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CONSTRUCT VALIDITY AND INTERNAL CONSISTENCY OF SUSTAINABLE RESIDENTIAL AREA MEASUREMENT IN SUBURBAN INDONESIA

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Abstract: The issue of liveability is an important aspect in the vision of implementing sustainable urban development. One of the preconditions to build sustainable urban areas is the planning of sustainable housing and/or residential areas. Nevertheless, this issue has not garnered serious concern in Indonesia. Thus, this article identifies 52 indicators of sustainability in residential areas and classified them into six parameters, namely economic, social, environment, infrastructure, technology and governance. The construct validity and internal consistency tests were performed on the indicators. Results showed that 44 of the indicators were valid and reliable points to consider in planning a sustainable residential area.

Keywords: Classic sustainability; infrastructure, technology, governance.

Introduction

In some countries, developing sustainable residential areas has acquired serious attention because it is an important factor in establishing sustainable cities that are liveable for generations to come (Tsenkova, 2016). More than that, it is associated directly or indirectly with sustainable development (Winston & Eastaway, 2008). Therefore, several criteria and indicators have been formulated and developed to measure the sustainability level of residential areas. Several empirical studies have even examined it in field surveys.

British Columbia in Canada, for example, is developing a criteria for evaluating the sustainability of small-size neighbourhoods (Haider *et al.*, 2018). In fact, Germany has implemented a certification system to identify sustainable residential areas (Rid *et al.,* 2017). In Iran, a study had been conducted to measure the sustainability of residential areas in Kermanshah City (Pakzad & Salari, 2018). Le and co-workers (2016) had identified 12 indicators to measure the quality of social housing in Vietnam. Moreover, Australia had developed seven principles for evaluating the sustainability of a residential area (Rauscher & Momtaz, 2015).

However, sustainable housing has not garnered serious concern in Indonesia. This can be seen from the fact that there are very few studies on the subject conducted in the country. In the level of empirical research, small efforts have been exercised by several researchers. An example is the research conducted by Santosa *et al.*, (2012) on a settlement in the Cisadane Watershed in Jakarta. However, the rest of the studies focused on the people's basic needs (Aminah, 2015), housing subsidies (Kusumastuti, 2015) and organisation strategy and policy reforms in housing and settlements (Suprijanto, 2004).

At policy level, the Indonesian Public Works and Housing Ministry had come up with a concept for sustainable urban settlements since 2014. Its parameters consist of social, economic and environmental aspects, with governance as the foundation. However, the concept has yet to be implemented. The lack of regulation may be a reasonable explanation on why the growth of residential areas is having a negative impact on living conditions in Indonesian cities (Huang & Jiang, 2009; Widhyharto, 2009; Elhadary *et al.*, 2013; including housing inequality, in a formerly egalitarian society. This article provides both a conceptual framework and an empirical analysis

of housing inequality in transitional urban China. Using the 1995 1% Population Survey and the 2000 Census data for Beijing, it shows that there was significant housing inequality between different socio-economic and institutional groups and that the reforms in the late 1990s aggravated it. While emerging market mechanisms began to contribute to housing inequality, socialist institutions such as the household registration (hukou Newman *et al.*, 2013; Ningrum *et al*., 2014; Hwang, 2015; Liu & Liu, 2016). However, current development practices still have a positive impact because they encourage economic agglomeration, which generates convergence of economic growth (The World Bank, 2009). This study explored the construct validity and internal consistency of 52 indicators of a sustainable residential area. The reason why this study is important is because of concerns on whether such indicators can effectively determine whether a residential area is sustainable in a consistent manner. This understanding is in line with the definition of construct validity, which is the degree to which a test measures what it claims, or purports, to be measuring (Cronbach & Meehl, 1955). In addition, the internal consistency shows the consistency of a measuring instrument.

Methods

A survey was conducted among 37 households in South Tangerang city, a suburb in the hinterlands of greater Jakarta. There are two main reasons why this part of the Indonesian capital was chosen. First, as a relatively new autonomous region, it had impressive achievements in good governance after winning several awards from the government and private organisations. They included (1) the best and potential city for investment in Indonesia's Attractiveness Award in 2016; (2) the environmental "Adipura" Certificate in 2016; and, (3) an award for "government and private cooperation in the provision of public space", in terms of planning and settlement by the Eastern Regional Organization for Planning and Human Settlements (EAROPH) in 2014.

With these achievements, South Tangerang had become a benchmark for other cities in Indonesia. Therefore, based on observations in the region's administration, the policy recommendations that emerged from this research could be considered for other local authorities to improve the administration of their residential areas (domino effect).

