested instrument for measuring perceived bureaucratic readiness is the main research output of this present study. This will enrich discussion of smart cities within the context of public bureaucracy. From a practical perspective, researchers and public managers can use this instrument to determine bureaucratic readiness in urban governments' smart city initiatives. The term "bureaucracy" is used to denote the Indonesian government, which is characterised as hierarchical and law based, with professional civil servants and specialised technical knowledge of rules and procedures (Pratama, 2017; Wihantoro *et al.*, 2015).

This paper begins by exploring smart city implementation in the context of Indonesia to position this concept as a research theme in a research setting. It will then present the initial measurement scale, synthesised from the literature review, qualitative interviews and expert-practitioner validation. The next section presents the results of an empirical

test of the initial scale using an online survey, indicating scale development, validity and reliability. Last, the results of this study are discussed in terms of their theoretical and practical implications.

Understanding Indonesia's smart cities: a practical perspective

The Minister of Communication and Informatics of the Republic of Indonesia's Regulation No. 14/2016 narrowly defines smart cities as digital or electronic cities. This definition does not match clearly the current debates on smart cities, which are recognised in terms of multi-dimensional aspects of urban governance and development. More comprehensive concepts and definitions of smart cities come from non-governmental organisations that deal with smart city projects. For example, the Indonesian Association of Intelligent Initiatives defines smart cities as initiatives for improving city residents' quality of life by managing city resources in a more effective, efficient, innovative and integrated way. This concept, called the smart city framework, supports sustainable development goals, including economic, social and environmental ones. Every domain has its own cluster and services, such as smart mobility, smart energy and smart health. This framework also distinguishes between e-government and smart cities, with smart cities being defined more broadly than e-government. A comprehensive approach is also proposed through this framework. Focus must not be given only to technical aspects, such as building ICT supports. The implementation of smart cities ought to consider social approaches, including smart government, smart living and smart society.

From a national development planning perspective, smart cities should promote city branding, such as the best products, human resources, society, culture and e-business, as well as the development of innovative and entrepreneurial human resource skills. This perspective is ensconced within the National Medium-Term Development Plan, 2015–2019. In substance, smart cities do not only enable ICT, but also seek to develop a better environment, society and economy. Given the various practical concepts of smart cities, this research does not rely on an exact definition; rather, it tries to explain the essence of the smart city concept. In this study, smart cities can be regarded as city initiatives, comprising of both technical and non-technical dimensions, that seek to deliver public services in smart ways.

Theoretical lens: linking PORC and organisational capability

Organisations need both capacity and capability to achieve successful change. The concept of perceived organisational readiness for change (PORC) has contributed to the study of change management since the 1970s (Cinite *et al.*, 2009). PORC's central argument is that change processes may be better understood by focusing on the assessment of organisations' members rather than outsiders. This premise has long been supported by empirical studies in various fields such as health and medical care (Weiner and Lee, 2008; Shea *et al.*, 2014), technology (Vakola, 2014), education (Zayim and Kondakci, 2015), cloud computing (Yang *et al.*, 2015), e-government (Koh *et al.*, 2008; Yaghi and Al-Jenaibi, 2017), big data (Klievink *et al.*, 2017) and public sector (Cinite *et al.*, 2009).

Another construct associated with change management is the ability for change. In the literature on organisations and management, change is regarded as a capability; as such, organisations must have the requisite capacity to deliver it (Altmann and Lee, 2015; Schweiger *et al.*, 2015; Sune and Gibb, 2015). From a digital governance perspective, organisational capability matters in facilitating the implementation of digital governance. Klievink *et al.* (2017) discuss the capacity to use big data in the public-sector drawing on such fields as IT adoption, IT implementation, innovation adoption, dynamic and core IT capabilities and big data application. These dimensions can be elaborated through practical assessment of organisational capability, particularly within the areas of IT governance, IT resources, internal attitudes, external attitudes, legal compliance, data governance and data science expertise.

Previous studies have advised that employees' perceived readiness and capacity to use organisational resources contributes to organisational readiness. As such, the literature on PORC within the public sector and the concept of organisational capability will be the main resource for this study's construction of a scale.

Setting

This study was conducted in the Yogyakarta city. This city was chosen due to its recognition as an adopter of the smart city concept. It has received several awards: first, Yogyakarta city received an award as one of the best smart city adopters from Rating Smart City Indonesia in 2017; second, it received the Best Smart Governance award from City Asia, Inc. Given this recognition, the Yogyakarta city government – especially its readiness for smart city programmes – is worthy of study.

To provide a clearer picture of Yogyakarta's smart city initiative, it is important to briefly describe the current state of its smart city implementation. Yogyakarta initiated its smart city programme a few years before the national "100 Smart Cities" movement was endorsed by the Ministry of Communication and Informatics, Ministry of Interior, Ministry of Public Work and Housing, Ministry of National Development Planning and the Presidential Office in 2017. Yogyakarta's smart city policy has strongly emphasised smart people.

One of its key projects is the Jogja Smart Service application, covering five categories: information and complaints covering all regions of Yogyakarta; data and information services, covering upcoming events, tourism sites, problems and job vacancies; partnerships with other sectors; general information about Yogyakarta, from the district to the village level; and emergency services, consisting of medical and firefighting services. Like other smart city initiatives, vendors and IT consultants have played an important role in developing Yogyakarta's smart city programme. However, the city government has acted as a principal on behalf of citizens. This also means that the local government is not only a contractor, but also has a responsibility to guarantee the accountable implementation of the smart city programme through its organisational and managerial mechanisms.

