

## **Integration Model of Sustainable Urban Architectural Elements: Evidence from Boulevard II in Coastal Manado, Indonesia**

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### **Abstract**

The development of road infrastructure in coastal areas plays a crucial role in improving connectivity, fostering economic growth, and reshaping the city's spatial structure. This study aims to analyze the impact of the Boulevard II development in Manado on the transformation of sustainable coastal urban architectural elements. Boulevard II is a coastal highway as part of the transportation infrastructure on the north coast of Manado City. The method used is a quantitative approach with multivariate analysis using SEM-PLS. Data were collected through observations and a survey of 100 respondents. The results showed that the Boulevard II development significantly affected the city's architectural elements, with a T-statistic value of 4.141 and a P-value of 0.000. Specifically, the greatest impact was observed in the socio-spatial aspect (Cronbach's alpha = 0.930; AVE = 0.707), followed by the socio-cultural (Cronbach's alpha = 0.936; AVE = 0.662) and socio-economic aspects (Cronbach's alpha = 0.870; AVE = 0.606). The development improved accessibility, changed land use by 27%, and increased trade and service activities by 101%. The conclusion of this study confirms the importance of an integrative approach in planning the coastal urban architectural elements, considering socio-cultural, socio-spatial, and socio-economic aspects to optimize sustainable coastal city infrastructure development.

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## 1.0 INTRODUCTION

The development of road infrastructure in coastal areas plays a crucial role in driving economic growth and enhancing regional connectivity. Cities in Europe and Asia tend to reclaim and develop urban land in coastal areas. The development of coastal roads is expected to facilitate the distribution of goods, enhance population mobility, and create a more efficient urban spatial structure (Alff, 2020; Daud Butt et al., 2024). This coastal road is uniquely characterized by having one side that runs parallel to and directly borders the shoreline. In contrast, other connecting roads, while also parallel, maintain a separation from the coastline.

Coastal road development not only serves as a means of transport but also affects the urban spatial structure, land use, environment, and socio-economic dynamics of local communities. Several studies have found that population growth, urbanization, land cover changes, and a series of land resource and environmental conflicts have occurred, especially in developing countries (Bakri & Prihartanto, 2020; Balboni, 2021; Daris et al., 2023; Feyzi et al., 2011; López-Vinielles et al., 2024; Montanari et al., 2014; Valionienė et al., 2024).

In addition to the above impacts, road infrastructure development in coastal areas also influences the urban architectural elements. Research conducted by Suriandjo et al. (2023) found that road construction in coastal areas impacts the transformation of urban architectural elements, leading to changes in land use, increases in land price values, modifications in regional architectural characteristics, types, and styles, changes in land use intensity, alterations in open space use, shifts in circulation, pedestrianization, and parking, and transformations in physical and environmental quality. Furthermore, it affects the socio-economic and socio-cultural spaces of local communities. Other studies have shown that coastal road development improves accessibility, encourages local economic growth, and enhances the urban environment without marginalizing local communities (Adewolu, 2024; Femi Oluwatoyin Omole et al., 2024; Suriandjo et al., 2023).

This study analyzes the impact of the Boulevard II Road on sustainable urban architectural in Manado. Understanding the link between coastal infrastructure development and sustainable urban architectural helps identify an integration model and key influencing variables for coastal cities.

## 2.0 LITERATURE REVIEW

### 2.1 Environmental Impacts of Infrastructure Development in Coastal Areas

The environmental impacts of infrastructure development in coastal areas are a major concern in many studies. Adshead et al. (2024) revealed that coastal infrastructure development is vulnerable to flooding, cyclones, and erosion. Hasan et al. (2024) stated that building coastal roads with embankments can reduce coastal erosion and flooding. However, other studies have found that unsustainable coastal road designs can increase noise pollution, waste, siltation, and environmental degradation (Andika et al., 2019; Mateus et al., 2016; Suriandjo et al., 2021; Wang et al., 2020).

Despite these findings, research linking the environmental impacts of coastal infrastructure development with the role of urban architectural elements in mitigating their effects remains limited. Many studies focus solely on environmental aspects without exploring the direct and indirect effects of coastal road development on urban sustainability. Therefore, further research is needed to integrate urban architectural elements into comprehensive and sustainable solutions.

### 2.2 Economic Impact of Infrastructure Development in Coastal Areas

Coastal road infrastructure is often seen as a catalyst for economic growth, both at the national and local levels (Arhipova & Patrakeeva, 2024; Banister & Berechman, 2001). In island nations, coastal infrastructure development has shown positive economic effects, contributing to sustainable local economies (Corral et al., 2016).

However, poorly planned or implemented projects can lead to serious financial overruns, corruption, and environmental consequences, while providing minimal economic benefits and sparking social and political conflicts (Alamgir et al., 2017). Other studies indicate that coastal infrastructure development influences socio-economic factors such as increased economic activity, higher community incomes, improved public health,

labor absorption, and the expansion of tourism and recreational industries (Adi et al., 2024; Cherian & Natarajamurthy, 2025; Ryndin et al., 2022).

Nonetheless, these studies primarily focus on socio-economic impacts, with little attention given to how coastal infrastructure development influences the sustainable urban architectural elements. Addressing this theoretical gap is a key objective of this research, emphasizing the need for an urban architecture-based approach to harmonize economic growth with the elements of a sustainable coastal city.

### **2.3 Socio-Cultural Impacts of Infrastructure Development in Coastal Areas**

Infrastructure development in coastal areas often poses a threat to cultural heritage located in coastal areas (Rodríguez-Rosales et al., 2021). In addition, infrastructure development in coastal areas is often gender inequitable. Therefore, coastal planning that develops more equitable and gender-responsive coastal management and conservation is needed (Harper et al., 2024).

Another study found that physical changes due to infrastructure development resulted in changes in social formation from single to multiple formations (capitalist and precapitalist), marginalisation of local residents, and a shift in the stratification system from simple stratification to sharper stratification and cultural changes from traditional agrarian culture to industrial urban culture (Batara, 2011; Surya, 2014, 2015).

Although previous studies have highlighted the social impacts of infrastructure development, literature on how coastal city architectural planning can specifically accommodate the needs of coastal communities in infrastructure development is still very limited. This research seeks to fill this void by developing the concept of sustainable coastal city architecture, which is able to accommodate the needs of coastal communities without neglecting socio-cultural factors.

