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# Smart Villages in Indonesia in the Light of the Literature Review

Wahyudi Agustiono
Department of Information Systems
University of Trunojoyo Madura
Bangkalan, Indonesia
wahyudi.agustiono@trunojoyo.ac.id
ORCID ID: 0000-0001-6816-5117

*Abstract*—In the last few years, smart village has received increased attention from both researchers and practitioners. Especially with the advancement of digital technology that allows the interconnection between rural areas, smart village discussion is getting popular. The objective of this study, therefore, is to gain insights into the existing literature and to present the knowledge of how the smart village research in Indonesia context has been carried out. With more than 74,000 villages and most diverse country, Indonesia offers fruitful context study. This study in particular adopted the recent PRISMA framework to identify eligible articles for further systematic review. Based on this framework, this study was able to identify 133 eligible articles. Analysis indicated that research on smart village in Indonesia has been started since a decade ago. Thematic analysis revealed that three research topics that received most attention from the researches in smart village including application development, IT/IS management, Strategy and Implication for society. Considering the complex problem in rural development, future research with more focus on the implementation of emerging technology such as IoT, AI and big data in producing smart solution.

*Keywords*—*Literature review, PRISMA, smart village, Indonesia.*

## I. INTRODUCTION

In the current ever-changing world and disruption era, smart systems are applied as an advanced and integrated solution for many problems in any sector. With the increasing demand of more better life quality, smart systems are getting popular and becoming part of daily life for many individuals. For example, smart surveillance, sensors, smartphones and smart TVs become must have tools for people. The utilisation of smart systems is likely no exception for city, especially with the increasing demand for better services for citizens and improving their quality of life [1].

In Indonesia, research on smart city has been the interest of many academia and continue to progress. Nonetheless, in the context of rural area, the concept of smart system, known as smart village, is relatively new [2]. The smart village concept, itself, is gaining traction on the rural development agenda, coinciding with the ongoing reform of the common agricultural policy [3]. Researchers with different point of view and background have come across with various smart village's definition. For example, researchers refer smart village as the ability of village in providing better services in the area of social welfare, economy and environment for its residents so that their quality of life improved. This study in particular adopt the European Parliament that defines smart village as *"those (local communities) that use digital technologies and innovations in their daily life, thus improving its quality, improving the standard of public services and ensuring better use of resources* [3, p.3]*"*.

The underlying theories and frameworks relating smart village is also underdeveloped. In addition, the development and implementation of smart village is lag and still infancy compared to the smart city initiatives. Especially for Indonesia as one of the world's major agricultural nations, the development of smart village still received little attention. With more than 74,953 villages across the country [4], smart village development should the priority of the national agenda. Furthermore, the Government of Indonesia has also initiated the new paradigm of village driven development as a mean to foster the national development[4].

Review from the literature indicated that there is limited works available investigating the state of the art of smart village in Indonesia. A notabel exception found in the literature that attempted to conduct meta analysis on the existing smart village study in the context of Indonesia [2]. However, the study focused on proposing a possible conceptual model of smart village along with with the components based on systematic review. Accordingly, the previous work offer little insihgt on the current state-of-the art concerning the smart village development in Indonesia.

Given the important agenda of smart village, this research at hand, therefore aims to undertake the systematic review. It particularly aims to gain insights on what has been done by the researchers in investigating smart village in Indonesia. Using Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) [5], this study carries out the literature review and discusses the emerging findings.

## II. RESEARCH METHOD

Considering the aim of this study, a Systematic Literature Review (SLR) analysis was employed as a research method. In search of an appropriate SLR framework, there are a number of review protocol conceptions such as SALSA [6], PSALSAR [7] and PICOC [8]. This study in particular used The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) suggested by Page et. Al. [5]. The PRISMA was chosen as it has been designed primarily for systematic review that is suitable research method for this study. Moreover, the PRISMA is recently updated and improved which makes it relevant for the current as well as future review study.

According to the updated PRISMA, the SLR involves a three-step process including Identification, Screening and Included as shown in Figure 1. The first step involved identification of related studies from databases and registers. By using the search string, keywords and Boolean operators, this study was able to record relevant studies for further review. All the records were also filtered to remove duplications. The second step specified a set of inclusion and exclusion criteria for determining which studies were
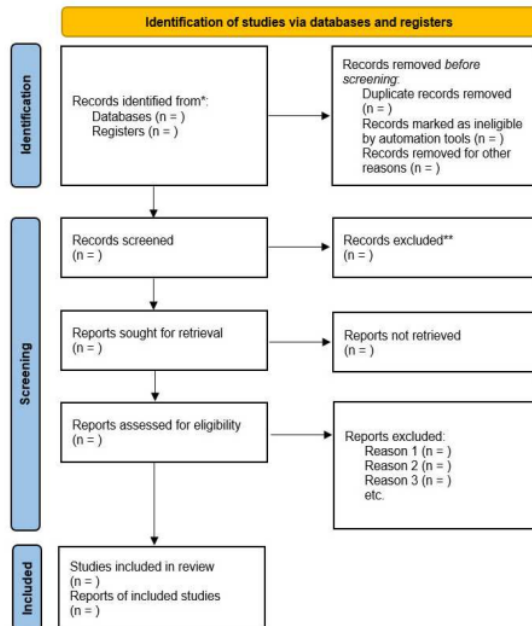


eligible. All the screened records were assessed using the criteria for eligibility, and included in the systematic review with reasons for exclusions at each stage. In the third step, the final records were then included in the review. During this step, a systematic analysis was conducted for each article to identify assess, synthesize the emerging themes and empirical evidence over a smart village study in Indonesia.

