

## **Planning and Solution of Urban Infrastructure Problems Through the Integration of Collaborative Geographic Information System (GIS) and Public Participation GIS: A Systematic Literature Review**

**Mohamad Syahrul Gunawan<sup>1\*</sup>, Yana Syafriyana Hijri<sup>2</sup>, Salahudin<sup>3</sup>, Iradhad Taqwa Sihidi<sup>4</sup>**

Department of Governmental Studies, Universitas Muhammadiyah Malang, Indonesia<sup>1,2,3,4</sup>  
Email: Forzagunawan@gmail.com

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### **ABSTRACT**

This study aims to research related to planning and solving urban infrastructure problems with the Literature Review method, namely reading and reviewing main ideas on the same topic to add and also strengthen the arguments and views or opinions of the author on the topic to be raised in this study. In addition, by using a review paper, the authors can also see the shortcomings of previous studies so that they can make improvements and a more regular and systematic formulation. This research reveals that in the planning process infrastructure development must have the impact and consequences of development planning so that problems do not occur in the development process. In the development process, another thing is to look at the environmental impact of infrastructure that will later be generated from development projects that will be initiated primarily in an urban area that has modern characteristics by involving the community in carrying out infrastructure development. In conducting this research, infrastructure is also a very important part of infrastructure. for an experience because it has a very large impact on growth and the economy in a country, especially Indonesia, therefore the purpose of this study is to examine and see the results of the journal a know the existing data.

**Keywords:** Infrastructure, Development, Network, City, GIS

### **INTRODUCTION**

In a study, researchers are required to obtain data that they want to know about a matter, it is necessary to analyze the variables that become the analytical knife in the form of data or discoveries of a thing to be studied, in this case to multiply a data source that may not be possible. Done directly, it can use the method of reviewing the paper. Through the review paper process, we can increase our understanding in analyzing data and build arguments to express opinions about the title that we lift, with the review paper, we can also see the views or perspectives of other writers on the issues raised so that they can provide references or guidance for other authors develop his opinion. In addition, by using a review paper, the author can also see the shortcomings of previous studies to make improvements and a more regular formulation. Several things must be done before doing the review, namely by reading and looking for journals that will be appointed, then examining the contents of the journal and finding a problem in the journal and rewriting it using their language and explain the contents of the journal or paper, so that from the explanation it can be concluded that a review of the journal; is a text that contains a summary of scientific research on the topics that have been raised. This can be considered a summary and evaluation are given by the author to the writings of others. Reviews are also written to provide a better understanding of the topic. In this way, it can help the reader understand some topics

without confusing them. Thus, the analysis related to development planning and urban infrastructure can be seen.

In the planning process for infrastructure development, physical infrastructure in the urban environment plays an important role in assisting the development of urban communities. Provincial and city-level roads and bridges, city lighting networks, drainage channels up to roads, lighting, and environmental drainage around urban communities constitute an integrated infrastructure system. The success and regularity of the infrastructure system will positively impact improving the quality of life of urban communities. Efforts to improve the quality of urban infrastructure continue to be carried out by the government and the community independently. In carrying out the improvement and development of urban infrastructure, the program to capture people's aspirations for infrastructure development has become a national policy. Starting from the NUSSP (Neighborhood Urban Shelter Sector Project) and PNPM (National Program for Community Empowerment), PJ (Street Lighting), urban and rural communities are given the freedom to voice their aspirations for non-physical and physical development including environmental infrastructure (Mohamed & Yacout, 2019), carry out independent surveys, as well as calculating development needs (Huang et al., 2021).

The role of Geographic Information Systems in infrastructure development, planning processes, and anticipating conflicts because of the implementation of infrastructure development requires the support of a multidisciplinary policy-making system and a mechanism for absorbing local aspirations and wisdom. For this, top-down and bottom-up approaches are often combined in planning and anticipating conflicts to get an appropriate and satisfactory solution (Choi & Enkhbat, 2020)