Data, methods and procedures

Many scholars have proposed steps through which researchers can develop scales (DeVellis, 2016; Gerbing and Anderson, 1988; Hinkin, 1995; Nunnally, 1978; Rossiter, 2002). For instance, DeVellis (2016) proposes eight general steps for developing a valid measurement instrument: determine clearly what you want to measure; generate an item pool; determine the format for measurement; have the item pool reviewed; consider the inclusion of validation items; administer items to a pilot sample; evaluate items; and produce the final measure. Rossiter (2002), meanwhile, formulated a simpler method called COARSE: Construct definition, Object classification, Attribute classification, Rater identification, Scale formation and Enumeration and reporting. The procedure is adapted from both of these models and synthesised to two phases.

First, qualitative research was conducted from February to May 2018. Qualitative data were collected by interviewing three key civil servants from the office of communication and informatics. This stage used a combination of deductive and inductive approaches. A set of exploratory factors was identified and synthesised with the literature as an initial draft of a bureaucratic readiness scale. Before the pooled item generation stage, academics and practitioners were consulted to improve the robustness of the initial draft.

Second, an online survey was conducted from May to June 2018 to test the validity and reliability of measurement scale. Double translation, from English to Indonesian and Indonesian to English, was conducted in the data collecting process. Respondents were civil servants involved in the smart city programme, selected using the random sampling method. Targeted respondents were ($n = 70$), with a response rate of 57.1 per cent. As such, a total of 40 civil servants ($n = 40$) were in the sample group. Regarding the sample size, this study follows

Wolf *et al.* (2013), who recommend a sample size of 30–460 for a simple model in structural equation modelling (SEM). Respondents were 65 per cent male and 35 per cent female, with 95 per cent in lower-middle positions in the bureaucracy and five per cent in the upper-middle management level. In terms of educational background, the majority of respondents had undergraduate degrees (75 per cent) followed by post-graduate degrees (15 per cent) and associate degrees (ten per cent). Ages ranged from 21 to 43, with a mean of 27.5 and SD of 4.36.

The procedure of this study can be seen in Figure 1.

Results

Phase 1: scale drafting

Based on the exploratory qualitative in-depth interviews about how civil servants perceive smart city readiness as a transformative process, a set of aspects constructing bureaucratic readiness were identified. Based on civil servants' insight, perceived bureaucratic readiness for smart city programmes may be determined based on the following aspects.

First, political and administrative commitment: one of the most important facets in the implementation of smart city policy is strong political will from the city mayor as the political leader of the city government as well as managerial commitment from the upper echelons of the bureaucracy. The political power of the mayor and his policy decisions are perceived as pre-requisites for smart city policies, while managerial commitment is an operational power in smart city policies. They believe that commitment from both is the key to achieve bureaucratic readiness. Commitment from superiors also means that the mayor, as the top leader of the smart city, must emphasise the application of smartness in public service delivery. Other informants stressed not only political commitment but also managerial support, meaning that the superiors who lead their project should support smart city implementation.

Second, laws and regulations on smart cities play an important role in perceived bureaucratic readiness. In the civil law tradition, laws and regulations are the source of government actions. Implementing agencies need to be backed by regulations whenever they operate. Current smart city policies in Indonesia, however, lack a specific definition, and as such the distinction between the electronic government and smart cities is blurred, thereby hindering the implementation phase. Another issue is related to policy coordination and synchronisation among multiple levels of government, which has occurred as a consequence of decentralisation in Indonesia. This system has given local government the autonomy to develop and design urban governance, resulting in cities having diverse policies and strategies.

Third, IT infrastructure – physical infrastructure and technical expertise of civil servants – is a major asset in smart city programme implementation. The combination of hardware and software is not all that is needed in technological-based governance; the local government bureaucracy must be ready to maintain IT infrastructure and expertise. Self-maintenance and low reliance on vendors were also major concerns of interviewees.

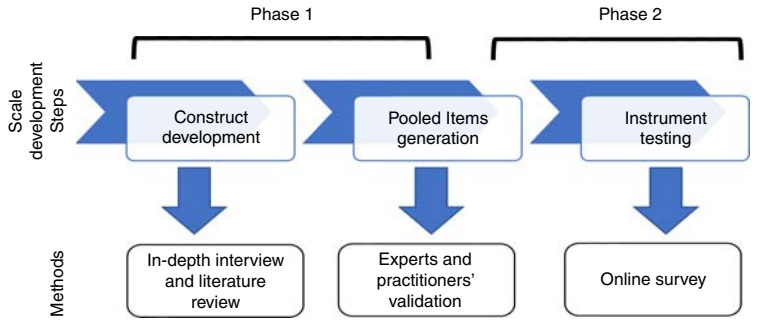

Figure 1.
Research procedure

Fourth, strategies and structures designate the ways in which city governments achieve their smart city aims and scopes, while structure leads to the availability of smart city operationalisation. Strategies designate the core objectives of smart city implementation and how to achieve them. As organs and machines, structures support and implement strategies that are approved by all stakeholders.

Scale construction

This study defines perceived bureaucratic readiness for smart city programmes as civil servants' beliefs, attitudes and intentions regarding the extent to which smart city programmes can be implemented in their jurisdiction. Building on the concepts of PORC and organisational capabilities, as well as grounded interview data, perceived bureaucratic readiness for smart city initiatives can be determined through four dimensions. The first dimension, commitment from the upper echelons, was modified from the commitment of senior management to change. The scale has drawn from the PORC construct (Cinite *et al.*, 2009), which consists of four items. Since the scale has been tested as a reliable and valid instrument, wording was modified to emphasise the commitment of leaders. For instance, the word "senior management" was changed to "upper echelon" and the substance of commitment was calibrated from "change" to "smart city". Therefore, commitment from the upper echelons was measured by four items: upper echelons are decisive with respect to the smart city programme; upper echelons have bought into the smart city programme; upper echelons determine the course of the smart city programme and consistently promote it on official occasions; and there is a champion of the smart city programme at the highest echelon of the organisation.

