

Model Development of Sustainable Island Ecotourism in Seribu Islands Regency: NRBV, ISM, and DEMATEL Approaches

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Keywords:	Abstract
Sustainable Island Ecotourism; Thousand Islands; NRBV; ISM; DEMATEL	Island ecotourism plays a crucial role in achieving sustainable development goals; however, its development is inherently complex. This study aimed to identify key elements of island ecotourism based on the Natural Resource-Based View (NRBV), analyze the interrelationships among these elements, determine their hierarchical structure, and classify them into relevant categories. Data were collected through a survey involving 12 expert respondents and 64 visitors. The study was conducted on Tidung Island and Untung Jawa Island in the Seribu Islands Regency, Jakarta Province, between August and October 2024. The data were analyzed using the Delphi method, MICMAC, ISM, and DEMATEL approaches. The findings identified key elements of island ecotourism with strong influence on sustainable development. These included unique local resources, effective green marketing, supportive and consistent government policies, adequate facilities and infrastructure, high-quality products and services, and the promotion of environmental awareness and appreciation. The results indicate that these elements collectively play a critical role in shaping sustainable island ecotourism development. These findings provide a strategic framework for stakeholders and policymakers in formulating development strategies. In particular, emphasis should be placed on strengthening unique local resources, green marketing practices, and consistent government policy support to ensure the long-term sustainability of island ecotourism.

INTRODUCTION

The 2009 Tourism Law affirms that tourism is an integral part of national development. Therefore, tourism development must be carried out systematically, in a planned, integrated, and sustainable manner. Furthermore, tourism development must be implemented responsibly while protecting religious values, community culture, environmental sustainability, and quality standards. Ministerial Regulation No. 9 of 2021 on sustainable tourism also emphasizes that tourism development must prioritize economic growth and equity, environmental responsibility, and respect for local culture. Sustainable tourism development also aims to support the achievement of the second “Asta Cita” vision, namely the creation of national independence through blue economic development.

In general, the literature identifies three objectives of tourism development: economic growth and social resilience; environmental and cultural preservation; and governance and operations. From an economic and social perspective, tourism development enables poverty alleviation, economic growth, reduced inequality, and infrastructure development. In this regard, tourism development creates employment

opportunities, expands business prospects for tourism actors, boosts local and regional economic performance, and improves economic equity in rural and urban areas (Zhou et al., 2023). From an environmental and cultural perspective, tourism development provides benefits through the protection of nature and biodiversity, the promotion of local culture and heritage, and the upgrading of infrastructure to support sustainability. In addition, tourism development involves integrating sustainability into tourism policies and business operations, engaging local communities in decision-making, promoting responsible and accessible tourism, and enforcing policies aligned with sustainable tourism goals (Prakasa et al., 2023).

One type of tourism that has attracted considerable attention is island ecotourism. Island ecotourism refers to travel to natural island areas conducted in a responsible manner, including participation in environmental conservation, support for local community well-being, and the enhancement of visitors' knowledge and awareness of environmental protection (Figueroa & Rotarou, 2021). In other words, island ecotourism encompasses three main elements: nature conservation, community well-being, and education. The first element aims to minimize the negative environmental impacts of tourism, support biodiversity conservation, and preserve islands' natural heritage. The second element aims to ensure that tourism activities directly benefit local communities, generate employment, and create relevant economic opportunities while respecting cultural heritage and traditions. The third element aims to increase visitors' knowledge, awareness, and appreciation of the natural environment and local culture through educational tourism activities (Hsiao et al., 2021).

Despite its potential benefits, many experts emphasize that island ecotourism faces various challenges, including economic, environmental, and social issues. Environmental issues arise from habitat destruction and degradation, pollution, natural resource depletion, biodiversity loss, and increased vulnerability to climate change. Meanwhile, social and economic issues emerge in the form of economic dependency and leakage, socio-cultural degradation, inadequate infrastructure, and transportation constraints (Chi & Liu, 2024; Fernandez-Abila, 2024).