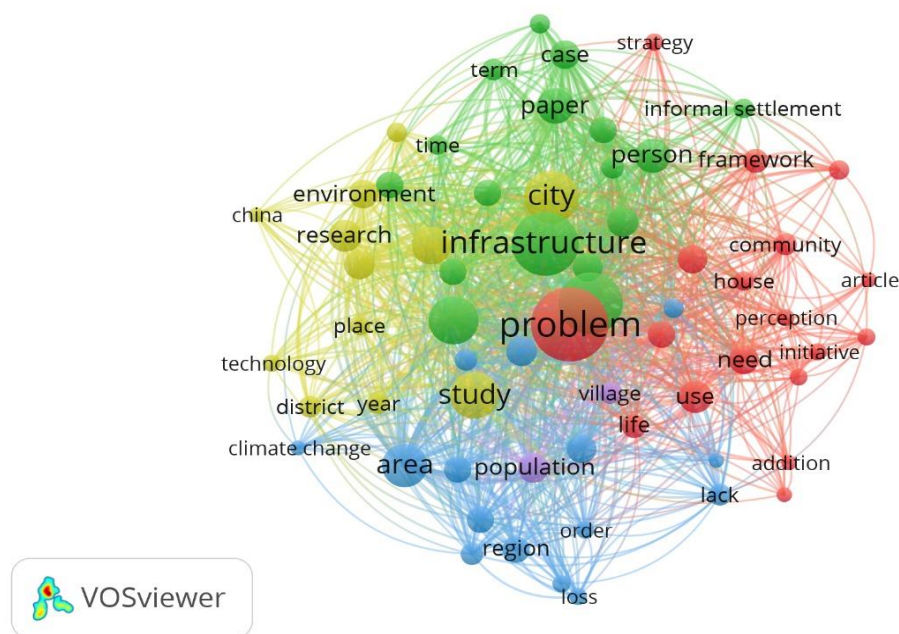
## **METHOD**

This study aims to examine and examine a problem in the article that relates urban development planning to GIS integration. The source of the data obtained is a collection of articles that have been published and made into international scientific journals. The study is based on the following questions: 1). What methods are used in researching GIS infrastructure? 2). What are the topics related to research on urban development planning with GIS integration? 3). What concepts are used in research studies on infrastructure development planning? 4). What are the obstacles in infrastructure development planning? Some of the things above can be included in the discussion to discuss related problems that have been determined and become a reference for studies based on the discovery of articles on SCOPUS. The article that will be reviewed basically has two stages: article search and topic mapping.

In this process, articles related to the topic of discussion are obtained through several stages: First, analyzing articles. This is used by searching the SCOPUS database by entering the keyword "Planning for urban infrastructure development" in the search column with limits for 2020 and 2021. The search found 1742 journal articles that match the topic to be discussed.

## RESULTS AND DISCUSSION

To see the relevance and grouping of themes, it can be seen in the results of the analysis of the verification process obtained based on 172 articles that have been selected from 194 articles. Through the media application, VOSviewer can map topics based on table classification. For example, figure 1 depicts topics related to the study of urban infrastructure development planning, which will later be grouped into clusters according to the focus of the discussion topic. The colors in the image show the grouping based on the existing topic. The purpose of this grouping is to make it easier to analyze topics that will be used as reference material and make it easier for readers to read explanations based on existing data by using a study in raising problems that occur, as we will see in the picture below. Below it is shown that which is the most dominant that can be done to be a reference in research and make it easier for readers to review an existing journal.



**Figure 1.** The study research discusses dominant issues in 2020-2021

In figure 1, displays a different color with each existing cluster. By displaying different images and colors like this, it is very helpful for researchers, especially those who have just done initial research. This method is ideal because it allows researchers to find out a lot related to themes. Cluster 1 appears several aspects (red lines) that will be discussed, namely use, partice, urban periphery, opportunity, need life, initiative, framework, example, case study, while in cluster 2 there are also aspects (green line) namely case, country, paper, part, person, resident, slum, slocution, time, way, home. While in cluster 3 (blue color) several aspects appear, namely Basic server, impact, lack, land, loss, region. While in cluster 4 it appears several aspects (yellow), namely, year, place, city, china, district, technology, so there are almost 62 total aspects that emerge from each cluster with the details, namely:

Cluster 1: In the first cluster there are 13 items taken in the last 1 year of 2020 marked in green.

Cluster 2: In the second cluster there are 15 items taken in the last 1 year from 2020 marked in green.