### **2.4 Socio-Spatial Impacts of Infrastructure Development in Coastal Areas**

The socio-spatial concept refers to the dialectical relationship between society and space, where space is produced through social practices while simultaneously reshaping social interactions, identities, and power dynamics within communities (Rocco, 2021; Stanek, 2015).

Previous studies employing a socio-spatial framework in coastal development have explored various interrelated factors shaping slum settlement patterns, including the expansion of densely populated areas, socio-spatial segregation, and the impact of shifting socio-economic conditions. These studies have also examined urban social integration in coastal development, such as optimal settlement location selection, variations in residential zoning based on population typologies, and the physical and socio-economic transformations driven by tourism. Such analyses provide insights into settlement localization, development trends, and the social challenges arising from urban transformation in coastal cities (Almuna et al., 2012; Dupont, 2004; Eranil Demirli et al., 2015; Fernández de Córdova et al., 2016; Lelo et al., 2019; Patel, 2016; Silin, 2016; Yankson et al., 2017; Zain et al., 2018).

### **2.5 Relevance of the Study on Sustainable Urban Architectural Elements**

Sustainable urban architectural includes the integration of environmental, social and economic aspects in infrastructure development (Iqbal et al., 2023; Özdamar, 1992; Saragih, 2023). The existing literature provides a basis for understanding the impacts of coastal road development on various aspects, rather than stand-alone. This means that there is a lack of theory that can integrate the sustainability dimension of coastal city architecture holistically (Ameen et al., 2015). As the findings Elrahman dan Asaad (2021) There is a gap in the theoretical approaches and concepts of urban architectural and urban planning, which are also still generally urbanised, rather than coastal.

In the context of coastal cities, Suriandjo et al. (2023) found nine socio-spatial elements of urban architectural, consisting of: 1) land use and land value enhancement; 2) architectural types and styles; 3) land use intensity; 4) open space utilisation; 5) circulation, pedestrian and parking characteristics; 6) physical and environmental quality; 7) historic spaces and buildings; 8) socio-economic spaces; and 9) socio-cultural spaces. In the same year their research also found eight key levers for the sustainability of urban architectural elements, namely: sewage pollution, residential density, income, expectation of new jobs that can become

permanent livelihoods, social class, deep-rooted culture, architectural type and style, and land use intensity (Suriandjo et al., 2023). Their research opens up opportunities for the development of other studies, because it only focuses on producing a basic theory based on perceptions. There is a gap in the findings, because it needs to be proven to yet explain the relationship and influence of each of these elements in an integrated manner based on socio-cultural, socio-economic, socio-spatial aspects and more measurable architectural elements of coastal cities.

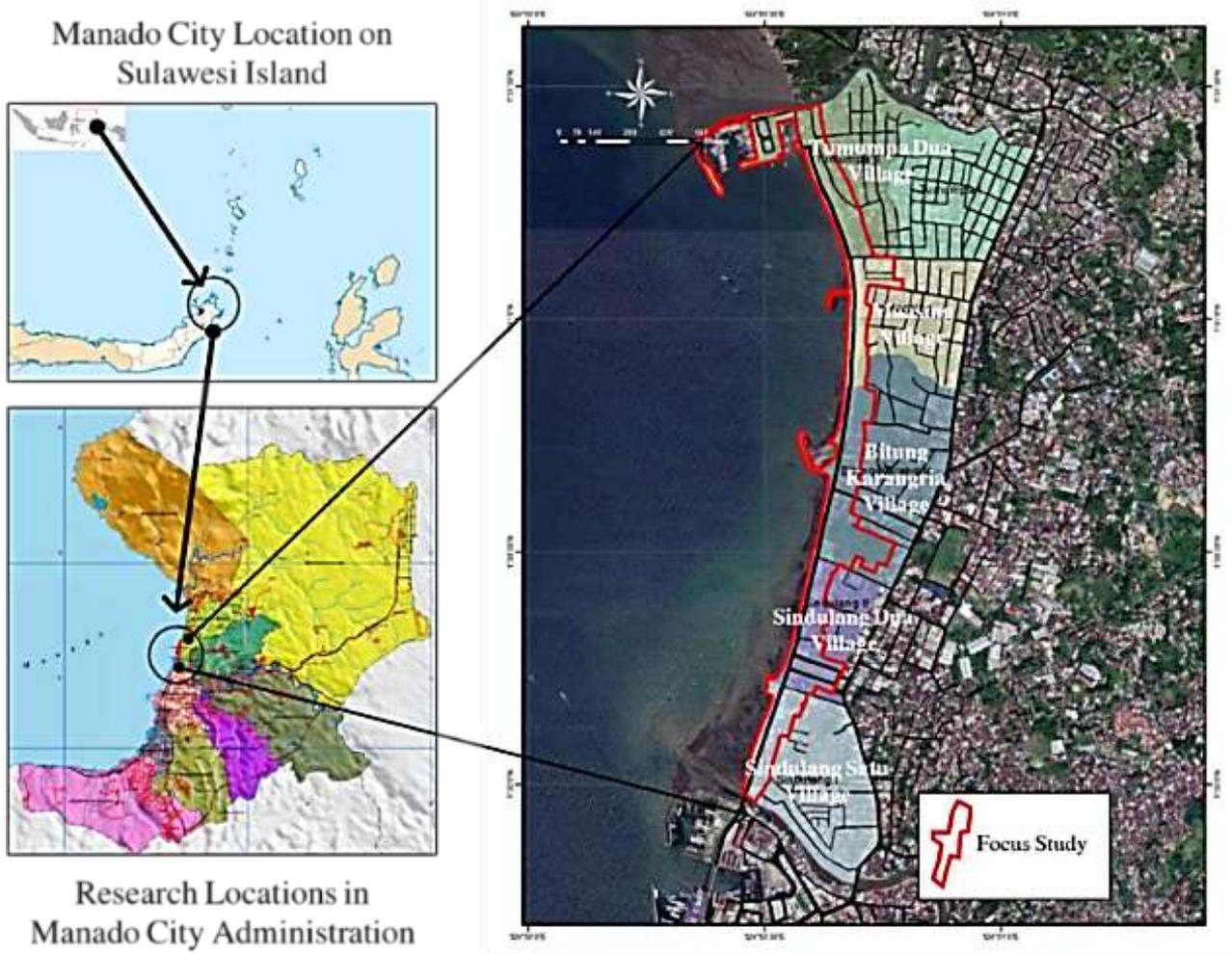
This study fills the gap by developing a conceptual model to assess the impact of coastal road development on sustainable urban architectural, identifying key variables and dominant indicators for recommendation.

