

# A Systematic Literature Review of Smart Rural

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## ABSTRACT

*There are many problems and challenges in developing rural areas. This includes poverty and social isolation. Meanwhile, interest in the concept of smart cities has increased in recent years, as reflected in the number of studies published in academic journals. In contrast to smart cities, smartization in rural areas has received only scarce attention, despite the beneficial effect that the transformation of rural areas could have for society. Even though smart cities and smart rural face different issues, we can adopt smart city solutions to smart rural. Furthermore, we need to rethink the impact of technology and the overall idea of becoming "smart" in this context. To answer these problems, this study conducted a Systematic Literature Review (SLR) related to smart rural. According to the research results, smart rural is sustainable development in rural areas which was developed with a potential specialization approach and the use of technology. This study also finds that there are still few models, frameworks, or architectures for smart rural areas. Most research has created a model, framework, or architecture for smart cities. With this fact, research on developing models, frameworks, or architectures of smart rural is still open for further research.*

**KEYWORDS:** Architectures, Frameworks, Models, Smart Rural, Smart Village

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## 1. 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 for 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 utilization of smart systems is likely no exception for cities, especially with the increasing demand for better services for citizens and improving their quality of life (Zhu et al., 2022). In Indonesia, research on smart city has been the interest of many academia and continue to progress. Nonetheless, in the context of rural areas, the concept of smart system, known as smart village, is relatively new (Mishbah et al., 2018). To understand the concept of smart rural and how to apply it well in various situations, it is necessary to study the literature so that we can clearly know the position of smart rural research to date. From the literature study conducted by researchers, no systematic research has been found that discusses aspects of smart rural, including definitions, technologies, and characteristics of smart rural.

This research seeks to answer these problems using a Systematic Literature Review (SLR). Part 1 is an introductory part that explains the background of the research. From this background, it is necessary to conduct research related to smart rural. It begins with identifying the definition of smart rural and the characteristics and developments of existing smart rural models, frameworks, and architectures. Section 2 describes the research methodology to get an overview of smart rural, including the definition, characteristics, and development of the model, framework, or architecture of smart rural. At the same time, Section 3 presents the findings from the literature, and will be carried out later. The conclusion and future research are covered in the final part (Section 5).

## 2. LITERATURE REVIEW

### Smart City

The 21st-century city faces complex challenges, from sustainability to social equity. The "smart city" concept, leveraging technology and citizen engagement, offers a potential solution. At its core, a smart city uses data to improve citizens' lives. (De Castro, 2016) cites Singapore's use of sensors and analytics for traffic management and public safety as a prime example. However, technology is only one part of the equation. (De Castro, 2016) stresses that citizen engagement is crucial, ensuring that smart city initiatives reflect the community's needs.

This transformation is not without its challenges. Data privacy, security risks, and the potential for increased inequality necessitate careful consideration. (Sadono & Herlily, 2018) warns against techno-solutionism, advocating for addressing root causes of urban issues. Sustainability is also paramount. Smart cities must balance growth with environmental responsibility. (Barletta et al., 2020) highlights the need to integrate sustainability principles into all aspects of development. The smart city is not a fixed

endpoint, but an ongoing process. (Shcherbina & Gorbenkova, 2018) emphasizes the need for adaptability, as each city's path will be unique.

**Smart Rural**

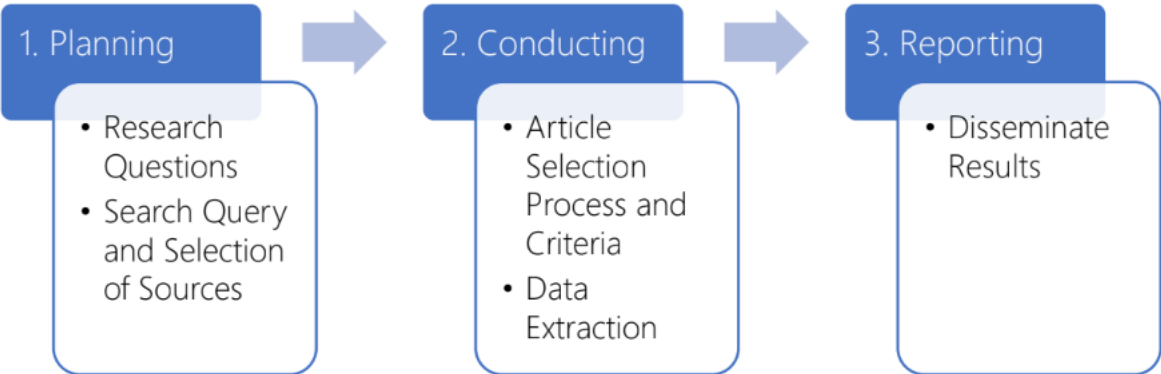
Defining "smart rural" necessitates moving beyond simplistic interpretations. While a universally accepted definition remains elusive, common threads emerge from the literature. (Zavratnik et al., 2018) emphasizes the importance of a place-based approach, recognizing the heterogeneity of rural areas and advocating for tailored solutions that address specific local needs and challenges. This resonates with (Alabdali et al., 2023), which underscores the need to move beyond a one-size-fits-all model and consider the unique socio-economic contexts of different rural communities.