Cluster 3: In the third cluster there are 13 items taken in the last 1 year from 2020 marked in green.

Cluster 4: In the fourth cluster, there are 6 items taken in the last 1 year from 20210 marked in light green.

In cluster 1, the most dominant theme is the problem discussed by (El-Shorbagy, 2020) with the title *Unplanned settlements in Saudi Arabia*. The case of Al-Sabeel district, Jeddah, explained that the community should widely feel the infrastructure provided by the government because for him the main purpose of infrastructure is to prosper the people in a country. This process requires cooperation between stakeholders, both from the community itself and from the government as those who have the policy. As discussed in the journal, from a broader perspective, unplanned settlements are built areas that the government and illegal settlements do not authorize, while slums indicate substandard housing in terms of services and infrastructure, building materials, and construction methods (Huang et al., 2021). They have also been categorized as “the most deprived form of settlement”, which is not necessarily illegal (Arif & Gupta, 2020). Thus, the specific definition of an unplanned settlement depends on the scale and context of the existing urban and what it is may not necessarily be categorized as a slum settlement, even though the population may not be poor (Silveti & Andersson, 2019). However, it is estimated that around one billion people live in slums worldwide, and this number is expected to double by 2030. About 881 million people live in slums in developing countries out of one billion people. The highest number was recorded in Asia, followed by Africa, Latin America, and the Caribbean. In 2015, it was estimated that around 25% of the world's urban population continued to make their homes in urban slums (Hong et al., 2020).

Furthermore, there are also journals related to cluster 1, namely *Synthesizing the dilemmas and prospects for a peri-urban land use management framework: Evidence from Ethiopia*, written by Wubie, AM de Vries, WT Alemie, BK, in which researchers researched that this study aims to find out the problems in the urban area in Ethiopia which are related to infrastructure, where the explanation is: According to land management in general, it is the process of establishing land policies, legal frameworks and appropriate technologies that need to be applied together to resources to use them effectively. This includes all activities that enable sustainable development to be achieved. More recently, de Vries and defined land management in a more practical way as "the science and practice concerned with the conceptualization, design, implementation, and evaluation of socio-spatial 'interventions', to improve the quality of life and livelihood security responsibly. Responsible, effective, efficient, consensual and intelligent". From this definition, one can read that land management interventions must ultimately enforce meaningful decisions and implementation processes for allocating land use rights. As a result, this will lead to better social relations. Harmony regarding land, effective and efficient transaction mechanisms, public and private tenure and housing security, and the right balance between productive and housing space. Currently, different land management and evaluation frameworks exist. These include a holistic, adaptive land management framework, framework land administration, the 8R model of land management g responsible, sustainable land management framework, and land administration paradigm for sustainable development. Most of these frameworks consider the joint participation of multiple stakeholders (Average, 2019).

Interests. For example, the holistic, adaptive land management framework (HALMF) is a process-based decision-making framework that requires the formulation of land management objectives, alternatives, and monitoring strategies through the involvement of communities and other stakeholders. HALMF has two main components: problem evaluation and management to answer current and future management questions. In addition, responsible land management is a socio-technical framework – developed in response to global land management challenges is also another innovative land management framework (Aggarwal & Haglund, 2019). In addition to public participation, effective contemporary land management frameworks demand innovation in land information tools and updates to evaluate land sector performance, understand land-use dynamics in suburbs, monitor urban expansion, and manage land holistically. The ongoing registration of land rights also enhances the broader land management system. Here the existence of a good and well-functioning land information infrastructure is the key to answering fundamental decision-making questions. This means that land information becomes the backbone of community development if it is complete, reliable, uniform, and sustainable (Wubie et al., 2021).

