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# Indicators of Smart City Using SNI ISO 37122:2019

E Kristiningrum<sup>1</sup> and H Kusumo<sup>2</sup>

<sup>1</sup>Center for Research and Human Resources Development, National Standardization Agency of Indonesia, Jakarta, Indonesia

<sup>2</sup>Directorate of Standard Development for Infrastructure, Conformity Assessment, Personal, and Creative Economy, National Standardization Agency of Indonesia, Jakarta, Indonesia

**Abstract.** In this digital age, many cities compete to invest significantly in designing and developing smart cities projects. In line with this, the development of various indicators that can later be used to measure and evaluate the performance of smart cities is also being developed. Standards are interpreted as a single language that must contribute to supporting the development and assessment of this smart city. The purpose of this paper is to inform the indicators for developing smart cities in supporting sustainable development programs. The method used is a descriptive analysis from secondary data by identifying indicators determined in international and national standards. Found 4028 ISO standards that can be implemented directly to achieve the goal of sustainable development. In terms of support for smart city development, ISO and SNI have issued standards that set 20 sectors and 81 indicators that can be used as guidelines in developing and assessing the maturity of smart cities. There are 7 clauses have been identified in SNI ISO 37122 which are basic mandatory services, and other clauses are additional services Smart city development programs are also supported by various types of regulations from the government, so an assessment scheme approach is needed to see the maturity of smart cities that are evaluated. Further research also needs to be planned and conducted to find out how to implement the identified indicators. With these many indicators, it is also important to determine which steps are the priorities for realizing smart city development.

## 1. Introduction

The acceleration of urbanize in city center, resulting in them having to be able to tackle the urgent global problems. Climate change and efforts to maintain service levels for an increasingly population by using limited resources are a challenge for the city [4]. Other challenges experienced by large cities include environment condition, use of resources, residual combustion products, and social imbalances. Intelligent cities program is one of the views that can be implemented to overcome these problems [7]. This concept offers a form of a solution in the form of digitalization with a fast process and technology development that can help the city on efforts to optimize the quality and accuracy of service methods with information and communication technology facilities, new technologies, and participatory approaches [4]. Smart city planning already discussed by several studies, including theories and methods that present new scenarios that are ready to be applied to cities/districts [7].

In Indonesia, the population that inhabits urban would reach 80% in 2040. Therefore, it is important not only to make cities smarter through smart cities but also to realize Indonesian people who are smart or smart people. Lots of urban-related issues consisting of multi-dimensional and multi-sector in responding to challenges in the form of global competitiveness and potential, geographical location, and socio-cultural. The focus of developing smart cities in Indonesia cannot be separated



from the development of intelligent government, smart economy, smart identity recognition, smart intelligent live, intelligent population, and intelligent empowerment. Intelligent cities have been recognized to bring benefits aimed at revolutionizing people's lives, not only limited to efforts to improve economic efficiency, reduce costs and reduce environmental output, but smart cities themselves are still in their infancy [10]. What support can be provided by standardization in developing and implementing smart cities? This paper review would describe the support of standardization to facilitate urban leaders in setting targets, assessing performance, monitoring, carrying out management, and making decisions in a policy.