The other three dimensions were adapted from the concept of organisational capability for big data use (Klievink *et al.*, 2017), in which grounded data are similar to this concept. The aspects of legal compliance, IT resources and IT governance were given special attention, since they represent smart city features. The legal support dimension entailed five items: the smart city programme has legal standing; there is no regulation overlap in smart city implementation; the bureaucracy has the ability to design a legal compliance strategy; the bureaucracy has the ability to implement a legal compliance strategy; and the bureaucracy has the ability to monitor and evaluate a legal compliance strategy. Meanwhile, the IT resources dimension was measured through three items: there is sufficient IT infrastructure to support smart city implementation; there is sufficient maintenance of IT infrastructure; and there is sufficient IT expertise to implement the smart city programme. Last, the smart city governance dimension was measured through six items: we have clear strategic planning for the smart city programme; the bureaucracy has the ability to design a smart city strategy; the bureaucracy has the ability to implement a smart city strategy; the bureaucracy has the ability to maintain a smart city strategy; the smart city programme has been supported by a well-defined structure; and previous processes will be smoothly integrated into the new system in which the smart city will take place.

A set of pooled items, consisting of 18 statements, were then discussed with academics specialising in Indonesian bureaucracy from Tidar University and 2 practitioners from the Yogyakarta city government. This process was administered to determine the validity of pooled items. Of the 18 items, only 1 item, from the governance dimension, was recommended to be removed from the initial scales. It was "The bureaucracy has the ability to maintain a smart city strategy". Finally, the initial scale for measuring bureaucratic readiness for smart city initiatives was created using 4 dimensions and 17 items (Table I).

Phase 2: instrument testing

To test the initial measurement scale, SEM was applied due to its fitness for assessing the scale and its dimensionality. Researchers typically prefer to measure latent constructs, rather than the content of a set of items (DeVellis, 2016). The use of SEM is one means of simultaneously

Quote/first order codes	Second order codes	Literatures codes	Dimensions
"[…] the mayor has a commitment to improve the quality of public services, as indicated by integrated, simple, transparent and accountable service delivery. How can that be improved? By utilising information and technology, with a special focus on the smart city programme JM/06/05/2018" "[…] while my manager is rather technical in action, he is a spearhead working with the mayor for the smart city and city branding programme. Further, Echelons 3 and 4 are reminders of the smart city roadmap" ITH/08/05/2018	Political and administrative Commitment	Perceive Organisational Readiness to Change/PORC (Cinite *et al.*, 2009)	Commitment of the upper Echelons
"[…] the regulatory framework for smart city should be comprehensive, from the national level to the sub-national level. It gives us a standing point to execute the policy using local government authorities […]" AR/10/05/2018	Regulatory framework and legal standing	Capability in digital governance (Klievink *et al.*, 2017)	Legal support
"[…] we are committed to continuously building IT infrastructure because it is a main value of our city's smart city programme, as is civil servants' skills. Technological developments must receive an expert response. Technology is evolving; human skills must also evolve […]" SRW/15/05/2018 "[…] the most important point to be considered in the smart city project is the availability of IT experts. Why? Because the government, as a contractor, requires project sustainability. If experts come from the outside, we will lose this sustainability as experts leave the project. I analogise it like this: the civil servant should hold the 'key' to computer programmes instead of non-civil servant experts […]" SS/13/05/2018	IT infrastructure and expertise	Capability in digital governance (Klievink *et al.*, 2017)	IT resources
"[…] strategy deals with vision and mission statements, as well as target designs and action plans. The way the government sets its strategy is very crucial, as it is the soul of the policy and programme. In Yogyakarta, strategy is linked to city branding as a counterpart of the smart city initiative. This gives a strategic direction and value to smart city implementation […]" EM/21/05/2018	Governance strategies and structures	Capability in digital governance (Klievink *et al.*, 2017)	Governance

Table I.
Construct building based on interviews and literature

accommodating the measurement of multiple dependence relationships between constructs and dealing with construct dimensionality (Noar, 2003; Farooq, 2016). The maximum likelihood of estimation was used for normality assumptions. The initial model consisted of 4 dimensions and 17 items, and their factor loading was estimated through AMOS – a statistical software package for SEM produced by SPSS. It can be depicted in Figure 2 and Table II.

Model validity can be measured using construct validity and goodness-of-fit (Farooq, 2016). Goodness-of-fit can be determined using three indices: absolute fit indices (RMSEA, GFI, RMR), incremental fit indices (CFI), and parsimony fit indices (AGFI). The model-fit from this initial model achieved the following output: CMIN/DF: 1.562, RMR: 0.129, GFI: 0.692, AGFI: 0.583, CFI: 0.819, RMSEA: 0.120. The default model indices did not indicate goodness-of-fit. For improvement, item purification was conducted by dropping items with a small factor loading. Five items with a factor loading of less than 0.60 were dropped: there is a champion of the smart city programme at the highest echelon of the organisation; the bureaucracy has the ability to implement a legal compliance strategy; the bureaucracy has the ability to monitor and