Secondly, South Tangerang was established under Act No. 51/2008 on 29th September 2008 after being separated from Tangerang Regency in Banten Province. It is in the eastern part of the province and was administratively divided into seven districts and 54 subdistricts, with an area of 147.19 km^2. The population growth reached an average of 3.56 % between 2011 and 2015. Data from the Local Statistical Bureau (BPS) showed that 70 % of the municipality's land use consisted of settlements and this increased

Table 1: Residential areas developed in South Tangerang

District	Number of residential areas	Number of housing
Ciputat	150	61.564
Ciputat Timur	183	66.969
Pamulang	176	72.736
Pondok Aren	115	50.560
Serpong	52	23.606
Serpong Utara	84	32.756
Without explanation*	39	30.153
Total	779	338.344

Source: Bureau of Settlement and Urban Planning of South Tangerang City, 2017

to 1.72 % (2.52 km^2) between 2011 and 2016. The Local BPS also expected the population to increase from 1.3 million people in 2011, to 1.5 million in 2015.

Data from Bureau of Settlement and Urban Planning of South Tangerang showed that the residential areas built by developers were spread evenly across the region. A shown in Table 1, there were 779 residential areas with a total of 338,344 housing units. In a regional macroeconomic perspective, the fast growth of the city had resulted in increases of property tax from 2011 to 2014, which meant the average growth achieved was 38.7 % per year. In addition, the real estate market in the city had contributed 17.04 % to the region's gross domestic product (GDP) in 2016. These developments had provided a relevant suburban model for this study.

The central limit theorem stated that if X_1, X_2, ... X_n were random variables of the population (in this case, the probability distribution) by any mean (μ_x) and variance (σ^2_x), then the mean of the sample tended to be normally distributed with a mean of μ_x and variance of $\frac{\sigma x^2}{n}$ when the sample size was increased to infinity. If X_i was assumed to come from a normal population, the sample mean would follow a normal distribution regardless of the sample size. Therefore, the sampling of 37 households were considered to be fairly representing the population and guaranteed to be Gaussian (Jolliffe, 1995).

The questionnaires distributed to the households used a seven-rating scale: very unimportant (1), not important (2), below average (3), average important (4), above average (5), important (6) and very important (7). General mathematical expressions to calculate the construct validity is presented in equation 1 while equation 2 is used to calculate the internal consistency.

$$r_{xy} = \frac{n\sum XZ - \left(\sum X\right)\left(\sum Z\right)}{\sqrt{\left(n\sum X^2 - \left(\sum X\right)^2\right)\left(n\sum Z^2 - \left(\sum Z\right)^2\right)}} \quad (1)$$

$$\alpha = \frac{N}{N-1}\left(\frac{\alpha_X^2 - \sum_{i=1}^{N}\alpha_{Y_i}^2}{\alpha_X^2}\right) \quad (2)$$

where rxy was the value of the correlation, *n* was the number of respondents, *X* was the total score of item questions and *Z* was the total score without involving the item question.

An indicator item would be considered a valid measurement if it had significant positive correlation with the total score. The higher the correlation value, the better the validity. A common convention was to evaluate whether such indicators had a valid value range between $0.40 \leq r < 1.00$, with $p > 0.05$. In equation 2, *N* was the number of survey items in the scale, α^2_X was the variance of the observed total scores and $\alpha^2_{Y_i}$ was the variance of item *i* for person *y*. And the value of consistency with α of 0.65–0.80 was often considered adequate (Vaske, Beaman & Sponarski, 2017). Data was proceeded using the Minitab 16 software (Minitab LLC, Pennsylvania, USA**)** (Reed, 1988).

Technical procedures for testing the construct validity and internal consistency of a measurement were executed by (i) tabulating the questionnaire according to the respondent's answer; (ii) scoring every item of question answered by respondents; (iii) for validity analysis, it totalizes all scores of items using by MS Excel; (iv) exporting all data to Minitab 16; (v) and the final stage was data analysis. The technical flowchart is described in Figure 1.

Results and Discussion

First, we needed to identify whether the sampling had normal distribution to indicate whether it was representative of the population. A simple test on whether the samples had a Gaussian distribution could be performed using a normality test with the Kolmogorov-Smirnov approach. We found that the samples did not have a satisfactory "Goodness of fit". Figure 2 showed that the p-value was 0.058, even though it should be much higher. The use of this data, therefore, would lead to biased conclusions because the process of calculating correlation would use the total score on the existing data.