Referring to Guden et al. (2021), this study argues that the development of sustainable island ecotourism is a complex and multidimensional issue. The complexity of island ecotourism stems from the many interrelated economic, environmental, and social elements involved. Therefore, its development requires a systemic approach that accommodates key factors and their interrelationships. This development model serves as a framework or roadmap for designing island ecotourism that is carefully planned, well-regulated, provides equitable benefits to local communities, and maintains environmental sustainability.

Furthermore, the literature also highlights the link between island ecotourism and environmental issues. In this regard, Samal & Dash (2023) argue that while island ecotourism can contribute to conservation and rehabilitation, it may also trigger environmental degradation, including habitat destruction, pollution, resource depletion, biodiversity loss, and alterations in natural systems. To minimize these impacts, island

ecotourism development requires a holistic approach that integrates economic, environmental, and social dimensions. Such an approach is crucial for achieving sustainable island ecotourism. Moreover, the literature introduces the Natural Resource-Based View (NRBV) as a theoretical lens for explaining competitive advantage. NRBV posits that a firm's competitive advantage stems from its capabilities related to environmental sustainability (Munch et al., 2022). Although NRBV has been widely discussed as a strategic perspective for corporate sustainability (Ramaano, 2023), its application in island ecotourism remains limited. Therefore, several scholars have called for further research on applying NRBV in island ecotourism to achieve sustainable competitive advantage (Wang et al., 2023). This study addresses this gap by developing a conceptual hierarchical model that outlines a roadmap for sustainable island ecotourism grounded in NRBV.

This study aimed to identify key elements of island ecotourism development based on the NRBV framework, analyze the interrelationships and hierarchical structure among these elements, measure the strength of influence and cause–effect relationships, and classify elements according to their driving power and dependence. Furthermore, this research formulated a strategic roadmap for sustainable island ecotourism development in the Seribu Islands Regency. The study offers both theoretical and practical contributions. Theoretically, it contributes to the literature on sustainable island ecotourism and NRBV by providing a systemic framework integrating economic, environmental, and social dimensions. Practically, the findings offer actionable insights for policymakers, tourism practitioners, and local communities to support sustainable island ecotourism development, thereby strengthening regional economic development, preserving natural and cultural heritage, and promoting environmental conservation.

Specifically, this study employed Interpretive Structural Modeling (ISM) and DEMATEL approaches to analyze island ecotourism development. The results provide five main contributions to theory and practice: identifying key elements relevant to the success of sustainable island ecotourism development in a regional context; identifying interrelationships among elements, including their relative importance; analyzing factor relationships and constructing a visual model; classifying elements based on driving power and dependence; and providing a clear visual roadmap for sustainable island ecotourism development in the region. This roadmap is expected to serve as a basis for decision-makers and practitioners in formulating policies and implementing practices that support sustainable island ecotourism and, in turn, contribute to sustainable regional economic development.

METHOD

This research applied mixed methods approach to gain a deeper understanding of various aspects of island ecotourism in the Thousand Islands region. This mixed method approach combined quantitative and qualitative research elements to answer the research question of how to develop a sustainable island ecotourism model based on NRBV in the context of the Thousand Islands region.

Research Location

The Seribu Islands Regency is home to hundreds of islands, both inhabited and uninhabited. Several of these islands offer ecotourism attractions, including mangrove, marine, culinary, and cultural tourism. To obtain more focused research results, this study focused on ecotourism on Tidung Island and Untung Jawa Island. Both islands are located in the South Seribu Islands sub-district, Seribu Islands Regency, Jakarta Province. The research was conducted from August to October 2024.

Data collection

In general, this research will utilize several methods to collect data, including literature review, in-depth interviews, questionnaire distribution, and field observations. The literature review and interviews aim to identify key elements for developing NRBV-based island ecotourism in the Thousand Islands region. Interviews involve various parties related to island ecotourism, including tourism industry players, academics, and visitors. The field survey aims to obtain an overview of various aspects of island ecotourism currently in effect. The questionnaire distribution aims to measure expert groups' perceptions of the relevance of island ecotourism elements in the Thousand Islands region. The questionnaire distribution also aims to measure visitors' perceptions and preferences regarding various aspects of island ecotourism in the Thousand Islands region.