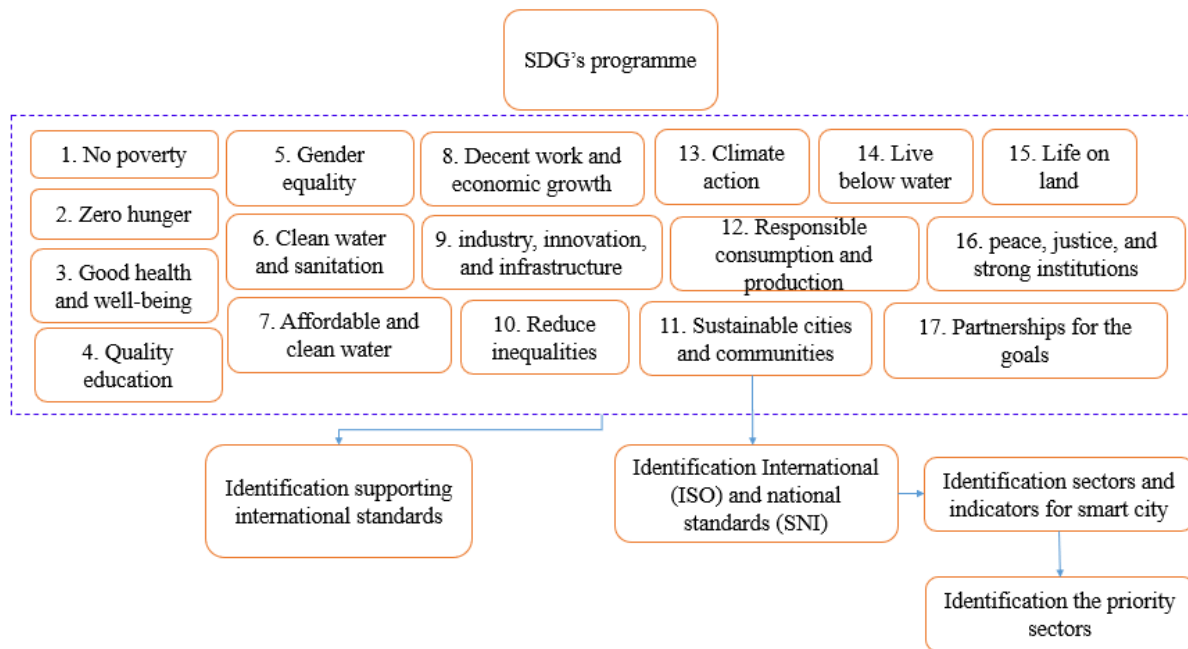
In the smart city construction program, it involves several sections, such as industry, regulator, population, information and data disclosure, health, building agriculture, gird, transportation. The number of related sectors resulted in the indicators used is the choice for each city in the process of developing intelligent city. This selected indicator is necessary, because will be used as a guideline for establishing urban management and also taking a resolution. Several indicators have been developed since 1990 and have been adopted by several cities as an approach to measuring and monitoring aspects of the urban system. Another approach taken is an attempt to find out the performance of one city to another [5].

In the smart city development program, the transportation, ecology, safety, tourism and recreation sectors are some of the most burdened sectors. Smart cities are often interpreted as urban management procedures that can provide data collection that will impact on improving the living level for each capacity [8]. Smart city initiatives are often grouped into 6 domains, namely smart economy, smart environment, smart governance, smart living, smart mobility, smart people [3,8].

Based on the history and popularity of the construct of intelligent city, in scientific literature, no one has a mutually agreed definition that has caused confusion among scientists, policymakers, city residents, and business people. Besides, many smart city designs used to carry out technology-centricity criticism, the needs of the city that are not considered, and there is no real role in the implementation of sustainable development [4]. A common understanding and standard terminology are needed to represent facts related to cities, services, organizations, streams of events, and key performance indicators, which also allow for alignment from various points of view (ontology). According to International Telecommunication Union (ITU), a Smart and sustainable city is "an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, the efficiency of urban operations and services, and competitiveness, while ensuring that it meets the needs of present and future generations concerning economic, social, environmental as well as cultural aspects ". Meanwhile, according to the International Electrotechnical Commission (IEC), a smart city is defined as an integration of technology that uses a program or strategic approach with the goal of sustainability, cost minimization, peace and welfare of the population, and developing of economic.

## **2. Research Method**

This study uses a descriptive method using secondary data of standard documents related to smart city. The first step is identifying sustainability programs which are followed by identifying international standardization support for each program. This review specifically highlights standardization support for sustainable city and community programs, so the next step is to identify international and national standard support for the program. The next step is to trace the indicators in SNI ISO 37122: 2019 (See Figure 1)



**Figure 1.** Research method

### 3. Results and Discussion

#### 3.1. The Goal of Sustainability Development

Ways to make a more sustainable future can be realized by tackling global challenges that include life on the poverty line, inequality, environment, justice and peace. Steps to achieve that situation, by overcoming challenges global issues, such as poverty, inequality, climate change, environmental integration, peace and justice, are known as sustainable development goals. This goal will be achieved in 2030, in which there are 17 targets in sustainable development, and all are interconnected. Sustainable development is a call for all countries to improve prosperity while protecting the planet.