### 3.0 RESEARCH METHODOLOGY

This study employs a survey-based quantitative approach with multivariate statistical analysis. This research design, defines the exploration of theoretical reality relationships of urban architectural elements, socio-cultural, socio-spatial, and socio-economic linkages in realising sustainable coastal city development in Manado City, North Sulawesi Province.

#### 3.1 Area of Study

The research location is in the coastal area of Boulevard II in Manado City, which includes five villages: 1) Tumumpa Dua; 2) Maasing; 3) Bitung Karangria; 4) Sindulang Dua; and 5) Sindulang Satu; as can be seen in Figure 1.

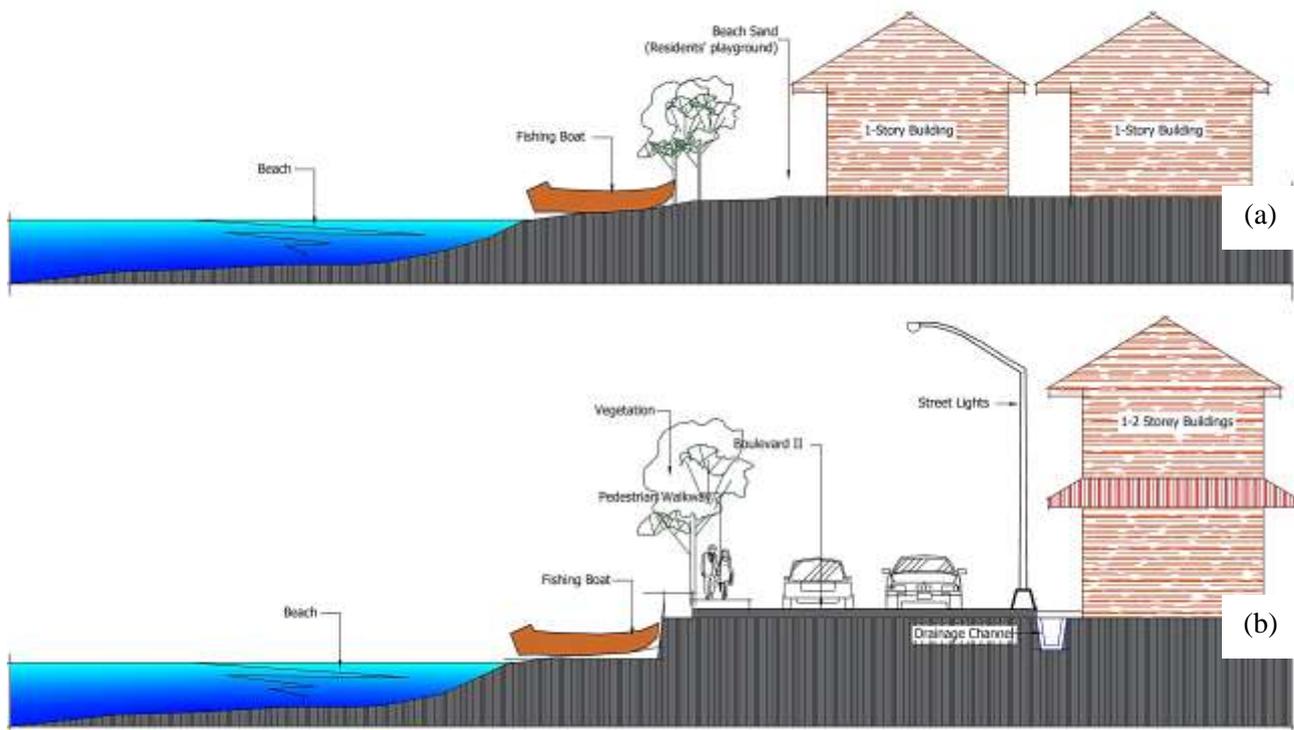


**Figure 1.** Area of Study Source: Map Data Processing by the Authors, 2025.

### 3.2 Data Collection

Data collection in this study was obtained through field observations and surveys. Observation in this study was used to obtain data on: 1) physical condition of Boulevard II; 2) socio-cultural condition; 3) socio-economic condition; 4) socio-spatial condition; and 5) architectural change condition of the coastal city. A comparison was made between pre-construction and post-construction conditions of Boulevard II (see Figure 2).

The survey was conducted through the distribution of questionnaires to collect data related to the construction of Boulevard II and the sustainability of coastal area development in Manado. The sample used was 100 respondents, distributed based on the maximum likelihood estimation of the recommended sample size between 100 and 200 (Goodhue et al., 2006).