As a preliminary paper, especially in terms of testing the validity and reliability of

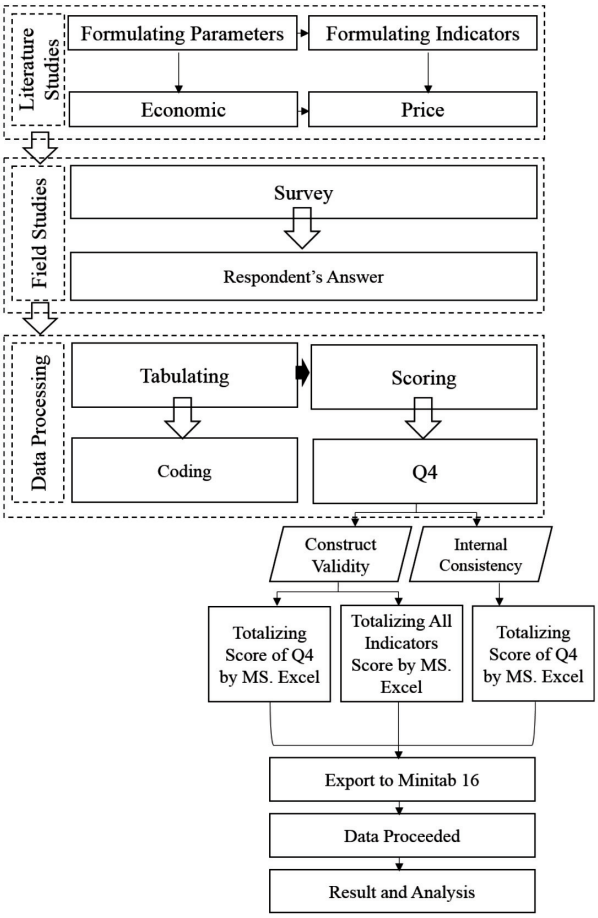
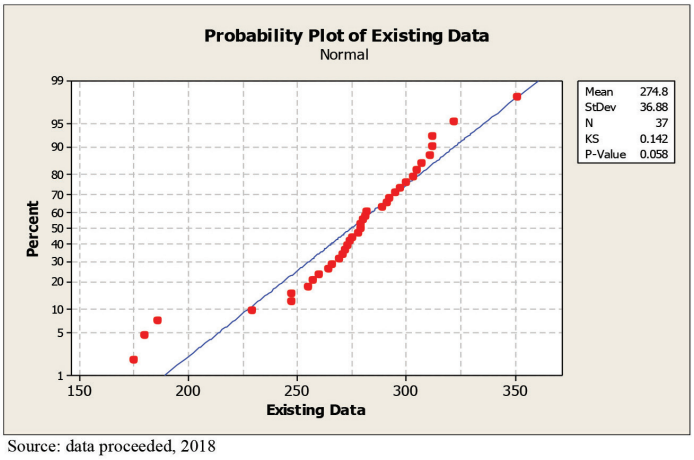
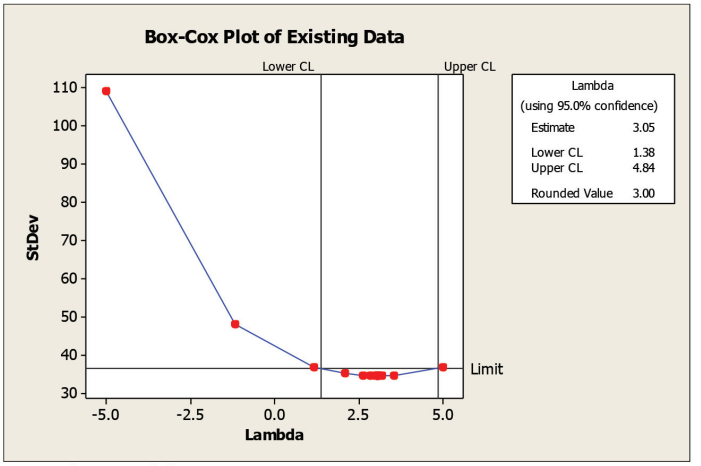


Figure 1: Flow chart of technical procedures to analyse construct validity and internal consistency



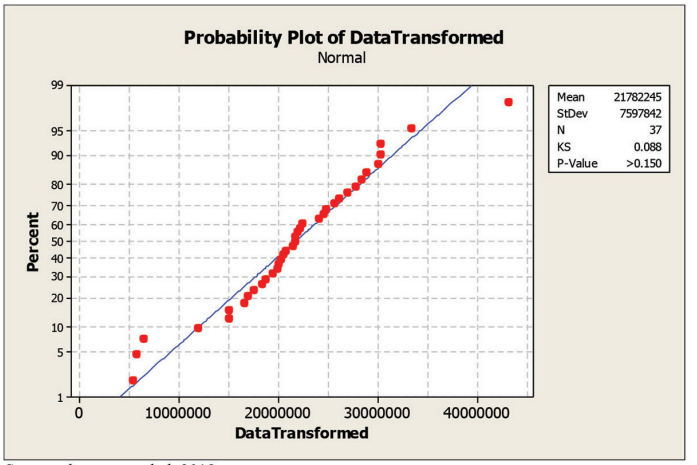
Source: data proceeded, 2018

Figure 2: Abnormal distribution of samples in the "Goodness of fit" test before transformation