The action plan that has been set by the UN in the framework of sustainable development must get support from the community component, which can include government, business, industry and individuals. To ensure the success of its achievement, the process requires an agreement in the form of consensus, collaboration, and innovation. In the process of developing standards, both international standards, and national standards, the process has been represented. Standards are developed based on consensus and provide a very strong basis for developing the innovations produced, so that the government, industry, and consumers are facilitated in contributing to the achievement of each steps in sustainable development.

There are three pillars are specific issues in sustainable development [6]. International Standardization Organization (ISO) standards provide support for 3 pillars in sustainable development, namely the economic, social, and environmental. On the first, standards support the sustainability of the economic through the facilitation of international trade, improving the quality of national infrastructure, and supporting the sustainability of business practices. ISO standards cover all economic activities, ranging from efficient farming methods to anti-bribery arrangements. On the social pillar, standards support its sustainability by ensuring that countries make improvements related to the health of their people. The ISO standards cover all aspects of health, starting from the health system and products related to social inclusion and accessibility. On the environmental pillar, standards encourage environmental sustainability by helping businesses and countries manage their environmental impacts. ISO standards cover several aspects such as the application of environmental management systems, measurement, and reduction of greenhouse gas emissions and energy

consumption [5]. The most significant contribution of ISO standards in the sustainable development goals can be seen in Table 1.

3.2. Sustainable cities and communities

There are several frameworks and indicators used to assess the sustainability or intelligence of an urban area. But the city indicator has been introduced by the world standardization organization. Support in international standardization activities for smart cities is hosted by ISO and ITU [4].

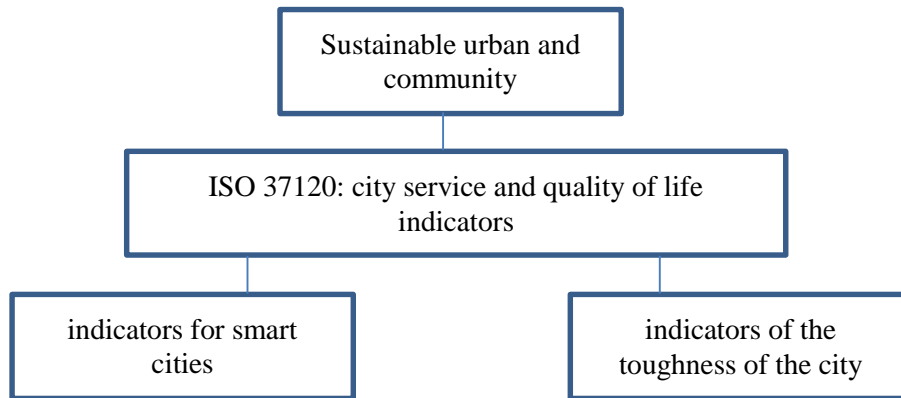


Figure 2. Sustainable community development - the relationship between family standards for smart city indicators.

Table 1. ISO standard support for SDG targets [5]

SDGs Targets	ISO Standard
There is no poverty rate	ISO 20400: sustainable procurement
There is no hunger rate	ISO 22000: food safety management
Good health and well-being level	ISO 13485: medical devices
quality of education	ISO 21001: management system for educational organization
Gender equality	ISO 26000: Social responsibility
Clean water and sanitation	ISO 24516-1: drinking water distribution networks
Provision of clean energy and can reach all layers	ISO 50001: Energy management
Employment that meets the requirements and economic improvement	ISO 45001: occupational health and safety
Innovation Industry, and infrastructure	ISO 50501: innovation management
Minimize inequalities	ISO 12812 series: mobile financial service
Sustainable cities and communities	ISO 37120: city indicators
Consistent and responsible use and production design	ISO14020 series: environmental labelling
Climate action	ISO 14080: methodologies on climate change
Live below water	ISO 21070: protective on marine environment
Life on land	ISO 14055-1: combatting land degradation and desertification
Peace, justice and strong institutions	ISO 37001: anti-bribery management
Partnership for the goals	ISO 44001: collaborative business relationship