**Figure 2.** Cross-Sectional before (a) and after (b) Development of Boulevard II. Source: Drawn by the Authors, 2025.

### 3.3 Analysis Method

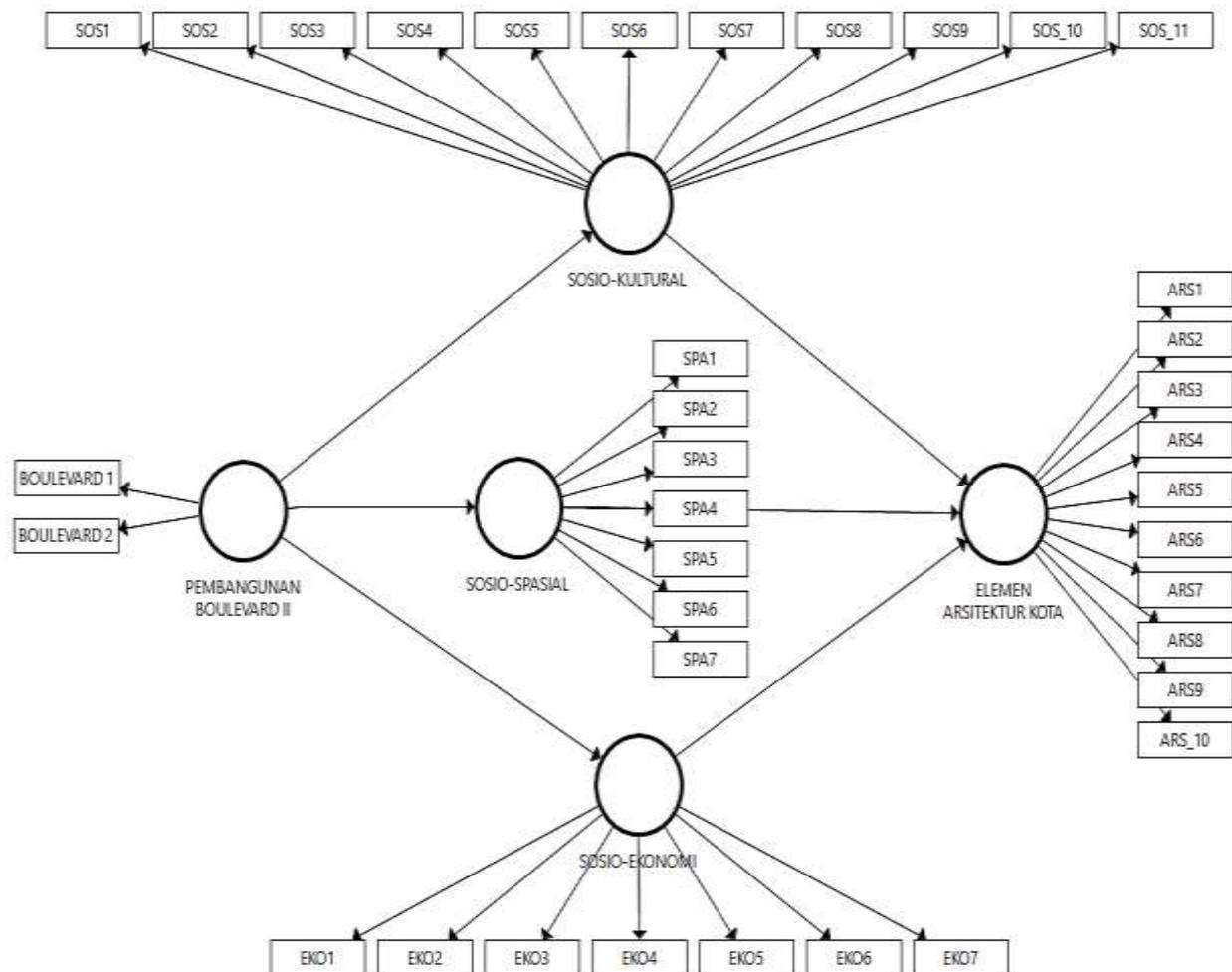
The analysis method used is quantitative descriptive analysis. from the data collected from the survey, which is then reviewed and integrated into Smart-PLS 3. Structural Equation Modeling (SEM) is a statistical technique for testing relationships between variables, both directly measured and latent, and analysing causal relationships in theoretical models (Deng et al., 2018). The Structural Equation Modeling (SEM-PLS) process is carried out simultaneously with the measurement and structural processes to build a model (Hair et al., 2019). This conceptual model confirms the relationship of coastal road development to socio-cultural, socio-economic, social space, and the transformation of urban architectural elements.

The variables with their indicators were developed from Suriandjo et al. (2023) which is shown in Table 1. Based on the variables and indicators, a model was built (see Figure 3), including the development of Boulevard II (X1) as the independent or exogenous variable, (X2) socio-cultural, (X3) socio-spatial and (X4) as intervening variables, and urban architectural elements (Y1) as the dependent or endogenous variable. Indicators were measured using a Likert scale through questions in a questionnaire and scored as follows: 1) strongly disagree, 2) disagree, 3) neutral, 4) agree, and 5) strongly agree.

**Table 1.** Dimensions and Variables.

| <b>No</b> | <b>Variable</b>                      | <b>Code</b> | <b>Indicator</b>   |
|-----------|--------------------------------------|-------------|--|
| 1         | The Development of Boulevard II (X1) | X1.1        | Boulevard II development process                             |
|           |                                      | X1.2        | Impact of Boulevard II development                           |
| 2         | Socio-Cultural (X2)                  | X2.1        | Lifestyle between migrants and local community               |
|           |                                      | X2.2        | Level of education   |
|           |                                      | X2.3        | Relationship between migrants and local communities          |
|           |                                      | X2.4        | Kinship among local communities                              |
|           |                                      | X2.5        | Community organisation                                       |
|           |                                      | X2.6        | Social class   |
|           |                                      | X2.7        | Dominant ethnicity   |
|           |                                      | X2.8        | Traditions, values and norms                                 |
|           |                                      | X2.9        | Cultural roots   |
|           |                                      | X2.10       | Spatial justice  |
|           |                                      | X2.11       | Social conflict  |
| 3         | Socio-Spatial (X3)                   | X3.1        | Safety from waves and coastal climate vulnerability          |
|           |                                      | X3.2        | Safety from vehicles   |
|           |                                      | X3.3        | Increased noise  |
|           |                                      | X3.4        | Increased temperature  |
|           |                                      | X3.5        | Sewage and rubbish pollution                                 |
|           |                                      | X3.6        | Shoreline change   |
|           |                                      | X3.7        | Settlement densification                                     |
| 4         | Socio-Economics (X4)                 | X4.1        | Change of profession   |
|           |                                      | X4.2        | Side job   |
|           |                                      | X4.3        | Hope to get a new job that can become a permanent livelihood |
|           |                                      | X4.4        | Working time   |
|           |                                      | X4.5        | Income   |
|           |                                      | X4.6        | Business relationship  |
|           |                                      | X4.7        | Money saved (savings)  |
| 5         | Urban Architectural Elements (X5)    | X5.1        | Land utilisation   |
|           |                                      | X5.2        | Land value and price   |
|           |                                      | X5.3        | Intensity of land utilisation                                |
|           |                                      | X5.4        | Architectural type and style                                 |
|           |                                      | X5.5        | Circulation and pedestrian                                   |
|           |                                      | X5.6        | Parking area   |
|           |                                      | X5.7        | Public open space  |
|           |                                      | X5.8        | Space for local wisdom activities                            |
|           |                                      | X5.9        | Utilisation of advertising space and landmarks               |
|           |                                      | X5.10       | Historic spaces and buildings in the area                    |

Source: Developed by the Authors from Suriandjo et al. (2023).