Research variables

The initial stage of this research framework is the identification of relevant elements for the successful development of sustainable island ecotourism. The literature review indicates that although several experts have proposed elements for successful island ecotourism development, no universal framework has yet been established. Table 1 below presents the elements of island ecotourism development identified from the literature review. Overall, 18 elements are widely cited as essential for the success of island ecotourism development.

Table 1. Key elements for successful island ecotourism development

Coding	Description	References
FS-1	Stakeholder collaboration	Cossengue (2024); Kabil et al. (2024)
FS-2	Active community involvement	Cossengue (2024); Sutrisno (2024)
FS-3	The existence of unique local resources	Jeong et al. (2023); Joseph (2024)
FS-4	Low cost travel agent	Sutrisno (2024)
FS-5	Community-based approach	Jeong et al. (2023); Joseph (2024)
FS-6	Empowerment of local communities	Jeong et al. (2023); Joseph (2024)
FS-7	Creating added economic value for the community	Cossengue (2024); Kabil et al. (2024)
FS-8	Minimizing environmental impact	Kabil et al. (2024); Joseph (2024)
FS-9	Effective management of natural resources	Kabil et al. (2024); Joseph (2024)
FS-10	Support and encourage conservation efforts	Kabil et al. (2024); Joseph (2024)
FS-11	Protect and promote cultural heritage	Cossengue (2024); Joseph (2024)
FS-12	Create unique and memorable experiences	Cossengue (2024); Sutrisno (2024);
FS-13	Effective green marketing	Kabil et al. (2024); Sutrisno (2024)

Coding	Description	References
FS-14	Supportive and consistent government policies	Tjilen et al. (2022); Sutrisno (2024)
FS-15	Adequate facilities and infrastructure	Tjilen et al. (2022); Jeong et al. (2023)
FS-16	Providing high quality products and services	Jeong et al. (2023); Kabil et al. (2024)
FS-17	Building environmental awareness and appreciation	Jeong et al. (2023); Joseph (2024)
FS-18	Availability of various modes of land transportation	Sutrisno (2024)

Source: Compiled from Cossengue (2024), Jeong et al. (2023), Joseph (2024), Kabil et al. (2024), Sutrisno (2024), and Tjilen et al. (2022)

Analysis Method

1. Delphi Method

Sustainable ecotourism development is a complex and multidimensional issue. Sustainable ecotourism development requires a systemic approach that integrates the key elements that support its sustainability (Abdul Shukor & Nga, 2022). This study applied the Delphi method to gather expert opinions on elements relevant to sustainable ecotourism development. Specifically, the application of this method also aims to support decision-making on elements relevant to sustainable ecotourism development in the Seribu Islands region. Referring to Brioso & Cruzado-Ramos (2020), the application of this method consists of several main stages, including the selection of an expert panel, the preparation and distribution of the first questionnaire, the analysis of expert responses to the first questionnaire, the preparation and distribution of the second questionnaire, and the analysis of expert responses to the second questionnaire.

2. Interpretive Structural Modeling (ISM)

Sustainable ecotourism development is a complex and multidimensional issue. Sustainable ecotourism development requires a systemic approach that incorporates the key elements that support its sustainability (Saeedi et al., 2022). Therefore, this study uses the ISM approach to analyze and model the relationships between relevant elements that support sustainable ecotourism development. Referring to Achmad & Ayman (2021), the application of ISM is specifically aimed at identifying elements related to island ecotourism, establishing contextual relationships among these elements, developing a hierarchical model, and categorizing elements based on their level of influence and interdependence within the system.

3. DEMATEL Method

The DEMATEL (Decision Making Trial and Evaluation Laboratory) method is a technique for analyzing complex problems by visualizing and mapping cause-and-effect relationships among factors (Runtuk, 2024). This study uses the DEMATEL method to gain a deeper understanding of the key elements that support the development of sustainable ecotourism in the Seribu Islands region. Specifically, the application of the DEMATEL method aims to identify causal elements and dominant elements that require more attention in the development of sustainable ecotourism. Referring to Teymourifar

& Trindade (2023) , the application of the DEMATEL method in this study includes six main stages, namely identifying relevant elements and supporting ecotourism development, assessing the direct influence of an element on other elements, compiling an initial direct relationship matrix, calculating the total influence of each element on all other elements, determining the total influence received by an element from other elements, and building a cause-and-effect diagram.