Source: data proceeded, 2018

Figure 3: Box-Cox transformation of the samples



Source: data proceeded, 2018

Figure 4: The samples displaying a normal distribution in the "Goodness of fit" test after transformation

instruments, the best option was to transform the data. For normality test, the data which needed to be transformed was the total score. This study used the Box-Cox Transformation approach: $Y = p_{\lambda}(X) = (X^{\lambda} - 1)/\lambda$ when $\lambda \neq 0$ or $Y = ln(X)$ when $\lambda = 0$ (Freeman & Modarres, 2006). The Box-Cox transformation results were shown in Figure 3.

The data had a normal distribution after transformation. This was indicated by the $p > 0.05$ (Figure 4). Based on this information, the data analysis could proceed to the next stage. The correlation value was calculated from the results of the data transformation.

A literature study identified 52 qualitative indicators of a sustainable housing area, which were divided into six parameters. Those parameters were economy, with six indicators, social (nine indicators), environmental (nine indicators), infrastructure (11 indicators), technology (four indicators) and governance (13 indicators). Detailed information was presented in Table 2. Furthermore, Table 3 explained the variance of the respondents' characteristics.

Table 2: Respondents' characteristics

Aspects	n	%
Gender		
Male	20	54
Female	17	46
Education level		
Senior high school	3	8
Diploma/bachelor's degree	9	24
Masters	22	60
Doctoral degree	3	8
Residential characteristics		
Residential	26	70
Non-residential	11	30

Source: data proceeded, 2018; n = 37

The formulation of the parameters was opposite the mainstream concept, which were generally understood in academic discourse on sustainability. In classic sustainability, the parameters comprised economic, social and environmental aspects (triple bottom line) as mentioned by Elkington (1997). However, this study would further examine new parameters as shown in Figure 5, especially in the context of residential areas, namely infrastructure and technology, with governance as the foundation.

The consideration to include infrastructure as a parameter was based on the argument that the situation in urban/suburban residential areas was certainly different compared to rural areas. The social, economic and spatial situations in urban/suburban areas were characterized by the middle-class population (Ningrum, Putri &

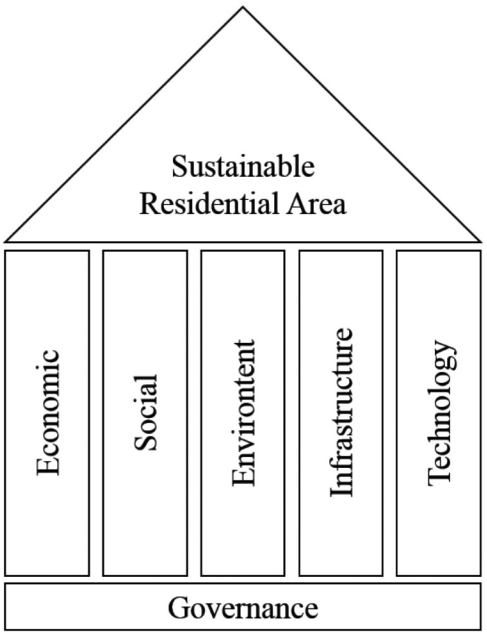


Figure 5: New concept of sustainability in residential area context

Ekaputri, 2014), which had a higher demand for sophisticated and accessible facilities compared to rural folk.

Relating to the technology, Bugliarello (2004) had stated the importance of that parameter in achieving sustainable development. A focus on urban sustainability must involve, by necessity, technology to answer the question of "what can we do?" Technology was needed to translate understandings into designs and functions that enhanced the quality of life. Cities that had complex structures in social and economic aspects required an integrated response to overcome problems and challenges. Technology allowed urban governance to be more participatory and it could contribute to social inclusion by increasing the availability of facilities for planners to respond to service needs. Therefore, the application of technology could contribute greatly to urban sustainability (United Nation 2015).

The question then was why governance had to become the foundation? Citing Jha and Murty (2000), the current concept of sustainability was incomplete because it did not include spatial aspects and behaviour and property rights in the model. They authors stated that human behaviour would always change and endogenously confirmed property rights would also change sustainability in the long run. Therefore, one of their five important proposals were non-market intervention. They implied that government elements, through the governance parameter, had become a new issue in sustainability. The government was considered because it involved the question of "do their policies contribute to the achievement of sustainable development?" (Evans *et al.* 2007).