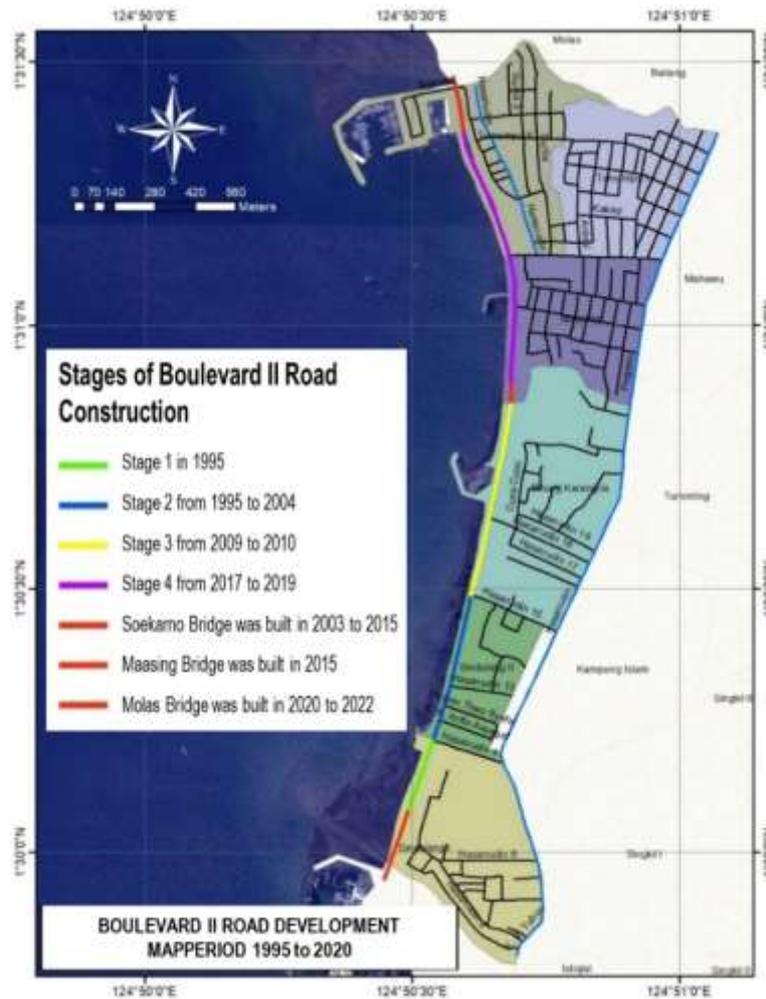
**Figure 3.** Proposed Research Model. Source: Model Processing by the Authors, 2025.

## 4.0 FINDING AND DISCUSSION

### 4.1 Boulevard II Development and Its Impact on the Coastal Areas

The Boulevard II area with a length of  $\pm 2.9$  km (including bridges) historically began with the installation of stone borders in 1993 to 1995 for a total of 400 metres, starting 200 metres from Sindulang I ward II. Furthermore, the construction was gradually continued every year since 1996 until the end of 2004, approximately eight years of border construction including pavement up to the Sindulang II village boundary. Development was halted around 2005 until 2008 due to the unavailability of further budget, and later began to be rebuilt in 2009, with the starting point starting from Bitung Karangria village. An overview of the development of Boulevard II from 1995 to 2022 can be seen in Figure 4.

During this period, the impact on the socio-cultural aspects of the culture of parking boats on the beach and lifting boats together began to be felt, which had become difficult due to the presence of large rocks (see Figure 5).



**Figure 4.** Boulevard II Development Progress. Source: Map Data Processing by the Authors, 2025.



**Figure 5.** Beachside Boat Parking (a). Boat Lifting Process (b). Source: Field Observation, 2025.

The paving process began in 2012 starting from Sindulang I to Bitung Karangria village. The paving process took place in two or three budget years from 2012 until 2015 when Boulevard II was completed and utilised until 2020. During this period, land use change to trade services increased (see Figure 6 and Table 2).