RESULTS AND DISCUSSION

Delphi Analysis

The literature has identified several key elements as prerequisites for the successful development of NRBV-based island ecotourism (Table 1). Referring to the work of Abdul Shukor & Nga (2022), this study considers several factors in determining these elements, including stakeholders' involvement and participation in the determination process. Therefore, in line with Brioso & Cruzado-Ramos (2020), this study believes that determining the key elements for the successful development of NRBV-based island ecotourism by considering the views of a group of experts is a relevant approach. The consensus of these experts, in turn, will help develop a model for NRBV-based island ecotourism development. To this end, this study has applied the Delphi method to identify valid and relevant elements for NRBV-based island ecotourism development in the Thousand Islands region. Specifically, the Delphi method aims to elicit opinions and build consensus among stakeholders by asking them about the relevance of elements identified in the literature to the actual conditions of the Thousand Islands region.

Referring to the work of Brioso & Cruzado-Ramos (2020), the Delphi method applied in this study comprises the following stages: determining the scope, selecting expert respondents, developing the questionnaire, distributing the first questionnaire, distributing the second questionnaire, and analyzing the results. Furthermore, this study uses two parameters to determine the relevance of elements for the successful development of island ecotourism: the weighted average (WA) and the level of *consensus* (LC). In this case, elements with $LC \geq 0.7$ and $WA \geq 4.0$ are valid and relevant for the successful development of island ecotourism in the Thousand Islands region. Table 2 presents the valid and relevant elements for the successful development of island ecotourism in the Thousand Islands region.

Table 2. Relevance of elements for the successful development of island ecotourism

Elements	Relevance					WA	LC
	1	2	3	4	5		
Stakeholder collaboration		0	0	1	5	6	4.42
	0.92						

Active community involvement	0.83	0	0	2	3	7	4.42
Unique local resources	0.83	0	0	2	4	6	4.33
Low cost travel agent*	0.33	0	1	7	3	1	3.33
Community-based approach	0.83	0	0	2	4	6	4.33
Empowerment of local communities	1.00	0	0	0	7	5	4.42
Creating economic added value	0.83	0	0	2	5	5	4.25
Minimizing environmental impact	0.83	0	0	2	2	8	4.50
Effective management of natural resources	0.83	0	0	2	3	7	4.42
Support and encourage conservation efforts	0.92	0	0	1	7	4	4.25
Protecting cultural heritage	0.83	0	0	2	6	4	4.17
Create memorable experiences	0.75	0	0	3	3	6	4.25
Effective green marketing	1.00	0	0	0	4	8	4.67
Supportive government policies	0.83	0	0	2	4	6	4.33
Adequate facilities and infrastructure	0.83	0	0	2	5	5	4.25
Providing quality products and services	0.92	0	0	1	6	5	4.33
Building awareness and appreciation	0.92	0	0	1	5	6	4.42
Availability of land transportation modes*	0.58	0	0	5	4	3	3.83

Source: Delphi survey results (August–October 2024)

As shown in Table 2, this study found that low-cost travel agents and the availability of land transportation modes had WA values below 4.00 and LC values below 0.70. This finding indicates expert respondents reached consensus that these two elements of island ecotourism development are less valid and relevant in the context of the Seribu Islands region. Therefore, this study removed these two elements from the lists used in the ISM and DEMATEL model development processes.

ISM Model Analysis

MICMAC Analysis

This study uses the MICMAC procedure to analyze the levels of dependency and driving force for the critical success factors in the development of island ecotourism based on NRBV. The analysis also aims to find the dominant elements that significantly contribute to the success of sustainable island ecotourism development. MICMAC analysis sorts each element into four categories: dependent, independent, autonomous,

and linkage. Figure 1 presents the MICMAC output for the elements driving success in sustainable island ecotourism development in the Seribu Islands region.