In the economic parameter, there were six indicators as stated in Table 2, but only three were found to be valid and reliable as analysed in Table 4. The idea of economic connectivity could be accepted as a measurement, as well as a house as an investment instrument. For city residents, the most important thing was access to facilities, such as public transport, hospitals, malls and sports centres.

In the social parameter, all nine indicators formulated were found to be valid and reliable (Table 4). This finding confirmed that housing did not only cover physical infrastructure, but also social issues. In the environmental parameter, eight of its nine indicators were valid and reliable, revealing the awareness of city residents on its impact to sustainability.

This study additionally formulated 11 indicators in the infrastructure parameter of residential areas and nine of them were found to be valid and reliable. The indicators included enclosed residential areas, speed bumps, physical adaptation of buildings to disaster, security, distance to social facilities (mosques, polyclinics/community health centers/hospitals and schools), distance to markets, the view of the area, accessibility for the disabled and street lighting.

Meanwhile, our other novelties found two of the four indicators in the technology parameter as valid and reliable. In governance, we proposed 13 indicators, all of which were valid and reliable.

Table 3: Formulation of sustainable residential area indicators

Parameter	Indicators	Description	Annotation & Citation
Economic	1. Economic network connectivity	Interrelation and combination of variations in economic activities. The basic idea is a mixture of activities that are mutually inseparable.	Talen (2014)
	2. Adoption of local labour	There are employment opportunities for local people in the residential area as household assistants, security guards etc.	Novelty
	3. Suburban farming	There are small-scale agricultural activities by residents in their homes, such as growing fruits and vegetables in their front and backyards.	Holler & Serra, (2012); Hoornweg & Freire, (2013)
	4. Price	The houses are affordable and the cost of living is manageable.	Handayani, (2009), Hapsariniaty *et al*., (2013)
	5. Value of investment	Strategic locations provide high returns of investment in real estate.	Hapsariniaty *et al.*, (2013); Serlin & Umilia, (2013)
	6. Access to public facilities	The residential area is adjacent to hospitals, malls, sports centres, etc.	Ding *et al*. (2010); Frenkel *et al.,* (2013)
Social	1. Social participation	Residents are actively involved in community activities.	Hoornweg & Freire, (2013); Talen (2014)
	2. Cohesion and social connection	There are activities that can strengthen the cohesion and social connection of residents.	Winston & Pareja Eastaway, (2008); Le *et al.,* (2016)
	3. Engagement medium	Religious events, social gatherings, sports events, cooperation, etc.	Hoornweg & Freire, (2013); Talen (2014)
	4. Adoption of local cultural values	The residential area adopts local culture, reflected by the openness of the people and appreciation of culture.	Rosenstein, (2011); Amado *et al.,* (2017); Grodach, (2017)
	5. Security	Low crime rate (theft, robbery, muggings, etc.)	Winston & Eastaway, (2008)
	6. Integration of neighbourhood association and citizens' association intra and inter-residential area	Neighbourhood and citizens' associations working together internally and externally with other residential areas.	Karim & Rashid, (2012)
	7. Religion	Residents actively participate in religious activities.	Saleh, (2004)
	8. Health	There are healthy aspects in the environment, both physically and mentally.	Liu et al., (2017); Barbato et al., (2017);
	9. Hospitality	Residents greet each other and are friendly.	Bell, (2007)

Table 3: Continued

Parameter	Indicators	Description	Annotation & Citation
Environment	1. The quality of public open spaces	Parks and recreational facilities are in good condition.	Mulliner *et al.,* (2016)
	2. Compliance to spatial plan regulation	The residential area is built in compliance with spatial plans set by the government.	Novelty
	3. Low noise pollution	Low traffic and not congested.	Winston & Eastaway, (2008); Talen (2014)
	4. Integrated waste management	There is proper system to dispose of rubbish in the community.	Suryani, (2016)
	5. Energy efficiency	Energy-saving policies are implemented as a way of life.	Talen (2014); Addanki & Venkataraman, (2017)
	6. Preservation of ecological and biodiversity environment	Maintaining cleanliness, recycling, separation of organic/non-organic waste, planting trees, etc.	Hoornweg & Freire, (2013)
	7. Efficiency of groundwater use	In areas that depend on groundwater supply, the residents should be aware on the importance of protecting and using their water source efficiently.	Garcia *et al.,* (2013); Loubet *et al.,* (2016)
	8. Involvement in location	The residential area is comfortable.	Hoornweg & Freire, (2013)
	9. Water quality	Clean water supply is available.	Strategic Plan of the Ministry of Public Works 2015-2019, Republic of Indonesia
Infrastructure	1. Enclosed residential area	A gated community provides a sense of safety and security.	Leisch, (2002)
	2. Adoption of local architecture	Building designs reflect local culture, such as traditional houses.	Le *et al.,* (2016); Amado et al., (2017); Rid et al., (2017)
	3. Strategic placement of speed bumps on roads	The distance between speed bumps, their shape and material and height should reduce the speed of traffic and not damage vehicles.	Decree of the Minister of Transportation No. KM. 3/1994; Dinh & Kubota, (2013)
	4. Physical adaptation of residential buildings to disaster	Houses are built to ensure safety in the event of disasters (fire, earthquakes, floods, etc.).	Renald *et al.,* (2016)
	5. Security	Guards are deployed to patrol the residential area to ensure security.	Leisch, (2002)