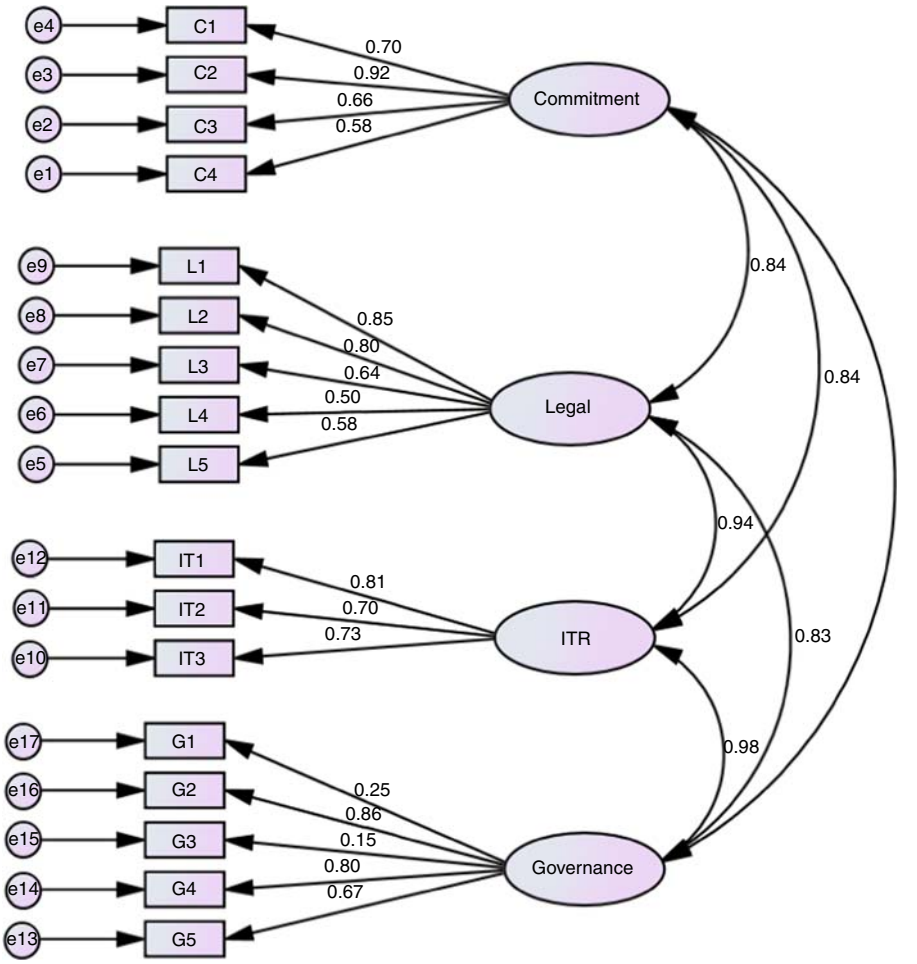

Figure 2.
Initial measurement model and its factor loading

evaluate a legal compliance strategy; we have clear strategic planning for the smart city programme; and the bureaucracy has the ability to implement a smart city strategy. After these items were dropped, a modified model with goodness-of-fit was reached. It was shaped by 4 dimensions and 12 items (Figure 3 and Table III).

The model-fit indices improved significantly after item purification. First, the absolute fit indices, denoted as the extent to which the model fits the sample data, were assessed through RMSEA, GFI and RMR. The RMSEA improved from 0.120 to 0.07, which achieved the cut-off value of 0.08, while the GFI improved from 0.692 to 0.81, which was close to the acceptable value of 0.90, and the RMR from 0.12 to 0.10. Second, incremental fit indices, which showed how well the specified model fits compared to alternative baseline models, were reviewed through the CFI value. After dropping the five items with low-factor loading, the CFI improved from 0.81 to 0.96, meaning that it reached the cut-off value of CFI (> 0.9). Other indices, such as TLI, were acceptable at a value of 0.94. Third, parsimony fit indices deal with overall discrepancy between observed and implied covariance, and are also associated with model complexity. In this study, the AGFI is relatively low, despite having improved from 0.58 to 0.69. Another measure of

Constructs	Definition	Items
Commitment of the upper echelons	Degree to which upper echelons have commitment on smart city programme	1. Upper echelons are decisive with respect to the smart city programme 2. Upper echelons have bought into the smart city programme 3. Upper echelons determine the course of the smart city programme and consistently promote it on official occasions 4. There is a champion of the smart city programme at the highest echelon of the organisation
Legal support	Degree to which bureaucracy can adjust smart city programme into regulation and legal system	5. The smart city programme has legal standing 6. There is no regulation overlap in smart city implementation 7. The bureaucracy has the ability to design a legal compliance strategy 8. The bureaucracy has the ability to implement a legal compliance strategy 9. The bureaucracy has the ability to monitor and evaluate a legal compliance strategy
IT resources	Degree to which bureaucracy is capable design, develop and maintain proper IT infrastructure and expertise to facilitate smart city programme	10. There is sufficient IT infrastructure to support smart city implementation 11. There is sufficient maintenance of IT infrastructure 12. There is sufficient IT expertise to implement the smart city programme
Governance	Degree to which bureaucracy is capable to design, develop, and maintain smart city strategy, decision making and responsibility structures, supporting organisations, including integration of systems	13. We have clear strategic planning for the smart city programme 14. The bureaucracy has the ability to design a smart city strategy 15. The bureaucracy has the ability to implement a smart city strategy 16. The smart city programme has been supported by a well-defined structure 17. Previous processes will be smoothly integrated into the new system in which the smart city will take place

Table II.
Constructs, definition and items

parsimony fit is CMIN/DF: 1.21 was acceptable, since a good value ranges from one to three. Given the above indices, the purified model was acceptable as a good fit.

Reliability assessment can be assessed by calculating composite reliability (CR) and average variance extracted (AVE). CR is mostly used in SEM testing, which measures internal consistency. CR and AVE were calculated in each dimension. This study follows Hair *et al.* (1998), who suggest that it is better for all CRs to have a value greater than 0.6 and all AVEs to be above 0.5. This means that more than half of the variance observed is accounted for by the hypothesised constructs. CR and AVE calculations were done manually, using an Excel spreadsheet, because AMOS does not provide for CR and AVE calculation. AVE was assessed by summing the square of the factor load divided by numbers of items. The following values were achieved:

- commitment from upper echelons has CR = 0.81 and AVE = 0.60;
- legal support has CR = 0.81 and AVE = 059;
- IT resources has CR = 0.79 and AVE = 0.56; and
- governance has CR = 0.81 and AVE = 0.59.

Since the CR and AVE for all constructs in the model were acceptable, evidence of good internal consistency was found.