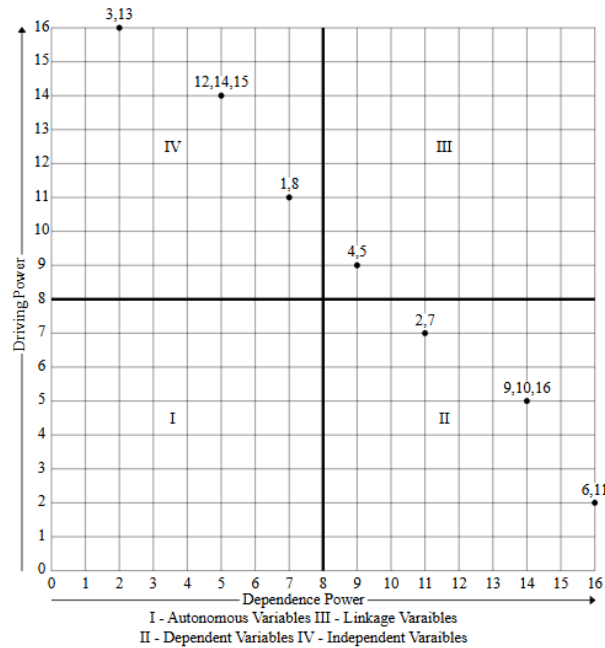


Figure 1. MICMAC analysis output

Source: Research data processed with SmartISM application, 2024

As seen in Figure 1, the MICMAC analysis output places elements that support successful island ecotourism development in four quadrants. Quadrant I is the area for autonomous elements. These elements are weak in both driving force and dependency. No elements occupy this quadrant. Quadrant II is designated for dependent elements with a low driving force and high dependency. MICMAC analysis shows seven elements in this quadrant: active community involvement (fs-2), empowering local communities (fs-6), creating economic added value for the community (fs-7), effective natural resource management (fs-9), supporting and encouraging conservation efforts (fs-10), protecting and promoting cultural heritage (fs-11), and providing high-quality products and services (fs-16). Quadrant III is for linkage elements with both high driving force and high dependency. The analysis identified two elements in this quadrant: the community-based approach (fs-5) and local community empowerment (fs-6).

Finally, quadrant IV includes independent elements. These have a high driving force and low dependence. MICMAC analysis shows seven elements occupy this quadrant: stakeholder collaboration (fs-1), the existence of unique local resources (fs-3), minimizing environmental impacts (fs-8), creating unique and memorable experiences (fs-12), effective green marketing (fs-13), supportive and consistent government policies (fs-14), and adequate facilities and infrastructure (fs-15). Achmad & Ayman (2021) explain that independent elements exert a strong influence on others in the system and are critical for achieving system objectives. This finding implies that island ecotourism

development must focus on fulfilling these seven elements, as they drive sustainable island ecotourism. Literature also recognizes their important role in sustainable ecotourism development (Setiadi et al. 2024).

Hierarchy analysis

Island ecotourism development is complex and involves many interrelated elements. Referring to Achmad & Ayman (2021), this study uses the ISM method to analyze and model the complexity of island ecotourism development. It creates a structured, hierarchical model of relationships among elements. The ISM method supports decision-making by turning complex data into a simpler, more understandable visual representation. This model shows how the elements of island ecotourism interact and provides a categorization for each element. Figure 2 presents the ISM output for key elements of island ecotourism success in the Seribu Islands region.