Cluster 2 has the most dominant aspect, namely infrastructure where the journal that was found entitled Green Infrastructure in informal settlements through a multiple-level perspective was written by (Diep et al., 2019), infrastructure that is a limitation in the current urban Green Infrastructure (GI) conceptualization and implementation, especially in informal settlements. The researcher proposes a Multi-Level Perspective (MLP) which helps analyze and identify opportunities to overcome these limitations. This article discusses the concept of GI and proposes its definition through the principles of multifunctionality, interrelation, and exchange. Recognizing the current gap in implementation in the context of informal settlements, the research results also support a better understanding of the socio-political conditions that enable or hinder the practice of GI. To reflect this gap, this article uses MLP to explore the lingering socio-ecological-infrastructure issues in water management, which can be sustained through current GI practices (Prastica et al., 2019). MLP is used as a heuristic framework to analyze the influencing factors at various interconnected social and biophysical levels. This framework is applied in the Brazilian city of São Paulo, where traditional water management has resulted in tensions between social and ecological systems between regimes (which include institutional structures) and niches (where innovations emerge, for example, through grassroots movements). Examples of community initiatives are used that demonstrates the disconnect between top-down structures and everyday practice. The researcher also concludes that if the GI presents the potential to support the transition to water management that benefits social and ecological systems, further characterization of the concept is needed (Diep et al., 2019).

Then there is the same journal that discusses infrastructure, namely the journal Factors distinguishing the decision to migrate from the flooded and inundated community of Sayung, Demak: A suburban area of Semarang City, Indonesia, which was written by Buchori, IPramitasari, APangi, P, Sugiri, A, Maryono, M, Basuki, Y, Sejati, AW which in the journal discusses investigations or fieldwork activities where the authors find important differentiating factors that underlie the intention to migrate from flooded communities in suburban areas; in this case, the community is Sayung District, Demak Regency. Previous studies have observed various self-mitigation and local migration patterns among communities in Semarang City. However, local governments often overlook suburban cases, which are often more focused on addressing city center problems. This study used a quantitative approach using descriptive statistical analysis

and discriminant analysis. In addition, in-depth interviews with key informants provide a complementary qualitative approach to deepen understanding of quantitative findings. The results of the study indicate that the factors that distinguish the population's desire to migrate or not are: income, ownership of private vehicles, community cooperation in maintaining environmental cleanliness and security, road conditions and access, proximity to education and health facilities as well as electricity, and environmental intensity. flood enters the house (Petter et al., 2020). In contrast to urban communities, the willingness to move to suburban communities is influenced by their financial capacity, the availability of residential infrastructure, the level of severe flooding, and their emotional ties to the place and the community. According to the author, infrastructure is very important for the community, especially the community. Because of the impact that was given after the presence of infrastructure, Semarang city should make the community more prosperous and get good service so that the infrastructure built can be felt by all the people of the city of Semarang (Buchori et al., 2021).

Cluster 3 is the most dominant Area. We know that the area is a factor and a place that is really needed in carrying out urban infrastructure development according to the journal that has been found, namely the journal Challenges of governing off-grid "Productive" sanitation. in peri-urban areas: Comparison of case studies in Bolivia and South Africa written by Silveti, & Andersson, K which discusses suburban areas experiencing rapid urbanization (Silveti & Andersson, 2019). Conventional infrastructure development is generally slow to catch up and the lack of basic sanitation in suburban areas is a growing and often overlooked problem. There are examples where these challenges have been overcome by "productive" off-grid sanitation systems that provide opportunities for recovery and reuse of valuable waste stream resources. However, setting up such a system and ensuring effective urban policies can be challenging as the socio-economic context in many suburban areas changes rapidly (Zhang et al., 2020). Comparing the two initiatives in Bolivia and South Africa offers valuable insight into introducing a functioning non-network "productive" sanitation system relying on urine-diverting dry toilets (UDDT) in suburban settlements. The findings show that household acceptance of UDDT is largely dependent on awareness-raising and consistent capacity building and adapting to local needs, and creating a sense of ownership of the toilet system. Changing perceptions of what constitutes an aspirational toilet, and developing services for waste management collection, appear to be critical components of ensuring the long-term use and functionality of UDDT (Latham & Nattrass, 2019). To make these systems cost-effective and logistically feasible further investment and innovation to improve resource recovery systems are required. It is important to assess the community economic benefits of "productive" off-grid sanitation compared to centralized wastewater systems to attract this additional investment. The comparison also highlights that off-grid sanitation requires a clear division and coordination of roles and responsibilities among different authorities to overcome the political difficulties where these boundaries overlap (Malik et al., 2020). Thus, integrating clear boundaries into urban planning policies and including informal processes in the community plays an important role in improving the governance of basic services in suburban areas (Hlaváček et al., 2019). The convenience of the local community is written because it refers to the conclusions described above (Hong et al., 2020).