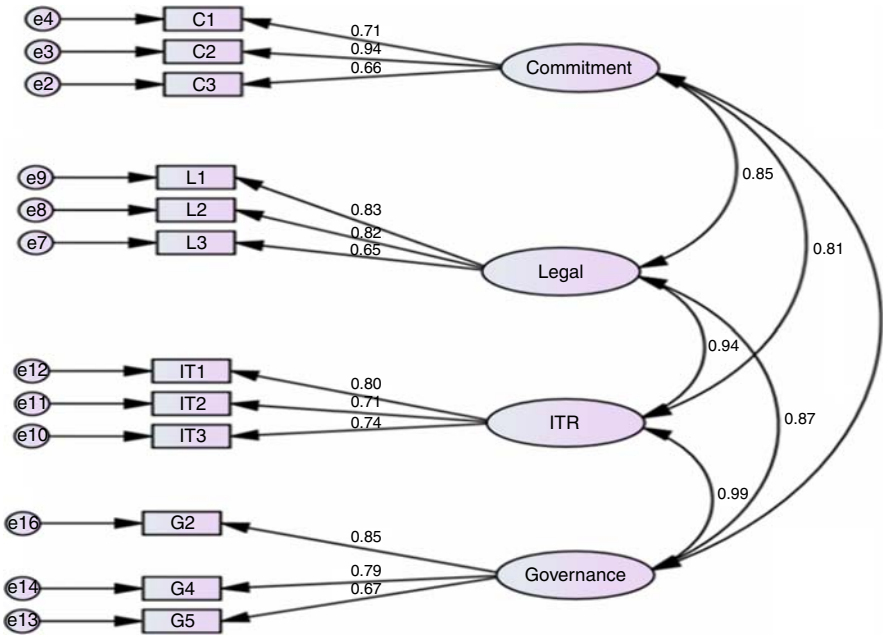

Figure 3.
Item purification model with factor loading of each item

Dimensions/items	Factor loading
Commitment of the upper echelons CR = 0.81 and AVE = 0.60	
1. Upper echelons are decisive with respect to the smart city programme	0.71
2. Upper echelons have bought into the smart city programme	0.94
3. Upper echelons determine the course of the smart city programme and consistently promote it on official occasions	0.66
Legal Support CR = 0.81 and AVE = 0.59	
1. The smart city programme has legal standing	0.83
2. There is no regulation overlap in smart city implementation	0.82
3. The bureaucracy has the ability to design a legal compliance strategy	0.65
IT resources CR = 0.79 and AVE = 0.56	
1. There is sufficient IT infrastructure to support smart city implementation	0.80
2. There is sufficient maintenance of IT infrastructure	0.71
3. There is sufficient IT expertise to implement the smart city programme	0.74
Governance has CR = 0.81 and AVE = 0.59	
1. The bureaucracy has the ability to design a smart city strategy	0.85
2. The smart city programme has been supported by a well-defined structure	0.79
3. Previous processes will be smoothly integrated into the new system in which the smart city will take place	0.67
Notes: Core indices of model-fit CMin/df = 1.21; GFI = 0.81, CFI = 0.96, RMSEA = 0.07	

Table III.
Summary of final measurement scale

Discussion

A smart city programme can be assumed to be a transformational process in which a city government shifts its mode of governance to become smarter in delivering public services. This study is mainly built from the change management literature, especially the concepts of organisational readiness and organisational capability. This study has produced a

multi-dimensional construct of perceived bureaucratic readiness to contribute to smart city debates, especially on how bureaucracies engage with smart city policies and programmes. The findings of this study also support the human-centred paradigm, which believes that acceptance, adaptation and employee mindset play important roles in programme implementation (Cunningham *et al.*, 2002; Oreg *et al.*, 2011; Vakola, 2014). Thus, instead of relying on external assessment, focus is given to internal perspectives of readiness, providing a clearer understanding of the bureaucracy's readiness for smart city initiatives.

As transformational development, smart city programmes should undergo a change process. One prominent theory for explaining change is theory of change (ToC), which emphasises how social and political changes evolve in society (Stein and Valters, 2012; Valters, 2014). Regardless of the various definitions used in different disciplines, the common understanding of ToC posits that the logic of specific change can influence the outcome of desired change. This means that change should be planned in a systematic way to promote new management practices (Fernandez and Rainey, 2006; Van der Voet *et al.*, 2016).

To successfully transform bureaucracy through its smart city programme, the Yogyakarta city government must design a change management blueprint to guide its bureaucracy. Furthermore, the institutional factors, specifically how managerial actions and strategies implemented within organisations, affect the transformation process in which change occurs. Successful change management is related to the degree to which organisations are ready to face the change itself (Napier *et al.*, 2017). Following Price and Chahal (2006), planning and well-documentation of change management which includes: the background of the change management programme; vision, goals and objectives; the design of the change management programme; implementation plan; and timescales, matter in the process of transformation.

Given a valid and reliable scale for measuring bureaucratic readiness for a smart city programme, the Yogyakarta city government and other local governments may consider four dimensions of readiness in its programme implementation. First, the commitment of the upper echelons, including both the mayor and senior civil servants, is very important in ensuring bureaucratic readiness. The support of the upper echelons is very beneficial in strategic policy decisions and planning. This concept is also connected to recent debates on leadership and change management in the public sector (Van der Voet *et al.*, 2016), which emphasises transformational leadership during reform and transformation processes. Second, clear and comprehensive regulations for smart city initiatives may give smart city implementation a powerful legal standing. Regulatory framework is perceived as necessary for putting smart city policy into action as the bureaucracy must be backed up with legal and written regulations. Third, since smart cities are strongly highly linked to technology, IT resources – the degree to which the bureaucracy is capable of designing, developing and maintaining IT infrastructure and the expertise to facilitate a smart city programme – need to be taken into account. Fourth, the degree to which the bureaucracy can design, develop and maintain strategies, decisions and structures to support smart city policy may contribute to the degree to which the bureaucracy is ready to implement a smart city programme. All of these four dimensions should be integrated with the five elements of documented change management within change management plan to promote readiness. The framework illustrates the integration of perceived readiness and change plan documentation (Figure 4).