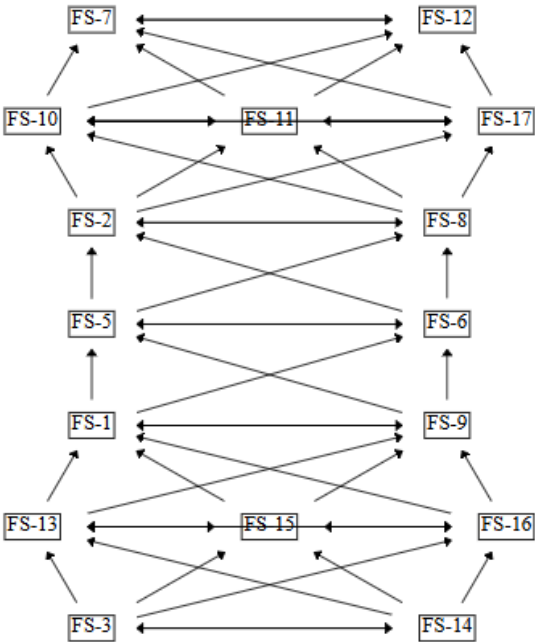


Figure 2. Hierarchical structure of the ISM model

Source: Research data processed with SmartISM application, 2024

As shown in Figure 2, the hierarchical model of island ecotourism success has seven levels, from bottom to top. Level I has two elements: unique local resources (fs-3) and supportive and consistent government policies (fs-14). Level II contains three elements: effective green marketing (fs-13), adequate facilities and infrastructure (fs-15), and high-quality products and services (fs-16). Level III has two elements: stakeholder collaboration (fs-1) and effective natural resource management (fs-9). Level IV also includes two elements: a community-based approach (fs-5) and local community empowerment (fs-6). Level V has two elements: active community involvement (fs-2) and minimizing environmental impacts (fs-8). Level VI includes three elements: supporting and encouraging conservation efforts (fs-10), protecting and promoting

cultural heritage (fs-11), and building environmental awareness and appreciation (fs-17). Level VII contains two elements: creating added economic value for the community (fs-7) and creating unique and memorable experiences (fs-12).

Furthermore, Figure 2 shows that the ISM method organized the elements of island ecotourism success into three levels: the most fundamental, intermediate, and most superficial. Achmad & Ayman (2021) state that fundamental elements occupy the bottom of the hierarchy. These elements have a high impact on the overall system. Key elements are those in the middle, serving as intermediaries connecting lower and higher levels. These influence elements above them and are influenced by those below. Direct elements are at the top and are the most visible in the system. The ISM model in Figure 2 affirms the MICMAC analysis's finding of five critical elements for sustainable island ecotourism success. These are: unique local resources (fs-3), supportive and consistent government policies (fs-14), effective green marketing (fs-13), adequate facilities and infrastructure (fs-15), and high-quality products and services (fs-16). These five are fundamental because they are at the model's base.

DEMATEL Analysis

Sustainable island ecotourism development is complex and involves many interrelated elements. In line with Runtuk (2024), this study applies DEMATEL to analyze cause-and-effect relationships among elements and identify the essential ones. DEMATEL also helps create a visual model of their interdependence. Specifically, DEMATEL helps build a structural model that distinguishes between causal and consequential elements and identifies the most influential. Figure 3 shows the output of the DEMATEL analysis for categorizing the elements influencing sustainable island ecotourism development in the Seribu Islands region.

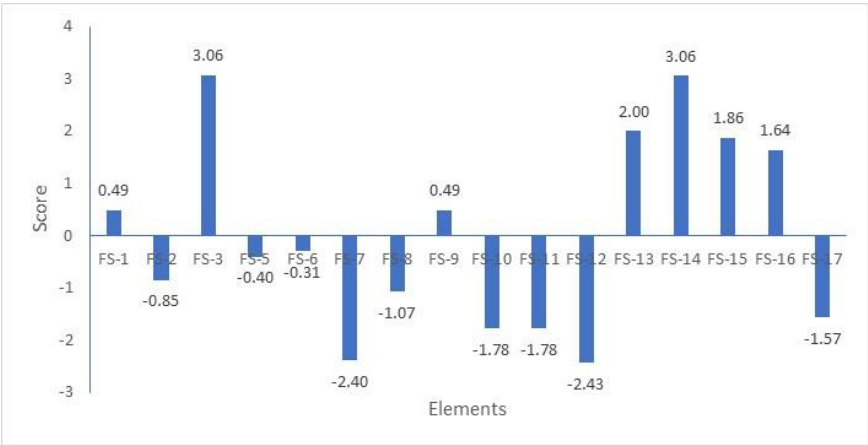


Figure 3. DEMATEL analysis output

Source: Research data processed with DEMATEL application, 2024

Figure 3 shows five causal elements: unique local resources (fs-3), effective green marketing (fs-13), supportive policies (fs-14), adequate facilities (fs-15), high-quality products (fs-16), and building environmental awareness (fs-17). These five are essential for sustainable island ecotourism. This suggests stakeholders should focus on these