Table 3: Continued

Parameter		Indicators	Description	Annotation & Citation
	6.	Distance of residential area to social facilities (mosques, polyclinics/ community health centers/hospitals and schools)	Residential areas close to social facilities allow residents to attend events and seek services easily.	Le *et al.* (2016)
	7.	Distance of residential area to market	Residential areas close to commercial areas have good economic growth.	Le *et al.* (2016)
	8.	View of residential area	Residential area provides a refreshing view.	Hapsariniaty *et al.,* (2013)
	9.	Accessibility for the disabled	The residential area has facilities that cater to people with special needs.	Le *et al.* (2016)
	10.	Access to workplace	Residents like to stay in areas where they can commute to work easily.	Mulliner, *et al.*, (2016)
	11.	Street lighting	The residential area has sufficient street lighting.	Mulliner, *et al.,* (2016)
Technology	1.	Internet connection and speed	The Internet service is good and fast.	Kummitha & Crutzen, (2017)
	2.	Public transport	The residential area is well connected to the city by buses, trains and roads.	Miralles-Guasch & Domene, (2010); Talen (2014)
	3.	Social media interaction	Residents are incorporated into WhatsApp, Line group etc. under their respective neighbourhood and citizens' associations.	Novelty
	4.	CCTV cameras	Housing areas need to be equipped with CCTV cameras to ensure security.	Leisch, (2002)
Governance	1.	Program innovation	The local authorities design breakthrough programs relating to housing and/or residential area.	Hoornweg & Freire, (2013); Addanki & Venkataraman, (2017)
	2.	Vision of local leaders	There is a clear vision of local leaders in the governance of the housing and/or residential area.	Hoornweg & Freire, (2013); Priyarsono, (2017); Addanki & Venkataraman, (2017)
	3.	Participation in the planning process	The authorities provide a medium for citizens to participate in the governance of their own residential areas.	Rid et al., (2017)
	4.	Permits for events, projects	The permits are easy, concise and fast to obtain without resorting to bribery.	Buchori & Sugiri, (2016); Rid *et al.,* (2017)

Table 3: Continued

Parameter	Indicators	Description	Annotation & Citation
	5. Waste recycling	The is an efficient waste recycling program to take care of the environment.	Talen (2014)
	6. Neighbourhood proactiveness	Neighbourhood and citizens' associations regularly publish information of local government policies, especially those relating to citizenship services.	Novelty
	7. Neighbourhood and citizens' associations facilitate social media communication	Associations are tech-savvy and frequently use WhatsApp, Line group, etc. to communicate information to residents in a fast manner.	Novelty
	8. Coordination in neighbourhood and citizens' associations	Implementation of regular meetings.	World Bank (2017)
	9. Credible commitment of local government	Proactive in social programs and monitoring residential development.	Ostrom, (1990); World Bank, (2017)
	10. Youth, women and social activities	Programs involving the local government to empower young people (karang taruna), women's association activities and mutual cooperation (gotong royong).	Le *et al.*, (2016)
	11. Suburban farming incentives	The local government provides incentives for citizens to grow their own food.	Novelty
	12. Certification of sustainable system	The government needs to develop a standard for developers to build sustainable residential areas.	Rid *et al.,* (2017)
	13. Transparency	Transparency of government actions through information and communication technology media.	Hardjaloka, (2014)