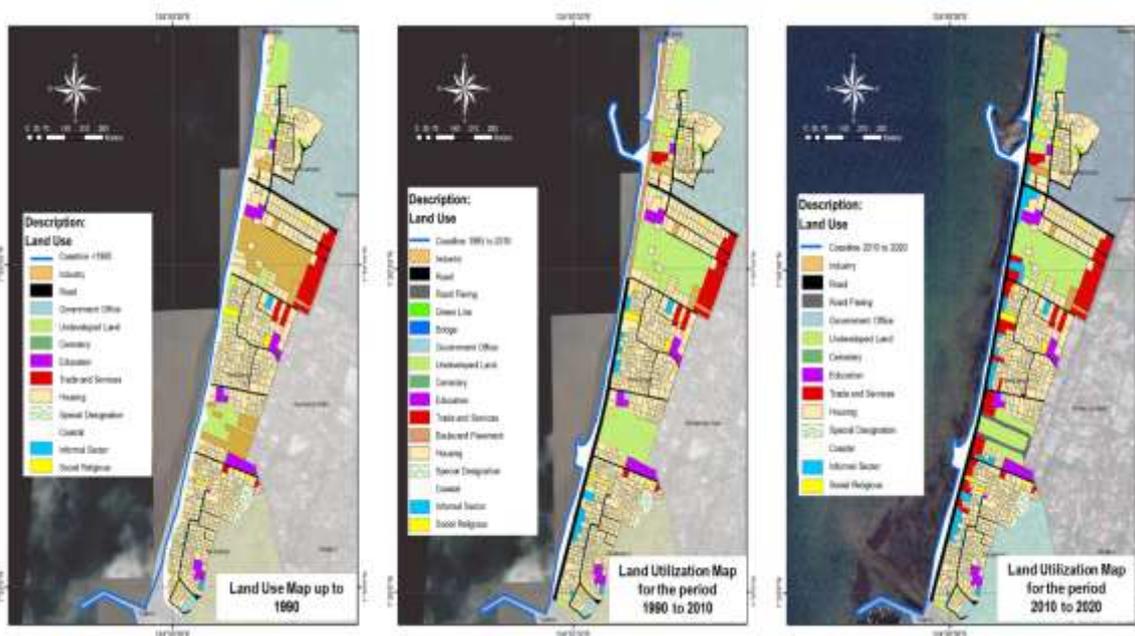


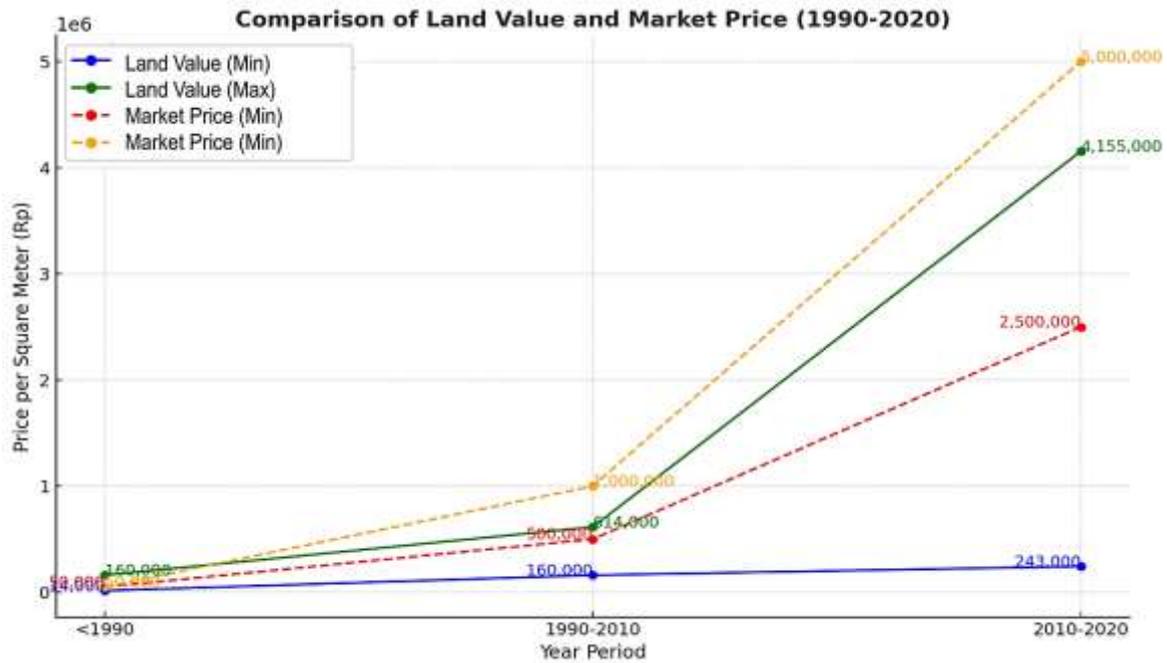
Figure 6. Land Use Change from 1990 to 2020. Source: Map Data Processing by the Authors, 2025.

Table 2. Land Use Change from 1990 to 2020.

| Land Use            | <1990        | From 1990 to 2010 | From 2010 to 2020 |
|---------------------|--------------|-------------------|-------------------|
|                     | Area (ha)    | Area (ha)         | Area (ha)         |
| Industry            | 4.71         | 0.48              | 0.48              |
| Road                | 1.55         | 3.59              | 8.59              |
| Government Office   | 0.24         | 0.24              | 0.24              |
| Undeveloped Land    | 3.03         | 7.52              | 6.65              |
| Cemetery            | 0.04         | 0.04              | 0.04              |
| Education           | 1.25         | 1.25              | 1.25              |
| Trade and Services  | 1.58         | 1.78              | 3.17              |
| Housing             | 20.36        | 20.93             | 19.01             |
| Special Designation | 0.44         | 0.44              | 0.44              |
| Coastal             | 3.07         | 3.18              | 4.74              |
| Informal Sector     | 0.19         | 0.77              | 1.68              |
| Religious Social    | 0.54         | 0.56              | 0.56              |
|                     | <b>37.02</b> | <b>40.78</b>      | <b>46.87</b>      |

Source: Analysis Results, 2025.

According to Table 2, the total land use change from 1990 to 2020 increased by 27%. Changes can be seen in the addition of road utilisation which was originally only 1.55 ha in 1995, to 8.59 ha in 2020. Then the increase in the use of trade and services from initially 1.58 ha in 1995, to 3.17 (101% increase) ha in 2020. Then, there was also an increase in land use in the informal sector from 0.19 ha in 1995, to 1.68 ha in 2020.



**Figure 7.** Comparison of Land Value and Market Price (1990 to 2020). Source: Analysis Results, 2025

As shown in Figure 7, the increasing market value of land is no longer in line with the Assessed Property Value (APV). For example, in the 90s, the APV was in the range of 14,000 IDR to 160,000 IDR but the market price was already at 50,000 IDR per m<sup>2</sup>. Similarly, from 2010 to 2020, when the Boulevard II Road was already in operation, there was a significant increase in the value and price of land, which had touched the price of 2,500,000 IDR to 5,000,000 IDR per m<sup>2</sup>.

Since 2020, socio-economic changes—marked by shifts in livelihoods and land use from residential to trade-oriented functions such as restaurants and cafes—have increasingly impacted the urban architectural elements, as shown in Figure 8.



**Figure 8.** Change of Residential to Trade Service Function. Source: Field Observation, 2025.

The biggest impact is also related to the socio-culture of the local population, where the culture of lifting boats together is diminishing, due to the difficulty of boat parking space, making use of the road (Figure 9).



**Figure 9.** Utilisation of Pedestrian Access Points for Boat Parking. Source: Field Observation, 2025.

#### 4.2 The Influence of Boulevard II Development on the Socio-Cultural, Socio-Spatial, and Socio-Economic Shaping of the Urban Architectural Elements

##### *Measurement Model Analysis (Outer Model)*

The results of the concurrent validity test show that all indicators have met the criteria with an outer loading value  $\geq 0.7$ , which means that the indicator is a valid construct. As seen in Table 3.

**Table 3.** Internal Consistency Reliability.

| Laten Variable (Code)        | Cronbach's Alpha | Composite Reliability Average (rho_A) | Composite Reliability Convergent (CR) | Average Variance Extracted (AVE) |
|------------------------------|------------------|---------------------------------------|---------------------------------------|----------------------------------|
| Urban Architectural Elements | 0.923            | 0.930                                 | 0.935                                 | 0.589                            |
| Development of Boulevard II  | 0.791            | 0.803                                 | 0.905                                 | 0.826                            |
| Socio-Economic               | 0.870            | 0.881                                 | 0.902                                 | 0.606                            |
| Socio-Cultural               | 0.936            | 0.938                                 | 0.946                                 | 0.662                            |
| Socio-Spatial                | 0.930            | 0.935                                 | 0.944                                 | 0.707                            |

Notes: Loading Factor  $>0.70$ , CR  $>0.70$ , AVE  $>0.50$  (Hair et al., 2019).