Another significant element is capability, meaning that the organisation (city government) must have the requisite capacity to deliver change. Referring to the bureaucratic readiness construct, capacity building for civil servants may focus on such areas as smart city policymaking and strategy, IT expertise and security, governance, collaboration and institutional development. In the public-sector context, capability is rather different than in the private sector (Andrews *et al.*, 2016). This is due to environmental differences that must be addressed properly. Capacity building for bureaucratic readiness, thus, must be integrated with the existing capacity building framework in the local government context. The administrative

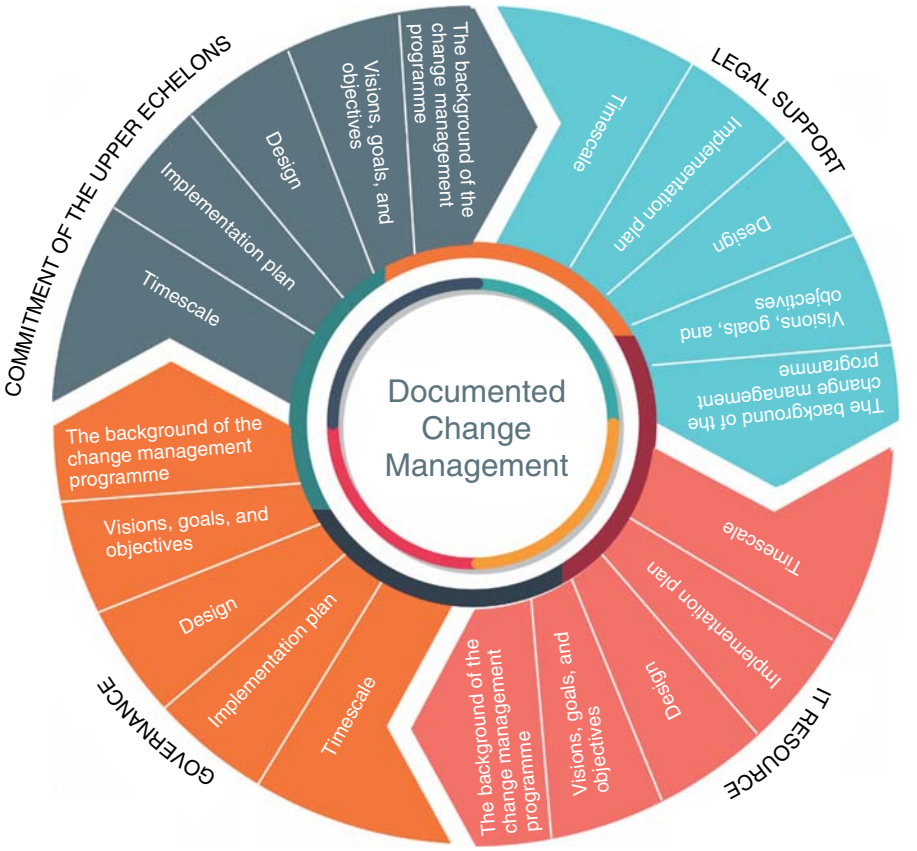

Figure 4.
The integration of perceived readiness and documented change

and regulatory framework for capacity building, training and educating civil servants should be aligned with the national and regional civil service systems.

Managerial implications can be drawn from our proposed measurement scale. Smart city managers can utilise the multi-dimensional construct of bureaucratic readiness and its scale to assess how ready the government bureaucracy is to implement a smart city initiative. This means that the scale gives the bureaucracy diagnostic power to self-assess readiness for smart city implementation. Furthermore, by mitigating the weaknesses of the perceived bureaucratic readiness metric, smart city managers can design further interventions that enable them to achieve a higher level of readiness.

Conclusion

Recalling that the objective of this study is the development and validation of a scale for measuring bureaucratic readiness in Indonesia's smart city initiatives, a scale comprising 4 dimensions and 12 items has been prepared. The validated items are as follows: first, commitment of the upper echelons dimension consists of three items: upper echelons are decisive with respect to the smart city programme, upper echelons have bought into the smart city programme, upper echelons determine the course of the smart city programme and consistently promote it on official occasions. Second, the legal support dimension consists of three items: the smart city programme has legal standing, there is no regulation

overlap in smart city implementation, and the bureaucracy has the ability to design a legal compliance strategy. Third, the IT resources dimension consists of three items: there is sufficient IT infrastructure to support smart city implementation, there is a sufficient maintenance of IT infrastructure and there is sufficient IT expertise to implement a smart city programme. Fourth, the governance dimension consists of three items: the bureaucracy has the ability to design a smart city strategy, the smart city programme has been supported by a well-defined structure and previous processes will be smoothly integrated into the new system in which the smart city will take place.

The final scale for measuring perceived bureaucratic readiness for smart city initiatives has been tested empirically and meets the validity and reliability thresholds. Consequently, this scale provides an alternative instrument for measuring perceived bureaucratic readiness when local governments intend to implement a smart city programme. Smart city planners and senior public managers may consider this proposed instrument to assess the bureaucracy's perceived readiness before and during smart city implementation. However, this instrument has a model generalisability issue, since data were only derived from one city government, which is relatively small in size and scope. Thus, it can only be generalised to cities with relatively similar contexts. Future research can be conducted by replicating this study in other contexts and settings, including different cities in different countries. Also, this study did not verify convergence validity, which examines the relationship of perceived readiness with other associated constructs. Future studies with a convergence validity test may improve the robustness of this model.