The technical committee that develops ISO standards for this matter is TC sustainable cities and communities. One of the standards produced is ISO 37120: 2018 [1] which has been identically adopted as SNI ISO 37120:2019 by Indonesia. The focus on SNI ISO 37120 is city service performance and quality life. In 2012, this standard was published, and the last revision was done in July 2018 by adding 28 indicators and removing 24 old indicators, as well as slight modifications to 10 indicators. ISO 37120 presents three indicators, namely: a) the main indicator, b) recommended supporting parameter or indicator, and c) the profile of indicators. A total of 52 cities have been certified (data since February 2018) using the 2014 version of the ISO 37120 indicator. With the latest edition of ISO 37120 published, those who have been certified need to consider revised indicators if they wish to remain certified using the standards [2,4]. In the SNI ISO 37120: 2018 standard, there are indicators and testing methods used to assist urban areas in:

- Measuring the performance of urban services and quality of life over time
- Benchmarking performance measures
- Support the development of policies and priority settings

Further development for indicators supporting city intelligence is listed in ISO 37122 which has also been identically adopted as SNI ISO 37122: 2019. In this standard set indicators used to determine the assessment of the performance results of smart cities. The scope of this standard is to determine and define the meanings and limitations also the methods for a group of smart city indicators and parameters. Together with SNI ISO 37120 and ISO 37123, this standard provides a set of various indicators to calculate progress toward smart cities. (Fig.2).

To evaluate the maturity and performance of smart cities, SNI ISO 37122: 2019 has been determined (Table 2). As the tool is developed, indicators are very important to establish. Often the first step in doing part is related to relevant indicators using prescribed selection methods, for example, literature discussion, expert selection, and stakeholder discussions.

The indicators specified in the SNI ISO 37122: 2019 are 20 sectors and 81 indicators. Cities who wish to implement this document to assess the intelligence performance of their city must report each indicator by the requirements stated in the document. Of the 20 regulated sectors, the transportation and energy sector have a greater number of indicators than the other sectors, so for this sector, more resources will be needed in its implementation. ISO 37123 as the third indicator is in the process of being compiled. The principle of sustainability is a guide in the development of this standard.

### 3.3. Indonesia Smart city maturity approach

With the increase in smart city development programs, there has been an increase in the development of tools and indicators to assess the success of their programs [9]. Table 3 informs several awards at the international and national level issued by organizations as a tool to evaluate the maturity of a intelligent urban city. Level maturity is applied per service.

**Table 2.** Indicator for smart city assessment based on SNI ISO 37122: 2019 [1]

No	Sectors	Indicator
1.	Economy	4 indicators including: data disclosure policies, new business continuity, workers in the ICT field, worker in the education, research and development areas.
2.	Education	3 indicators including: expert, infrastructure for digital studies, higher education
3.	Energy	10 indicators, including: electricity and heat energy, the use of wastewater, the use of solid waste, electricity generated from a decentralized system, storage capacity of energy networks, existing lighting for street, lights that have been damaged and renewed, buildings