The results of the simultaneous validity test show that all latent constructs have adequate validity, meeting the  $\geq 0.7$  criterion with a high level of reliability, indicated by Composite Reliability values ranging from 0.803 to 0.935 and AVE values that are above the 0.50 threshold, indicating that more than half of the indicator variance can be explained by the construct. Discriminant validity assessment based on the Fornell-Larcker criterion shows that the root AVE value of each construct is greater than the correlation between variables, ensuring that each construct is more related to its own indicators than to other constructs. The highest correlation was found between the socio-cultural and socio-spatial variables, indicating a close association with a correlation value of 0.94.

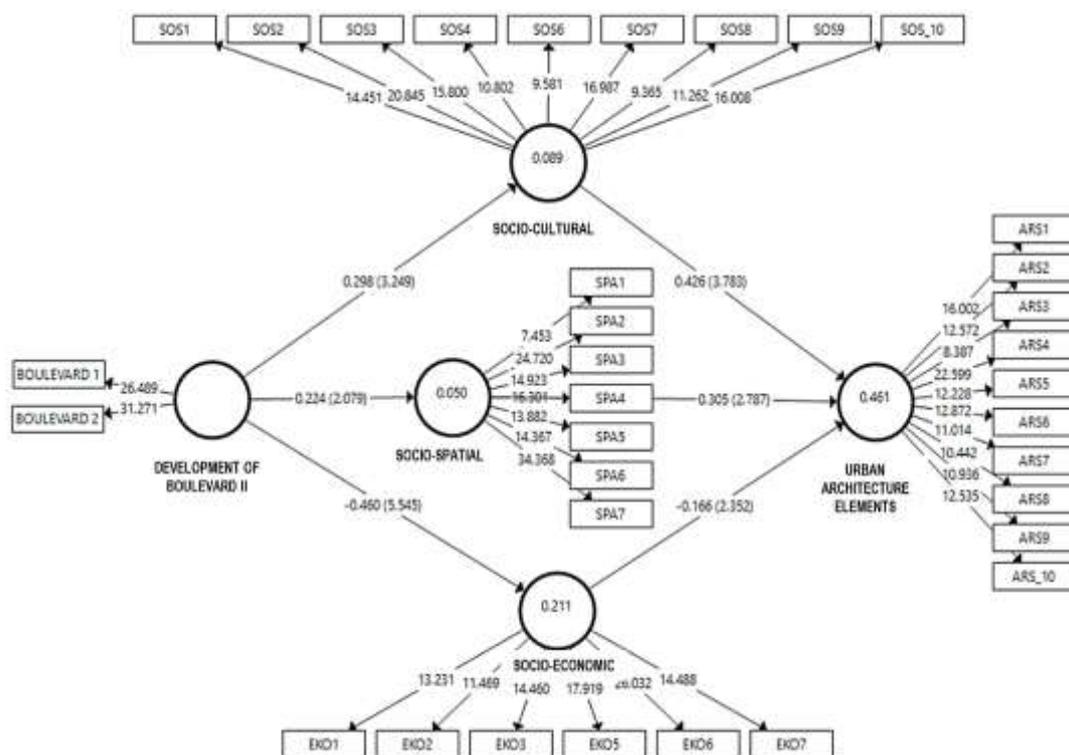
The greatest impact of the Boulevard II development was seen in the socio-spatial variables, with high reliability reflected by Cronbach's alpha value of 0.930 and AVE of 0.707, indicating significant changes in settlement densification and neighbourhood security. Socio-cultural variables, with the highest reliability values (Cronbach's alpha of 0.936 and AVE of 0.662), indicate important contributions to community adaptation through increased education levels and strengthened social relations. The socio-economic variable,

with an AVE of 0.606, reflects the impact of the development on business relations, job changes and new economic opportunities.

The transformation of urban architectural elements is driven by interactions across variables, with a reliability value of 0.923 and an AVE of 0.589. Changes in land use, public open space management, and area infrastructure are key aspects in creating a more structured and sustainable environment. Overall, the development of boulevard II not only provides direct benefits but also contributes to the holistic transformation of the city, with socio-spatial variables as the main drivers followed by the significant influence of socio-cultural and socio-economic variables.

*Structural Model Analysis (Inner Model)*

The results of the analysis in Table 4 and Figure 10 below, show that the construction of Boulevard II has a significant direct influence on changes to the urban architectural elements, with a T-statistics value of 4.141 and a P-value of 0.000.



**Figure 10.** Inner Model Analysis. Source: Results of Data Processing with Smart-PLS Ver.3

**Table 4.** Results of Path Coefficient Values and P Values

| Path   | T Statistics | P Values | Description |
|--|--------------|----------|-------------|
| Boulevard II Development -> Urban Architectural Elements | 4.141        | 0.000    | Valid       |
| Boulevard II Development -> Socio-Economic               | 5.545        | 0.000    | Valid       |
| Boulevard II Development -> Socio-Cultural               | 3.249        | 0.001    | Valid       |
| Boulevard II Development -> Socio-Spatial                | 2.079        | 0.019    | Valid       |
| Socio-Economic -> Urban Architectural Elements           | 2.352        | 0.009    | Valid       |
| Socio-Cultural -> Urban Architectural Elements           | 3.783        | 0.000    | Valid       |
| Socio-Spatial -> Urban Architectural Elements            | 2.787        | 0.003    | Valid       |

Source: Results of Data Processing with Smart-PLS Ver.3

This shows that infrastructure development in Boulevard II significantly changes the design and characteristics of the city's architectural elements, such as land use, land use intensity, architectural type and style, and public open space. The development of Boulevard II also has a significant impact on the socio-cultural dynamics of the community, as shown by the T-statistics value of 3.249 and P-value of 0.001. This indicates that the development of this infrastructure creates changes in social interaction patterns, cultural activities, and community adaptation to the new environment. Boulevard II development has a significant effect on socio-spatial change, with T-statistics 2.079 and P-value 0.019. This finding suggests that the new infrastructure changes spatial distribution, accessibility, and inter-area relationships, impacting the spatial structure of the neighbourhood.