At its core, "smart rural" signifies the strategic leverage of technology, not merely for technological advancement, but as a means to foster holistic rural development. This encompasses economic growth, driven by innovation and enhanced productivity, as well as social inclusion, ensuring equitable access to opportunities and services. Importantly (Cowie et al., 2020) reminds us that "smart rural futures" should prioritize sustainability, ensuring that technological advancements align with environmental stewardship and long-term well-being.

**3. METHODS**

**Review Method**

A systematic approach for reviewing the literature on smart rural is chosen. A systematic literature review (SLR) is defined as a process of identifying, assessing, and interpreting all available research evidence with the purpose to provide answers for specific research questions (RQ) (Kitchenham, 2007). The process carried out in this study is shown in FIGURE 1.



**FIGURE 1.** Phase of SLR (Kitchenham & Charters, 2007; Purba & Arman, 2022)

**Research Questions**

The research questions (RQ) were specified to keep the review focused. The research questions and motivation addressed by this literature review are shown in TABLE 1.

**TABLE 1.** Research Questions

ID	Research Questions	Motivation
RQ1	What is the definition of smart rural?	To identify the definition of smart rural
RQ2	What are the characteristics of smart rural?	To identify the characteristics of smart rural
RQ3	What models, frameworks, or architectures have been developed to date?	To identify models, frameworks, or smart rural architectures from case studies in various countries

### Search Query and Selection of Sources

After determining the research question, the next step is to determine the keywords used in the search for articles in the journal database. The keywords used to answer the research question are (smart AND (village OR rural) AND (model OR framework OR architecture)). The databases were searched by title, keyword and abstract. The search was limited by the year of publication: 2015-2024. Two kinds of publication, namely journal papers and conference proceedings were included. The search was limited only articles published in English.

Before starting the search, an appropriate set of databases must be chosen to increase the probability of finding highly relevant articles. The most popular literature databases in the field are searched to have the broadest set of studies possible. A broad perspective is necessary for an extensive and broad coverage of literature.

Here is the list of the digital databases searched:

- ACM Digital Library (dl.acm.org)
- IEEE eXplore (ieeexplore.ieee.org)
- Scopus (scopus.com)

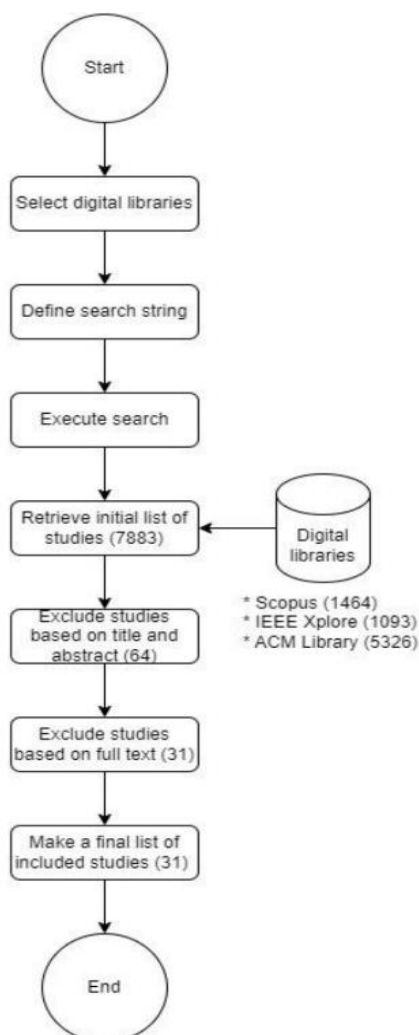
### Article Selection Process and Criteria

Next step of SLR is decided the inclusion and exclusion criteria and proses of selecting article. The inclusion and exclusion criteria are shown in TABLE 2.