Furthermore, in a different journal entitled Autonomous Complex for Water Disinfection in Rural Areas of Uzbekistan, which was written by Radjabov, A, Berdishev, A S, Mussabekov, A T which discussed the urgent need to provide drinking water for remote rural residents. Water sources in these areas are usually highly polluted by pathogenic bacteria, and the water must be



sterilized before use. Due to the remote nature of settlements in this area, it is impossible to perform this task using traditional methods suitable for urban areas due to economic challenges (Mohamed & Yacout, 2019). The problem is the lack of developed infrastructure (electricity, communication) because of the economic situation and the remote location of the villages. In this case, the author also discusses infrastructure that is still far from sufficient to provide various kinds of food needs for the people there. The scale of community infectious diseases caused by poor water quality in the countryside of the republic is relatively large. In this regard, the development of compact and efficient water purification devices, affordable for rural residents, is of particular relevance. Ultraviolet (UV) radiation does not inactivate microorganisms through chemical interactions, unlike most disinfectants. UV irradiation inactivates organisms by absorbing light, which causes photochemical reactions that convert the molecular basis of the components into cell functions. When UV light penetrates the cell walls of microorganisms, the energy reacts with nucleic acids and other vital components, causing injury or death of exposed cells. Ultraviolet lamps work in much the same way as fluorescent lamps. The difference between the two lamps is that the fluorescent bulb of the lamp is coated with a phosphor compound that converts ultraviolet radiation into visible light. UV lamps are not enclosed, emitting ultraviolet radiation generated by the arc. This study confirms the scheme's efficiency developed from an autonomous device for disinfecting water when exposed to ultraviolet light radiation with electricity supply from a photovoltaic system. food needs for the people there (Radjabov et al., 2019).

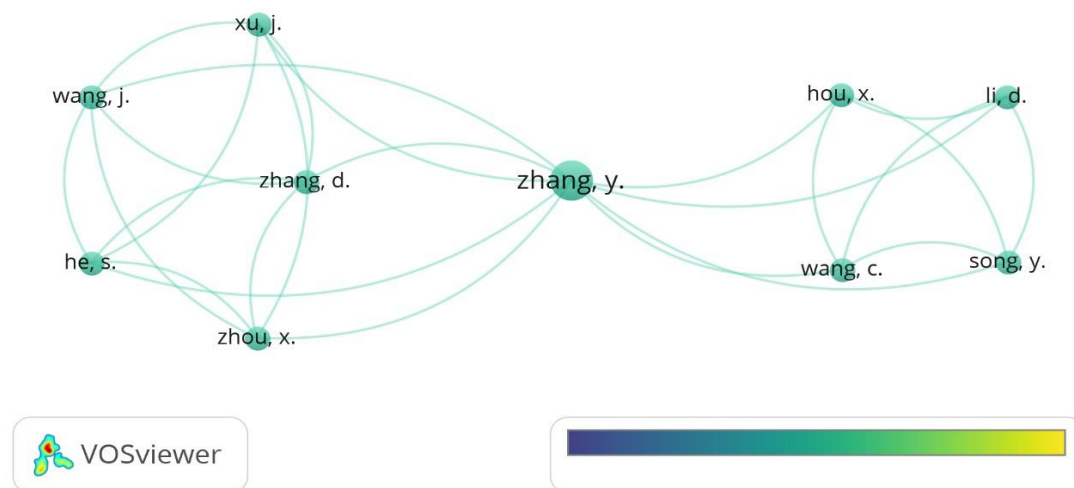
Cluster 4, in this cluster is the most dominant city, according to the picture listed above is a study based on journals that have been found, several journals are following the discussion described above, namely Study to promote the sustainable mobility in university Scheffer, AP, Pagnussat Cechetti, V, Lauermann, LP, Riasyk Porto, E, Dalla Rosa, F Recognizing the need to work with sustainable urban mobility issues such as traffic congestion, pollution, inadequate infrastructure are becoming recurring problems in the city center, which directly affect the quality of life. Such unsustainable systems are often observed in universities, as these accommodate large numbers of people and vehicles without proper planning. To promote a sustainable strategy in higher education, this study focuses on the sustainable mobility plan (SMP) implemented at the University of Passo Fundo (UPF). Design/methodology/approach: Bibliographic research on-campus mobility has now been carried out (Scheffer et al., 2019). Questionnaires were distributed to understand opinions on the subject of key people. Findings: The priority of treatment given to vehicles is mostly a factor of vigilance that must be resolved immediately, considering the need for planning and realignment. Suggested possible solutions are also relevant and considered for implementation of the plan. Originality/value: This study stands out for using the 2030 Agenda, specifically Goal 11 (Making cities and human settlements inclusive, safe, resilient, and sustainable), using university campuses as objects of study. The description of the mobility plan is based on several actions to fulfill all parts of the goal. This study stands out because its methodology can be used in universities other than UPF and also, on a larger scale, in cities, with similar technical features. It is based on several aspects where infrastructure is needed in a country to run. a structured economy wheel, the author, examines related to the journals above and analyzes what is happening in that country (Enríquez-de-Salamanca, 2019). In this journal, the researchers also discuss the differences between previous researchers and current researchers as well as the advantages and disadvantages of of disagreements that occur in existing journals, which where one of them discusses a lot about urban infrastructure but is different from the reality