elements. DEMATEL findings match MICMAC and ISM, confirming these elements as fundamental, highly influential, and important for achieving sustainable ecotourism. The DEMATEL analysis also provides another output: a cause-and-effect diagram or map. Figure 2 presents a cause-and-effect map for the elements in sustainable island ecotourism development in the Seribu Islands region. As shown in Figure 4, the study found two essential elements with high impact: unique local resources (fs-3) and supportive, consistent government policies (fs-14). Both elements directly affect five others: active community involvement (fs-2), local community empowerment (fs-6), minimizing environmental impacts (fs-8), effective green marketing (fs-13), and adequate facilities and infrastructure (fs-15). These two also indirectly influence the other elements.

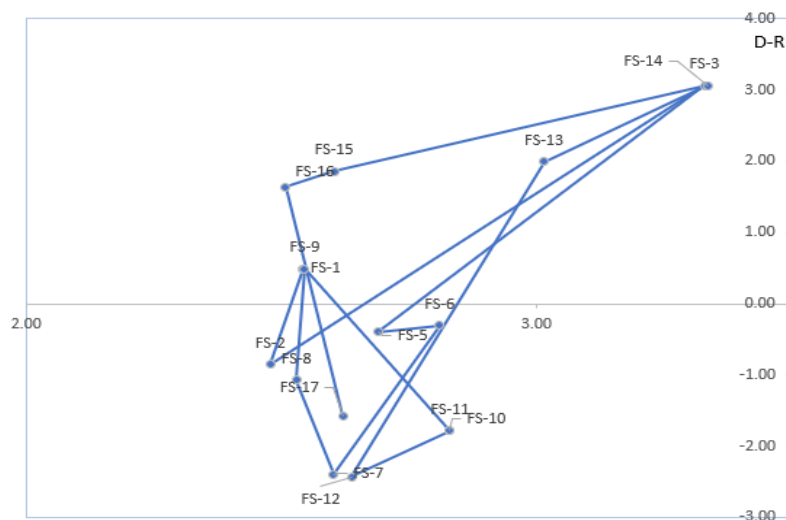


Figure 4. Cause-effect map

Source: Research data processed with DEMATEL application, 2024

CONCLUSION

. This study focused on key elements supporting the success of sustainable island ecotourism. A total of 18 elements were identified from the literature and aligned with the Natural Resource-Based View (NRBV) framework. A two-round Delphi process was conducted to validate the relevance of these elements. The process ensured that the selected elements were applicable to island ecotourism development in the Seribu Islands context. Ultimately, 16 elements were confirmed as valid and relevant.

Subsequently, MICMAC, ISM, and DEMATEL analyses were conducted to examine interrelationships among elements, their driving and dependence power, their classification, and their hierarchical structure. The results confirmed five key elements with the highest impact on sustainable island ecotourism development, namely unique local resources (fs-3), effective green marketing (fs-13), supportive and consistent government policies (fs-14), adequate facilities and infrastructure (fs-15), high-quality products and services (fs-16), and environmental awareness and appreciation (fs-17).

The findings contribute to the literature on sustainable island ecotourism in the Seribu Islands region by identifying elements that support economic growth, natural

resource conservation, social responsibility, and the Sustainable Development Goals (SDGs). In addition, the study maps the interrelationships, critical factors, and hierarchical structure of these elements. The results provide a strategic framework for stakeholders and policymakers in developing sustainable island ecotourism. In practice, the findings highlight that unique local resources, effective green marketing, and consistent government policy support are the most critical factors. Therefore, these elements should be prioritized in policy formulation and development strategies.

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