In addition, the analysis shows that the Boulevard II Development has a significant effect on the Socio-Economic Growth of the community, with T-statistics of 5.545 and P-value of 0.000. This reflects that the development encourages economic activity, such as increased local businesses, new investments, and access to jobs. Socio-cultural dynamics were shown to have a significant influence on the urban architectural elements, with T-statistics of 3.783 and a P-value of 0.000. Changes in people's values, norms and customs are reflected in the design and structure of the urban architectural elements that adapt to the local identity. Socio-spatial changes have a significant influence on urban architectural elements, with T-statistics 2.787 and P-value 0.003. This finding suggests that transformations in spatial distribution patterns and accessibility influence the planning and development of urban architectural elements. Socio-economic growth was also shown to influence the city's architectural elements, with a T-statistics value of 2.352 and a P-value of 0.009. This suggests that increased economic activity in the region is driving changes in the urban architectural design to support growing economic activity.

#### **4.3 An Integration Model of Sustainable Urban Architectural Elements in Coastal Areas**

The analysis results demonstrate that the development of Boulevard II as a transportation infrastructure has a significant direct impact on the architectural elements of the coastal city. This confirms that the transportation infrastructure project has created substantial transformations in land use patterns, spatial structures, and public space design. This finding is very novel and perhaps the only one in the literature that attempts to find a link between coastal infrastructure and its impact on the architectural elements of the city. However, at least these findings are in line with the concept of more natural coastal green infrastructure to reduce pressure on the coast (Chávez et al., 2021). The findings emphasise the importance of sustainable spatial management in the development of coastal green infrastructure, manifested in public open spaces as one of the architectural elements of coastal cities. Similarly, the findings Jabareen (2006) through seven sustainable urban design concepts: cohesiveness, sustainable transport, density, mixed land use, diversity, passive solar design, and greening, are reinforced through the present findings through the elements of circulation and pedestrian pathways, settlement densification, land use, spatial equity, and public open space.

Furthermore, the findings of Pallathadka et al. (2023) identifies four key issues in the current urban sustainability literature: space, scale, stakeholders, and dimension are issues that sustainability planning needs to focus on in developing locally appropriate solutions. These four key issues are reinforced through the elements of sustainable urban architectural: land use, land use intensity, local wisdom activity space, and rooted traditions, values and norms and culture.

The results of the analysis show that the construction of Boulevard II significantly affected the socio-cultural dynamics of the community. Lifestyle changes, increased social interaction, and cultural adaptation due to this infrastructure development are the main catalysts for socio-cultural change. This is relevant to Batara (2011) which highlights that infrastructure can change patterns of social relations, and requires an inclusive approach to minimise the marginalisation of local residents. Similarly, in line with the physical changes due to infrastructure development, changes in social class, profession, education level, lifestyle, spatial equity, cultural roots, working time and income have been observed (Suriandjo et al., 2023). Socio-cultural dynamics influence the architectural elements of the city, as evidenced by their influence on the architectural elements of the city. Changes in community values and norms are reflected in the design of public spaces that are inclusive and rooted in local identity, supporting the findings of the study Setiawan et al. (2021) and Suriandjo et al. (2023) on the importance of integrating local wisdom in urban architectural. It also reinforces

the important finding to consider architectural elements and environmental conditions on planning, without neglecting cultural heritage to achieve sustainable urban living (Formolly & Saraei, 2024).

Significant influence was also found on the relationship between Boulevard II development and socio-spatial changes. This finding indicates a transformation in spatial distribution, increased inter-regional connectivity, changes in spatial utilisation patterns and other social patterns. Findings from Pratomo et al. (2021) proved that there were physical changes in the area in the form of significant land use changes to fulfil housing and urban infrastructure needs, job displacement, and income both before and after displacement. Socio-spatial changes also affect the architectural elements of the city. The relationship between socio-spatial changes and urban architectural elements shows that spatial redistribution and accessibility patterns influence the overall urban layout, supporting the research that has been conducted Wang et al. (2020) on the importance of sustainable spatial design.

The analysis shows that the development of Boulevard II has had an impact on the socio-economic growth of the community. Increased employment opportunities, business relations, diversification of income sources and increased land price values are clear evidence of this positive impact. This finding supports Banister and Berechman (2001) highlights the role of transport infrastructure as a key driver of economic growth in coastal areas. Socio-economic growth also shows a relationship to the architectural elements of the city, where increased economic activity drives the development of commercial areas and a more dynamic urban layout. This is in line with the findings Lee (2025) changes in the area's economy led to changes in architectural elements in the renovated buildings and evolved into commercial functions.

The model proposed in this research includes the integration of socio-cultural, socio-economic and socio-spatial aspects to create a sustainable coastal city. From the socio-cultural side, it is important to create inclusive public spaces and strengthen the participation of local communities in urban planning. In addition, maintaining local identity in the city's architectural design is also crucial so that development remains relevant to the local cultural context. Socio-economically, this model encourages the development of commercial areas that support small businesses and avoid gentrification that could potentially harm local communities. However, socio-spatially, this development also poses challenges, particularly in terms of settlement densification and environmental impacts such as increased noise and coastal erosion.

## 5.0 CONCLUSIONS

This study concludes that the development of Boulevard II in Manado has significantly impacted the transformation of coastal urban architectural elements. The dominant factors influencing these changes are socio-cultural, socio-economic, and socio-spatial aspects, which integrate into sustainable urban architectural elements: 1) land use; 2) land value; 3) urban architectural styles; 4) land use intensity; 5) settlement density; 6) public open space utilization; 7) circulation, pedestrian, and parking characteristics; 8) physical and environmental quality; 9) historic spaces and buildings; 10) socio-economic spaces; and 11) socio-cultural spaces. The findings of the eleven elements of urban architecture are a development of the findings of previous studies (Suriandjo et al., 2023) as shown in Table 1, related to the elements of urban architecture.

This study has limitations, as the data collected primarily employ a quantitative approach, lacking qualitative insights from local communities. Additionally, the study does not provide a long-term analysis of climate change impacts and environmental resilience. Future research should explore these aspects to provide more comprehensive and applicable recommendations.

## 6.0 AUTHOR'S CONTRIBUTION

Suriandjo conducts research, writes and revises articles. Waani and Malik conceptualized the main research ideas and provided a theoretical framework. Suriandjo and Rondonuwu designed the research. Suriandjo and Lahamendu supervised the progress of the research and carried out the review, revision and approval of article submissions.

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