Table 4: Valid and reliable indicators of a sustainable residential area

Parameter	Indicators	Construct Validity		Internal Consistency		
		Correlation	p-value	Adj. Total Mean	Adj. Total Standard Deviation	Cronbach's Alpha
Economic	Economic network connectivity	0.498	0.002	269.16	36.09	0.943389
	Value of investment	0.452	0.005	268.95	36.24	0.943683
	Access to public facilities	0.627	0.000	268.35	35.89	0.942241
Social	Social participation	0.609	0.000	269.00	35.95	0.942492
	Cohesion and social connection	0.580	0.000	269.05	36.08	0.942923
	Engagement medium	0.562	0.000	269.11	36.02	0.942886
	Adoption of local cultural values	0.446	0.006	269.59	36.16	0.943791
	Security	0.531	0.001	268.35	36.10	0.942972
	Integration of neighbourhood association and citizens' association intra and inter-residential area	0.479	0.003	269.38	36.18	0.943908
	Religion	0.637	0.000	268.46	35.80	0.942056
	Health	0.480	0.003	268.32	36.43	0.943731
	Hospitality	0.480	0.003	268.59	36.40	0.943705
Environment	The quality of public open spaces	0.568	0.000	268.41	36.34	0.943353
	Compliance to spatial plan regulation	0.450	0.005	268.84	36.28	0.943670
	Low noise pollution	0.478	0.003	268.35	36.49	0.943836
	Integrated waste management	0.599	0.000	268.22	36.29	0.943129
	Preservation of ecological and biodiversity environment	0.614	0.000	268.73	36.01	0.942545
	Efficiency of groundwater use	0.610	0.000	268.41	36.16	0.942865
	Involvement in location	0.452	0.005	268.38	36.52	0.943959
	Water quality	0.688	0.000	268.38	36.17	0.942672
Infrastructure	Enclosed residential area	0.566	0.000	270.38	35.94	0.943038
	Strategic placement of speed bumps on roads	0.513	0.001	270.95	36.10	0.943827
	Physical adaptation of residential buildings to disaster	0.550	0.000	268.97	36.19	0.943265

Table 4: Continued

Parameter	Indicators	Construct Validity		Internal Consistency		
		Correlation	p-value	Adj. Total Mean	Adj. Total Standard Deviation	Cronbach's Alpha
	Security	0.474	0.003	268.46	36.23	0.943472
	Distance of residential area to social facilities (mosques, polyclinics / community health centres/ hospitals and schools)	0.546	0.000	268.49	36.41	0.943585
	Distance of residential area to market	0.542	0.001	269.41	36.21	0.943370
	View of residential area	0.553	0.000	269.08	36.20	0.943333
	Accessibility for the disabled	0.686	0.000	268.81	36.05	0.942463
	Street lighting.	0.473	0.003	268.35	36.50	0.943850
Technology	Public transport	0.530	0.001	268.54	36.26	0.943301
	CCTV cameras	0.534	0.001	269.19	36.18	0.943188
Governance	Program innovation	0.700	0.000	271.38	35.96	0.942966
	Vision of local leaders	0.688	0.000	271.00	35.92	0.942821
	Participation in the planning process	0.632	0.000	271.35	35.95	0.943473
	Permits for events, projects	0.476	0.003			
	Waste recycling	0.624	0.000	271.03	35.84	0.943294
	Neighbourhood proactiveness	0.644	0.000	271.05	35.85	0.943230
	Neighbourhood and citizens' associations facilitate social media communication	0.450	0.005	270.89	36.15	0.944342
	Coordination in neighbourhood and citizens' associations	0.615	0.000	271.14	35.99	0.943235
	Credible commitment of local government	0.660	0.000	271.03	35.95	0.942899
	Youth, women and social activities	0.598	0.000	270.86	36.05	0.943420
	Suburban farming incentives	0.591	0.000	271.78	36.08	0.943625
	Certification of sustainable system	0.588	0.000	269.46	36.07	0.942916
	Transparency	0.520	0.001	270.43	36.00	0.943882

Source: data proceeded, 2018

Table 5: Invalid and unreliable indicators of a sustainable residential area

Parameter	Indicators	Construct Validity		Internal Consistency		
		Correlation	p-value	Adj. Total Mean	Adj. Total Standard Deviation	Cronbach's Alpha
Economic	Adoption of local labor	0.297	0.074	269.35	36.53	0.944553
	Suburban farming	0.115	0.499	269.92	36.72	0.947005
	Price	0.211	0.209	268.89	36.44	0.945289
Environment	Energy efficiency	0.325	0.049	268.97	36.40	0.944537
Infrastructure	Adoption of local architecture	0.314	0.058	271.19	36.32	0.945290
	Access to the workplace	0.223	0.184	269.05	36.65	0.945620
Technology	Internet connection and speed	0.313	0.059	268.68	36.52	0.944802
	Social media interaction	0.382	0.020	269.86	36.42	0.944676

Source: data proceeded, 2018

Table 5 shows the details of the eight invalid indicators. An interesting observation was that out of six indicators under the economic parameter, three of them were invalid i.e. the adoption of local labour ($r = 0.297$; $p = 0.074$); (2) suburban farming ($r = 0.115$; $p = 0.499$); and, (3) price ($r = 0.211$; $p = 0.209$).