Fig. 1. PRISMA flow diagram

### III. RESEARCH RESULTS

This section summarises the results of this study based on the PRISMA framework. It then provides an overview and explanation on how the development of smart village in Indonesia in the light of the literature.

#### A. Identification

As mentioned previously, the main activity in stage was conducting literature search. For this purpose, this study used online academic repositories such as Google Scholar, ACM Digital Library, Elsevier (SCOPUS), Emerald, IEEE Xplore, ScienceDirect, and IGI Global. Since the focus of this study is on smart village in Indonesia context, the literature search also was conducting using Science and Technology Index (SINTA), an Indonesian scientific and scholar database, to identify relevant sources.

The literature search was conducted by, first, choosing search string or keyword according to the research topic. In identifying the relevant literature, this study used possible keywords, phrases and strings related to "smart village", "digital village", "cyber village", and "smart rural". A combination of keywords and Boolean operators was also used to search relevant articles such as ("smart village" AND "Indonesia"). To identify the literature published in the Indonesian journals, this study also developed search strategy using Indonesian phrases such as "desa digital (digital village)", "desa pintar (smart village)" and "desa cerdas (smart village) ". All these keywords, phrases and search strings combination were applied one by one in each online databases mentioned previously.

The data collection process was carried out using Publish or Perish, a software program that has capability to retrieve and analyse academic citations from various scientific database indexing. Iinitially, a total of 261 articles were successfully retrieved from Google Scholars, Scopus, IEEE Xplore and SINTA. While the retrieval process from others indexing databases (ACM, Emerald, ScienceDirect, and IGI Global) had no result. All these articles were then screened the titles, name of journal or conference manually to identify duplication. After the screening process and found 17 duplications, records marked as ineligible by automation tools 12 and removed for other reasons 5 articles. Accordingly, there were 167 potentially eligible articles were identified for further screening. Table 1 summarizes the searching results of the identification phase.

TABLE I.    LIST OF IDENTIFIED ARTICLES

| Sources | Identified | Removed | Results |
|---|---|---|---|
| Scopus | 14 | 1 | 13 |
| IEEE Xplore | 23 | 2 | 21 |
| ScienceDirect | 0 | 0 | 0 |
| IGI Global | 0 | 0 | 0 |
| ACM | 0 | 0 | 0 |
| Google Scholar | 180 | 47 | 133 |
| Total | | | 167 |

#### B. Screening

Following the literature identification, the next step was screening to ensure all the articles obtained previously met the scientific quality and suitability with this study's aim. For this purpose, a set of eligibility criteria was defined for the screening guideline. The criteria were also important to help answer the research questions. The following were Inclusion Criteria (IC) that were used to screen the articles:

- IC1: Study on smart village in the context of Indonesia

- IC2: reviewed article presented in national or international conferences or published in journal indexed by Indonesian or International scientific database

- IC3: article aimed at reporting the conceptual design, development, adoption and implementation of smart system for village or study related to the utilization of ICT in rural areas.

## C. Inclusion for Review

By using the inclusion criteria defined above, all the articles were then screened by identifying the publishers, reading the title, abstract, research aim and results. The references were also retrieved for further thematic review to identify any article that was not meeting inclusion criteria. For full-text articles retrieval, this study employed manual searching through research websites such as Google scholars, ResearchGate, IEEE Xplore, Scopus and ScienceDirect. In case not available and not open-access, a request e-mail was sent to the authors to obtain the article. After the screening process, 65 potentially eligible articles were identified for further full text retrieval. Table 2 show the eligible article for full text review.

TABLE II.  ELIGIBLE ARTICLES FOR REVIEW

| Sources | Identified | Removed not meeting | | | Eligible |
|---|---|---|---|---|---|
| | | IC 1 | IC 2 | IC 3 | |
| Scopus | 13 | 0 | 1 | 0 | 12 |
| IEEE Xplore | 21 | 0 | 1 | 2 | 18 |
| Google Scholar | 133 | 6 | 9 | 15 | 103 |
| Total Eligible Articles | | | | | 133 |

## D. Discussion

Once all the eligible articles were collected, a systematic review was conducted to extract the emerging themes and empirical evidence over a smart village study in Indonesia. The following sub-sections discussed the finding from the systematic review of 133 eligible articles.