No	Sectors	Indicator
		damaged, building with energy measuring device, electric vehicles charging stations
4.	Environment and climate change	3 indicators, including: building renovated, long distance air quality monitoring stations, building with quality of air meter
5.	Finance	2 indicators, including: yearly financial gain, electronically payment
2	Government	4 indicators, including: online access data, online services, response time, IT infrastructure
3	Health	3 indicators, including: integrated health file online, medical appointment, accessibility public warning system
4	Housing	2 indicators, including: the use of energy gauges, the use of water gauges
5	Population and social conditions	4 indicators, including: building for special needs, budgeting for special needs, pedestrian using signal, crossing facilities, budgeting for digital divide
6	Recreation	1 indicator is online recreational services
7	Security	1 indicator is municipalities with a digital monitor camera
8	Solid waste	6 indicators, including: waste disposal centers, individual waste collection systems, waste for energy producing, recycled plastic waste, waste disposal with sensor, electronic and electrical waste
9	Sports, culture	4 indicators, including: online custom and cultural infrastructures, culture registered, publicity books and electronic book titles, member of mass reading room
10	Telecommunication	3 indicators, including: accessibility to broadband, area with no telecommunications connectivity, region within by internet connectivity
11	Transportation	14 indicators, including: warning traffic information for road, using of transportation, transportation equipment, total bicycles, public roads with real time system facilities, online public transportation services, common parking space, information about parking availability, traffic signals, area mapping, autonomous transportation facilities, route mass transportation, road facilities for autonomous driving purposes, public transport motorized
12	Urban/local agriculture and food security	3 indicators, including: budget for agrarianism and food, food leftovers, online food supplier mapping system
13	Urban planning	4 indicators, including: people involve in the planning process, building permits through the electronic delivery system, time of building permit approval, population densities
14	Wastewater	5 indicators, including: wastewater reused, biosolids reused, energy derived from wastewater, wastewater used, wastewater pipelines
15	Water	4 indicators, including: drinking water, environmental water monitoring stations, water distribution network, smart water meter
16	Reporting and maintaining records	-

**Table 3.** Several Awards

No	Appreciation	Executing
1	World e-Governments Organization of Cities and Local Governments (WeGO) Smart Sustainable City Awards	WeGO
2	Movement Towards 100 Smart City 2018	Ministry of Communication and Information, Ministry of Home Affairs, Ministry of PUPR, Bappenas and Presidential Staff Office
3	Indonesia Smart Nation Award (ISNA)	Citiasia Inc
4	Indonesia Smart Cities Rating (RKCI)	The Bandung Institute of Technology is supported by APEKSI, BRI and Indosat

The level of maturity of smart cities in Indonesia is measured using assessment requirements, namely:

- SNI ISO 37122 Requirements
- Adaptation of CMMI maturity (capability maturity model integration)
- Law Number 23 of 2014 concerning regional government
- Government Regulation Number 2 of 2018 concerning minimum service standards
- Minimum service standard regarding technical standards, for example the basic mandatory requirements for the education, health, social, public housing and residential areas sectors, public works and spatial planning, as well as peace, public order and community protection standards.

Table 4 shows service priority sectors in smart cities. There are 7 clauses have been identified in SNI ISO 37122 which are basic mandatory services, and other clauses are additional services. Smart city assessment approach is done by conducting a preliminary assessment (using standard and regulation guiding), which will then be carried out field assessments. There are 5 levels of assessment results, namely M1 (planning), M2 (development), M3 (operation), M4 (interoperability), M5 (optimization).

**Table 4.** Service priority sectors in smart cities

SNI ISO 37122	Clause	Basic mandatory services (high priority)
Education	(6)	Education
Health	(11)	Health
Population and social condition	(13)	Social
Housing	(12)	Public and regional housing settlement
Wastewater, water	(22), (23)	Public works and spatial planning
Safety	(15)	Peace, public order, and community protection
SNI ISO 37122	Clause	Other services / customize
Economy (5), Energy (7), Environment and climate change (8), Finance (9), Governance(10), Recreation (14), Solid waste (16), Sport and Culture (17), Telecommunication(18), Transportation (19), Urban/local agriculture and food security (20), Urban planning (21)		non basic compulsory services (priority), and choice (customize)



#### 4. Conclusion

In recent years there has been an increase in the development of tools to assess the performance of smart city programs. Conclusion of this research are indicators set by ISO and SNI can be used to assess the performance of smart cities. There are 20 sectors and 81 indicators based on SNI standard. Transportation and energy sector has a greater number of indicators than the other sectors, this indicates that in the both sectors, more resources will be needed in its implementation. There are 7 clauses have been identified in SNI ISO 37122 which are basic mandatory services, and other clauses are additional services. The smart city development program is also supported by various kinds of regulations from the government, so an assessment scheme approach is needed to see the level of maturity of the smart city being evaluated. Further research needs to be planned and conducted to find out how to implement the identified indicators. With these many indicators, it is also important to determine which steps are the priorities for realizing smart city development.

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