References

Altmann, P. and Lee, C. (2015), "Cognition, capabilities, and resources: developing a model of organizational change", *Journal of Management and Change*, Vols 34/35 Nos 1/2, pp. 76-92.

Andrews, R., Beynon, M.J. and McDermott, A.M. (2016), "Organizational capability in the public sector: a configurational approach", *Journal of Public Administration Research and Theory*, Vol. 26 No. 2, pp. 239-258, doi: 10.1093/jopart/muv005.

Armenakis, A.A., Harris, S.G. and Mossholder, K.W. (1993), "Creating readiness for organizational change", *Human Relations*, Vol. 46 No. 6, pp. 681-703, doi: 10.1177/001872679304600601.

Cinite, I., Duxbury, L.E. and Higgins, C. (2009), "Measurement of perceived organizational readiness for change in the public sector", *British Journal of Management*, Vol. 20 No. 2, pp. 265-277, doi: 10.1111/j.1467-8551.2008.00582.x.

Cunningham, C.E., Woodward, C.A., Shannon, H.S., Macintosh, J., Lendrum, B., Rosenbloom, D. and Brown, J. (2002), "Readiness for organizational change: a longitudinal study of workplace psychology", *Journal of Occupational and Organizational Psychology*, Vol. 75 No. 4, pp. 377-392.

DeVellis, R. (2016), *Scale Development: Theory and Applications*, Sage, Los Angeles, CA.

Farooq, R. (2016), "Role of structural equation modeling in scale development", *Journal of Advances in Management Research*, Vol. 13 No. 1, pp. 1-24.

Fernandez, S. and Rainey, H.G. (2006), "Managing successful organizational change in the public sector", *Public Administration Review*, Vol. 66 No. 2, pp. 168-176, doi: 10.1111/j.1540-6210.2006.00570.x.

Gerbing, D.W. and Anderson, J.C. (1988), "An updated paradigm for scale development incorporating unidimensionality and its assessment", *Journal of Marketing Research*, Vol. 25 No. 2, pp. 186-192, doi: 10.2307/3172650.

Hair, J.F., Anderson, E.R., Tatham, R.L. and Black, W. (1998), *Multivariate Data Analysis*, 5th ed., Prentice Hall, Upper Saddle River, NJ.

Hinkin, T. (1995), "A review of scale development practices in the study of organizations", *Journal of Management*, Vol. 21 No. 5, pp. 967-988, doi: 10.1016/0149-2063(95)90050-0.

Hollands, R.G. (2008), "Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?", *City: Analysis of Urban Trends, Culture, Theory, Policy Action*, Vol. 12 No. 3, pp. 303-320, doi: 10.1080/13604810802479126.

Hui, T.K.L., Sherratt, R.S. and Sánchez, D.D. (2017), "Major requirements for building smart homes in smart cities based on internet of things technologies", *Future Generation Computer Systems*, Vol. 76, November, pp. 358-369, doi: 10.1016/j.future.2016.10.026.

Hwang, Y., Al-Arabiat, M., Rouibah, K. and Chung, J.Y. (2016), "Toward an integrative view for the leader-member exchange of system implementation", *International Journal of Information Management*, Vol. 36 No. 6, pp. 976-986, doi: 10.1016/j.ijinfomgt.2016.06.008.

Ibrahim, M., El-Zaart, A. and Adams, C. (2018), "Smart sustainable cities roadmap: readiness for transformation towards urban sustainability", *Sustainable Cities and Society*, Vol. 37, February, pp. 530-540, doi: 10.1016/j.scs.2017.10.008.

Klievink, B., Romijn, B.J., Cunningham, S. and de Bruijn, H. (2017), "Big data in the public sector: uncertainties and readiness", *Information Systems Frontiers*, Vol. 19 No. 2, pp. 267-283, doi: 10.1007/s10796-016-9686-2.

Koh, C.E., Prybutok, V.R. and Zhang, X. (2008), "Measuring e-government readiness", *Information and Management*, Vol. 45 No. 8, pp. 540-546, doi: 10.1016/j.im.2008.08.005.

Kumar, S., Datta, D., Singh, S.K. and Sangaiah, A.K. (2018), "An intelligent decision computing paradigm for crowd monitoring in the smart city", *Journal of Parallel and Distributed Computing*, Vol. 118 No. 2, pp. 344-358, doi: 10.1016/j.jpdc.2017.03.002.

Lim, C., Kim, K. and Maglio, P.P. (2018), "Smart cities with big data: reference models, challenges, and considerations", *Cities*, Vol. 82, December, pp. 86-99, doi: 10.1016/j.cities.2018.04.011.

Napier, G., Amborski, D. and Pesek, V. (2017), "Preparing for transformational change: a framework for assessing organisational change readiness", *International Journal of Human Resources Development and Management*, Vol. 17 No. 1, pp. 129-142.

Noar, S. (2003), "The role of structural equation modeling in scale development", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 10 No. 4, pp. 493-524, doi: 10.1207/s15328007sem1004.

Nunnally, J. (1978), *Psychometric Theory*, McGraw-Hill, New York, NY.

Oreg, S., Vakola, M. and Armenakis, A. (2011), "Change recipients' reactions to organizational change: a 60-year review of quantitative studies", *Journal of Applied Behavioral Science*, Vol. 47 No. 4, pp. 461-524, doi: 10.1177/0021886310396550.

Praharaj, S., Han, J.H. and Hawken, S. (2017), "Urban innovation through policy integration: critical perspectives from 100 smart cities mission in India", *City, Culture and Society*, Vol. 12, March, pp. 35-43, doi: 10.1016/j.ccs.2017.06.004.

Pratama, A.B. (2017), "Bureaucracy reform deficit in indonesia: a cultural theory perspective", *Journal of Public Administration and Governance*, Vol. 7 No. 3, pp. 88-99, doi: 10.5296/jpag.v7i3.11519.