The fundamental question is why some indicators, which were considered strong and valid, were rejected by the respondents. This seemed to be associated with their profile. Well-educated respondents indicated that they had a quality profession as their occupation. They were middle-class workers and generally didn't have much time to manage agricultural activities, even on a small scale. This could be the reason why suburban farming was irrelevant for measuring residential area sustainability. However, if the local government provided incentives to the people, the respondents would be interested to undertake agricultural activities in their homes. This incentive indicator was valid in the governance parameter ($r = 0.591$; $p = 0.000$).

The price indicator also suggested the same scenario, in the sense that it was not compatible in measuring the sustainability of a suburban residential area. This finding required us to identify a more compatible indicator. We intend to include a housing subsidies indicator in future studies.

In the environmental parameter, we examined the efficiency of energy consumption (electricity, gas and fuel) as an indicator. This indicator was also found to be invalid in measuring the sustainability of a residential area in South Tangerang ($r = 0.325$; $p = 0.049$). In the infrastructure parameter, there were two invalid indicators, i.e. adoption of local architecture ($r = 0.314$; $p = 0.058$); and access to workplace ($r = 0.223$; $p = 0.184$) (Table 5).

The former was like the adoption of local cultural values under the social parameter, but it did not seem to capture the respondents' interest in terms of infrastructure. In the context of an Indonesian suburb, the latter indicator was not a crucial issue probably because many residents generally owned a motorcycle, which could be used to manoeuvre in traffic with ease.

In the technology parameter, Internet connection and speed ($r = 0.313$; $p = 0.059$) and social media interaction ($r = 0.382$; $p = 0.020$) were invalid indicators. We presumed that the first invalidity was caused by the fact that Internet access had been largely available through smartphones, which were ubiquitous.

Therefore, it could be assumed that the cable-based Internet connection had become obsolete.

The idea for a social media interaction indicator came from considering the urgency of cohesiveness inside and outside a residential area. However, the test results showed that this indicator was invalid.

On the other hand, under the governance parameter, a different result could be seen in the initiatives of neighbourhood and citizens' associations (*rukun tetangga* and *rukun warga*) in facilitating the formation of social media groups. The intuitive meaning of the above seemed related to the necessity of a "preliminary action" by the local government. The respondents seemed to respond positively to the indicator only when the "preliminary action" was implemented by regulation.

The invalid indicators could not be summarily dismissed because they were obtained only from a population in South Tangerang and might still be compatible with the social and spatial situations in other regions. Can these indicators be applied in a more structured manner in other areas using better analytical tools? The answer is in the affirmative as the indicators could serve as an inspiration for more studies in other suburban residential and/or housing areas in Indonesia and even countries that have similar characteristics.

On the other hand, we had different results on the value of internal consistency. All invalid indicators in Table 5 had an average Cronbach's Alpha of 0.94 and because very high reliabilities (0.95 and above) were not necessarily desirable, this indicated that the items might be redundant (Streiner & Streiner, 2003). Therefore, from the 52 indicators, 44 had the potential to be used as measuring instruments of a sustainable residential area in South Tangerang.

Conclusion

In realizing results of sustainable development at state level, the efforts must begin from the regional level, especially in a decentralised context in Indonesia, where policies relating to public affairs may be regulated at the regional level. One of the important policies at the regional level concerns settlements, housing and residential areas. The reason why this issue is important is because it is related directly and indirectly to sustainability. This study formulates six parameters and 52 indicators for a sustainable residential area in suburban Indonesia. Three novel parameters of sustainability, namely infrastructure, technology and governance, are introduced. We believe that these parameters are important determinants in supporting sustainable residential areas. The validity and reliability of the formulation results are finally examined. They show that there are eight invalid indicators, which are relevant in South Tangerang but may be applicable elsewhere. We examined more indicators in infrastructure parameter than social and technology. Thus, efforts to find additional indicators in both parameters are an important agenda for further studies. In addition, this study surveyed households in one suburban area only, namely South Tangerang, which is part of greater Jakarta. Further research should be conducted in other suburbs of greater Jakarta, such as Bogor, Depok and Bekasi cities. Of course, this preliminary study must also be followed up with better analytical tools to determine the relevance of an indicator. In that case, we propose to use of the Structural Equation Modeling to resolve it.

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