discussed in previous studies is the concept of rural development planning, so it is possible to use it in recent research.

Author and writer have different meanings, where the author has a work that is designed to express existing ideas and his work is more specific and more closed from public opinion, while the author is someone who employs himself as a writer who works in more than one area. Specific areas, where the author is more able to make conclusions according to the existing drawings to get a concept of the problem that will be discussed following the picture below:



**Figure 3.** Author and writer discuss problems in 2020-2021

Based on the figure 3, the dominant one is Zhang, y, with different topics but related discussions regarding rural development planning. The author here explains the relationship between the topics that will be taken by the author, namely rural development planning and the relationship with urban and existing infrastructure. The author will review several articles to support topics that will later be used as titles or new research. Some authors do not stand alone but rather consist of several people or writers on the topics discussed in this article with urban infrastructure development planning. In Figure 3 it can also be seen that Zhang, y dominates in the author's mapping following the existing journals related to the title of this research. The same is true of other studies.

## CONCLUSION

The planning process for urban area development in the sense of infrastructure is development that meets the needs of the community without having to reduce the ability to meet the community's ability to obtain services and also meet existing food needs, not only that, there

is also a way to build infrastructure using the GIS method, namely by absorption citizen aspirations and collaborative planning of policy makers using maps and GIS technology. The process of independent surveys and identification of problems, preparation of plans and proposals, and determination of program priorities can be facilitated through portals and participatory mapping activities and decision-making group discussions. Such a methodology can support the effectiveness and efficiency of independent urban community development programs such as the PNPM Mandiri program promoted in urban areas.

Not only that, the presence of infrastructure and the GIS method makes the community easier to be directed and invited to participate in discussing problems in their environment with the discussion method between residents and participatory mapping. They feel that access to public maps needs to be improved. They are not used to reading maps in everyday life, even though maps are not foreign goods (maps are not yet culture). The spatial orientation ability of the questionnaire respondents is still very low, while the scale and distance processing capabilities are quite good, it is necessary to get an introduction to participatory mapping to support independent surveys because independent survey activities are increasingly becoming a demand for residents in implementing infrastructure development programs from the government. convey aspirations and when doing the infrastructure

The limitations in this study are the lack of journal sources that match the title raised so that it is necessary to find new things to reveal problems in the infrastructure development planning process using the GIS method, in addition to the limitations found in differences in countries that have their views on regional development. For example, urban areas with the GIS method in building infrastructure are different from those in Indonesia with the diversity and traditional nature of their communities, so that in the process of infrastructure development, it is necessary to accommodate interests and not disturb the ecology and not forget the welfare of the community in getting services that are following the existing infrastructure development. In addition, the infrastructure development planning process using the GIS method is also still lacking in socialization and application because there are still many countries that do not have binding rules regarding the implementation of infrastructure development planning using the GIS method.

For researchers and writers, if they raise this topic in the future, they must be able to do a mapping first in determining topics related to the title so that later they can reduce errors and misunderstandings about the title being raised by digging new things following articles that have been determined to strengthen the argument in writing this article.

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