Price, A.D.F. and Chahal, K. (2006), "A strategic framework for change management", *Construction Management and Economics*, Vol. 24 No. 3, pp. 237-251, doi: 10.1080/01446190500227011.

Rossiter, J.R. (2002), "The C-OA-SE procedure for scale development in marketing", *International Journal of Research in Marketing*, Vol. 19 No. 4, pp. 305-335, doi: 10.1016/S0167-8116(02)00097-6.

Schweiger, C., Kump, B. and Hoormann, L. (2015), "A concept for diagnosing and developing organizational change capabilities", *The Asian Institute and the Justice and Security Research Programme*.

Shea, C.M., Jacobs, S.R., Esserman, D.A., Bruce, K. and Weiner, B.J. (2014), "Organizational readiness for implementing change: a psychometric assessment of a new measure", *Implementation Science*, Vol. 9 No. 7, pp. 1-15, doi: 10.1186/1748-5908-9-7.

Stein, D. and Valters, C. (2012), "Understanding 'theory of change' in international development: a review of existing knowledge", *Justice and Security Research Programme Paper*, No. 1, pp. 1-25.

Sune, A. and Gibb, J. (2015), "Organizational change and dynamic capabilities: how a firm transforms its resource base", *Journal of Organizational Change Management*, Vol. 28 No. 2, pp. 213-231.

Todnem By, R. (2007), "Ready or not …", *Journal of Change Management*, Vol. 7 No. 1, pp. 3-11, doi: 10.1080/14697010701265249.

Vakola, M. (2013), "Multilevel readiness for organizational change: a conceptual approach", *Journal of Change Management*, Vol. 13 No. 1, pp. 37-41, doi: 10.1080/14697017.2013.768436.

Vakola, M. (2014), "What's in there for me? Individual readiness for change and the perceived impact of organizational change", *Leadership and Organization Development Journal*, Vol. 35 No. 3, pp. 195-209, doi: 10.1108/LODJ-05-2012-0064.

Valters, C. (2014), "Theories of change in international development: communication, learning, or accountability?", *The Justice and Security Research Programme*, London.

Van der Voet, J., Kuipers, B.S. and Groeneveld, S. (2016), "Implementing change in public organizations: the relationship between leadership and affective commitment to change in a public sector context", *Public Management Review*, Vol. 18 No. 6, pp. 842-865, doi: 10.1080/14719037.2015.1045020.

Weiner, B.J. and Lee, S.D. (2008), "Measurement of organizational services research and other fields", *Medical Care Research and Review*, Vol. 65 No. 4, pp. 379-436, doi: 10.1177/1077558708317802.

Wihantoro, Y., Lowe, A., Cooper, S. and Manochin, M. (2015), "Bureaucratic reform in post-asian crisis Indonesia: the directorate general of tax", *Critical Perspectives on Accounting*, Vol. 31, September, pp. 44-63, doi: 10.1016/j.cpa.2015.04.002.

Wolf, E.J., Harrington, K.M., Clark, S.L. and Miller, M.W. (2013), "Sample size requirements for structural equation models: an evaluation of power, bias, and solution propriety", *National Institutes of Health*, Vol. 76 No. 6, pp. 913-934, doi: 10.1177/0013164413495237.Sample.

Yaghi, A. and Al-Jenaibi, B. (2017), "Organizational readiness for e-governance: a study of public agencies in the United Arab Emirates", *South Asian Journal of Management*, Vol. 24 No. 1, pp. 7-31.

Yang, Z., Sun, J., Zhang, Y. and Wang, Y. (2015), "Understanding SaaS adoption from the perspective of organizational users: a tripod readiness model", *Computers in Human Behavior*, Vol. 45, April, pp. 254-264, doi: 10.1016/j.chb.2014.12.022.

Yarime, M. (2017), "Facilitating data-intensive approaches to innovation for sustainability: opportunities and challenges in building smart cities", *Sustainability Science*, Vol. 12 No. 6, pp. 881-885, doi: 10.1007/s11625-017-0498-1.

Yeh, H. (2017), "The effects of successful ICT-based smart city services: from citizens' perspectives", *Government Information Quarterly*, Vol. 34 No. 3, pp. 556-565, doi: 10.1016/j.giq.2017.05.001.

Yeo, K.R. and Gold, J. (2015), "More than meets the eye: working around technology in cross boundary work contexts", *Information Technology and People*, Vol. 28 No. 3, pp. 623-652.

Zayim, M. and Kondakci, Y. (2015), "An exploration of the relationship between readiness for change and organizational trust in turkish public schools", *Educational Management Administration and Leadership*, Vol. 43 No. 4, pp. 610-625, doi: 10.1177/1741143214523009.

About the authors

Arif Budy Pratama is Lecturer in the Department of Public Administration, Universitas Tidar, Indonesia. He holds his Master's degree in Public Administration (with Distinction) from the University of Exeter, UK, funded by Chevening Scholarship 2015–2016. He also earned his Master's degree in strategic studies from the University of Indonesia in 2011 and Bachelor's degree in Public Administration from Universitas Diponegoro in 2007. Prior to joining academia, he worked as Head of Programme Formulation in the Planning and Organisation Bureau, Ministry for Political, Legal and Security Affairs of the Republic of Indonesia. He is interested in public-sector innovation and local governance research. Arif Budy Pratama is the corresponding author and can be contacted at: arifpratama@untidar.ac.id

Satria Aji Imawan, received his Bachelor's degree from the Faculty of Social and Political Sciences, Universitas Gadjah Mada, Indonesia, and acquired his Master's degree in Public Administration from the University of Exeter, UK. His research interests are behavioural public administration, public service innovation and regulatory impact assessment. He is currently a research staff at the Centre for Population and Policy Studies, Universitas Gadjah Mada, Indonesia.