*1) Smart village annual publication:* For many years, research on the area of smart village has been the interest scholars in many countries. Particularly, in Indonesian context, study investigating smart village has been started since a decade ago. Figure 2 shows the annual the number of smart village articles published in either journal or conference. As can be seen from the figure, the study of smart village in Indonesia gained its popularity in 2017. Since then the annual number of smart village papers increased and reacher to its peak in 2021 with 34 and 16 published in journal and conference respectively.
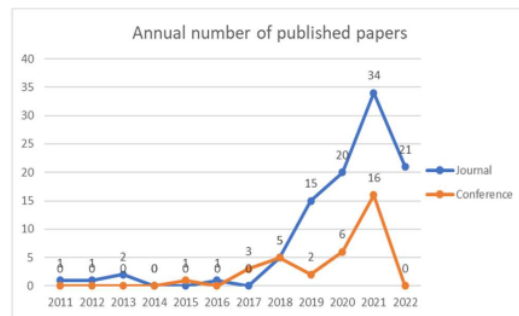


Fig. 2.  Annual number of smart village study

*2) The early study of smart village:* Review from the literature indicated that early study of smart village was initiated in 2011 by Permana [9]. This early study, however, was rooted primarily in the field of architecture that attempted to apply eco-architecture design concept to develop smart village. Accordingly, the development of smart village in this early was focused on creating smart-building as a component for sustainable and smar village. During this early time, little study had been carried out in the subsequent years especially by scholars with specialised expertise in ICT. In the other words, in this early study, the use of digital technologies had not been seen as core elements of developing smart city. This limited discussion also means there has been scarce knowledge existed in the literature relating to the development of smart village in Indonesia.

*3) The development of smart village:* Study on how Information and Communication Technology (ICT) can be applied for developing smart village had started gained attention found in the following year. Review from literature identified only one study [10] conducted in the following year, 2012, that attempted to utilise ICT for designing an e-learning system for rural egg farmers as a way to support the development of smart village. Similar study [11] was found published in the 2016. The review also showed that much of ICT development research for being used in rural area likely as database management and administrative tool [12-15]. Accordingly, the existing literature offered limited insights on how to produce ICT artefact in the context of smart village in Indonesia.

*4) Smart solution for smart village:* With the advancement of digital technologies, reseachers had also started to develop smart solution for smart village. For example some researchers had made attempt to design and implement Geographic Information Systems (GIS) to offer more interactive solution for mapping population [16], improve administrative works [17], infrastructure planning mapping [18, 19], food security [20] in the smart village. Researches had also tried to adopt the recent digital innovations sucha as cloud computing technology to make Indonesian villages smarter [15], mobile app [14], green internet technology [21], online shopping [22-24], Biga data [25, 26], digital payment [27]. Internet of Things [23]. Another study focused their investigation on providing infrastrucutre for smart village [28, 29]. Review on the literature also indicated that some digital transformation approaches had been also adopted in  recent studies to develop smart village such as digital mareketing [30], digital capability [31] and digital talent management [32].

*5) Smart village area:* Further review from the literature showed several area had been the context of the study. One of most discussed area in the most discussed area in the area of smart village study was smart agriculture [25, 33, 34]. This finding was likely to be attributed that the agriculture and on-farm related activities make up the basic fabric of rural life. The second most widely researched area was smart governance [13-15] that aimed to improve public services. Following smart governance, many studies had focused their attempt to create a foundation of technology and system that allowed the creation of smart economy as main element of smart village. For instance the development online shopping [22-24], digital payment [27], and digital mareketing [30] in the village context has

opened the opportunity and improved the access to new market for villagers' product. Smart tourims [24, 34] was also found to be popular research topic among scholars as an important element for many smart villages. This due to the facat that tourism is as one of the major industry sectors in Indonesia.

*6) Research Topics in smart village study:* Considering the research topic, this study adopted Competency Based IS2020 Curriculum Guidelines suggeseted by ACM. According to this guidelines the thematic analysis revealed that Application Development received most attention from the researches in smart village. Over the last ten years, there have been 43 study discussed about how Information and Communication Technology can be developed as the main component of smart village. Further thematic review identified that Information Systems Management and strategy study has also received considerable attention with 35 articles. Figure 3 show the frequently discussed topic in the study of smart village in Indonesia.
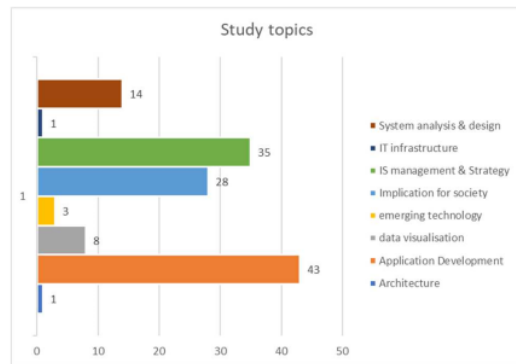


Fig. 3. Research topics in smart village study in Indonesia

## IV. CONCLUSIONS

As presented above, this study reviewed 133 studies on smart village development in the context of Indonesia. That has been initiated since the last ten years ago. Nevertheless, there has been little significant in progress, especially when dealing with the implementation of recent digital technologies such as artificial intelligence, deep learning, automation and IoT. Instead, much of the existing studies focused on the information systems development for administrative tools. This in particular suggest that research on smart village is important and needed in the Indonesian context.

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