**TABLE 2.** Inclusion and Exclusion Criteria

<b>Inclusion Criteria</b>	(I1) Article sourced from Scopus, IEEE eXplore, ACM Digital Library (I2) Articles discussing models, frameworks, or architectures (I3) Article written in English (I4) Full-text articles
<b>Exclusion Criteria</b>	(E1) Articles in the form of books, magazines (E2) Article found in another journal database (duplicate) (E3) Articles discuss models, frameworks, or architectures but are not specific about smart rural

Software package Zotero (<http://zotero.com>, n.d.) was used to store and manage the search results. The detailed search process and the number of studies identified at each phase are shown in FIGURE 2.



**FIGURE 2** Article Selection Process

## 4. RESULTS

### RQ1: What is the definition of smart rural?

After researching 31 articles, several definitions of smart rural were obtained, as shown in TABLE 3. From the overall definition, the researcher concludes that smart rural, smart rural is sustainable development in rural areas which was developed with a potential specialization approach and the use of technology.

**TABLE 3.** Definition of Smart Rural

Ref	Definition	Own-Synthesized
(Lindblom et al., 2021)	The concept arises precisely from the intersection of technology, human and institutional factors	Yes

(Slee, 2019)	A phenomenon associated with self-organized, bottom-up community action that either addresses the weaknesses of both state and market to contribute to local people’s wellbeing or exploits emergent opportunities through collective means.	Yes
(Despotović et al., 2020)	Emphasized pragmatic orientation in an effort to diagnose the problem and offer a solution	No
(Andari & Ella, 2019)	Have goal namely how village can provide all services to the villagers in the most effective and efficient way	Yes
(Alhari et al., 2022)	A village that applies information technology to improve the quality of life of the community	Yes

**RQ2: What are the characteristics of smart rural?**

From the research conducted, there are several characteristics of smart rural areas. The top four characteristics most frequently found in research are resilient infrastructures (19%), strategic funding (19%), governance (14%), and human capacity (14%), as shown in TABLE 4 below.

**TABLE 4.** Definition of Smart Rural

ID	Characteristics	Number of Articles	Reference
1	Resilient infrastructures	4 (19%)	(Andari & Ella, 2019; Lindblom et al., 2021; Maja et al., 2020; Slee, 2019)
2	Governance	3 (14%)	(Andari & Ella, 2019; Lindblom et al., 2021; Maja et al., 2020)
3	Strategic funding	4 (19%)	(Andari & Ella, 2019; Despotović et al., 2020; Lindblom et al., 2021; Slee, 2019)
4	Data openness	1 (4%)	(Lindblom et al., 2021)
5	Collaboration	1 (4%)	(Lindblom et al., 2021)
6	Human Capacity	1 (4%)	(Despotović et al., 2020; Lindblom et al., 2021; Maja et al., 2020)
7	Trust	1 (4%)	(Slee, 2019)
8	Leadership	1 (4%)	(Slee, 2019)
9	Sustainability	1 (4%)	(Andari & Ella, 2019)
10	Service Chains	1 (4%)	(Andari & Ella, 2019)
11	Environment	1 (4%)	(Maja et al., 2020)
Total		21 (100%)	

**RQ3: What models, frameworks, or architectures have been developed to date?**

From the research conducted, there are several models, frameworks, and architectures found. The model used in smart rural is smart rural development and collaborative governance model, shown in TABLE 5.

**TABLE 5.** Model, Framework and Architecture of Smart Rural

Category	Type	Reference
Model	Smart Rural Development	(Lindblom et al., 2021)
	Collaborative Governance Model	(Andari & Ella, 2019)

## 5. CONCLUSIONS

According to the results of the research, smart rural is sustainable development in rural areas which was developed with a potential specialization approach and the use of technology. There are four main characteristics of smart rural areas, namely resilient infrastructures, strategic funding, governance, and human capacity. This study also finds that there are still few models, frameworks, or architectures for smart rural areas. Most of the research has developed a model, framework, or architecture of a smart city. The existing models, frameworks, or architectures of smart rural areas are still very dependent on local economic potential, for example in food agriculture rural areas, tourism rural areas, and others. so further research is still needed that applies existing models, frameworks or architectures based on the potential of rural areas.

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