



Integrated Waste Management in Tourist Destinations: What Is the Role of Stakeholders? (Case Study in Borobudur Temple)

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ABSTRACT

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Borobudur Temple, waste management, stakeholder analysis, tourist destination, Atlas.Ti, probit regression

This research aims to (1) map the waste management issues in the tourist destination case study of Borobudur Temple; (2) analyse the motivation of the community to participate in the management of waste; (3) analyse the role of stakeholders in the success of waste management in the tourist destination. The research method is a mixed method using the Atlas.Ti analysis tool to map the issues in waste management so that they can be structured according to existing conditions, using the probit regression and the matrix of alliances and conflicts tactics, objectives, and recommendations to examine the role of stakeholders in waste management governance. The research results indicate that the government, the community, and the business world have a role in supporting infrastructure in waste management. The following finding is that the factors influencing the community's motivation to engage in waste management are the variables of education, the number of families, the location of residence, and the contribution to waste management funding. Meanwhile, the mactor report shows that the government, through the Regional Development Planning Agency, community efforts, and the business world, has a strong connection in supporting the success of waste management governance.

1. INTRODUCTION

The circular economy is directly related to environmental issues, which are currently significant in sustainable development. Environmental issues are crucial topics in development due to population growth and environmental hazards caused by human socio-economic activities. This problem has many aspects and profound impacts on human life. One ecological problem is waste. Waste is one of the key topics in the SDGs goals, including Goal 6 on waste and wastewater pollution, Goal 11 on urban waste, Goal 12 on sustainable production and consumption (reduce, reuse, recycle), and Goals 14 and 15 on preserving marine and terrestrial ecosystems. The circular economy, a system designed to minimise waste and utilise resources sustainably, is related to a paradigm shift from the linear economic concept. The consumption paradigm that has been "take-make-use-dispose," prevalent throughout the Industrial Revolution and increasingly popular in the global economy, is used in a linear economy. As the linear economy continues to be implemented, social, economic, and environmental considerations become less focused on sustainable development, thus emerging as a circular economy as a solution [1].

Indonesia has adopted the concept of a circular economy in its vision and development strategy, focusing on five priority sectors: (1) sustainable energy development, (2) integrated waste management, (3) green industry development, (4)

sustainable land restoration, and (5) inventory and rehabilitation of coastal and marine ecosystems. This is followed by preparing the National Action Plan (RAN), which positions the circular economy as one of the development priorities, aiming for a Waste-Free Indonesia by 2025. One of the main environmental issues is waste, a global problem that remains unresolved and is becoming increasingly concerning due to the uncontrolled growth of waste [2, 3]. Data shows that each individual produces about 0.5 kg of waste per day, so if there are 1 million residents, they will generate 500 tons. This situation certainly requires handling from the government and participation from all stakeholders, including the community [4]. The World Bank states that the world produces around 2.01 billion tons of solid urban waste yearly. As much as 33% of waste is not managed correctly, negatively impacting the environment. In the same report, the World Bank also projected that global waste will increase by 70% by 2050, reaching 3.40 billion tons annually [5]. This is driven by sufficient urbanisation, population growth, and rapid economic development [6].

Indonesia is the second-largest waste producer in the world after China. Based on data from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry (KLHK), Indonesia generated 35.93 million tons of waste throughout 2022, with 22.45 million tons or 62.49% of it being managed, while 13.47 million tons or 37.51% remain unmanaged [7]. The waste is

classified according to type, as shown in Figure 1.

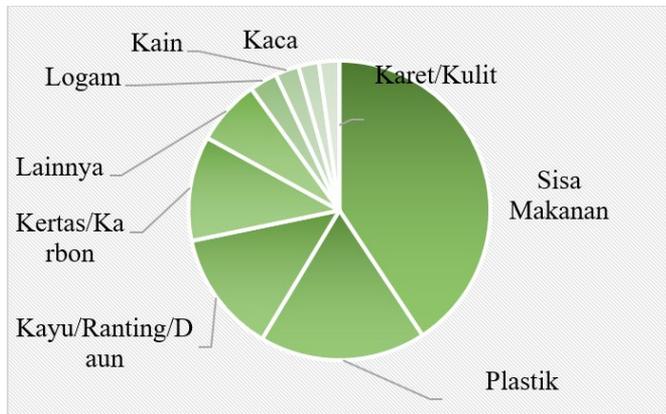


Figure 1. Classification of waste based on the type

The waste management paradigm, traditionally focused on end-of-pipe approaches, has transformed and has been replaced by a new paradigm that views waste as a resource with economic value that can be utilised. Waste management can be carried out with a comprehensive approach starting from upstream, which is from the point when a product that has the potential to become waste is not yet produced, to downstream, which is at the phase when the product has been used and becomes waste that is then safely returned to the environment [8, 9].

Community-Based Integrated Waste Management is an approach to waste management based on the needs and demands of the community, planned, implemented, controlled, and evaluated together with the community. The government and other institutions are motivators and facilitators. The function of a motivator is to encourage the community to think about and seek solutions to the waste problems they face. There are five components in the 5M concept, namely (1) reducing waste, (2) sorting waste, (3) utilising waste, (4) recycling waste, and (5) saving waste. The benefits of the 5M waste management system from an environmental perspective include reducing the amount of waste that needs to be disposed of in landfills, helping to reduce air pollution caused by waste burning, and creating a healthy and clean environment [10].

Over the past decade, tourism has grown massively and become a major contributor to GDP. However, it also generates significant amounts of solid waste, particularly plastic and organic waste. Addressing the waste problem at tourist destinations is crucial. Indonesia's 2,552 tourism destinations require sustainable management and careful top-down and bottom-up planning, making this research urgent. Borobudur Temple, a Super Priority Destination, can serve as a role model for waste management, involving a pentahelix of stakeholders: academia, business actors, the community, government, and the media to support the achievement of sustainable tourism destinations. Waste management at sustainable tourism destinations is crucial, given the growing contribution of the tourism sector, indicating the rapid growth of tourism travel and activities, which is directly related to waste volume and environmental degradation control [3].

The location of this research is the Borobudur Temple and its surroundings, one of the super-priority tourist destinations. Waste management in Borobudur is not yet well managed, as it relies solely on the government, particularly the environmental and parks agency. Therefore, awareness and participation from the community and tourists are still needed

to play an active role. Based on the background mentioned above, the objectives of this research are (1) map the waste management issues in the tourist destination case study of Borobudur Temple; (2) analyse the motivation of the community to participate in the management of waste; (3) analyse the role of stakeholders in the success of waste management in the tourist destination [11, 12].

2. LITERATURE REVIEW

The concept of a circular economy is a framework for utilising resources, waste, emissions, and discarded energy that can be minimised by reducing the production-consumption cycle through systems that extend product lifespan, maintenance design innovation, reuse, remanufacturing, and recycling to transform products back into their original form and recycling them into other products (upcycling). The main goal is to transform the linear economy into a circular economy. Various countries are currently utilising the concept of a circular economy to reduce the potential increase in gas emissions resulting from waste accumulation and other human activities. The main principle of the circular economy is a shift in the perspective of economic sustainability from a linear economy with a take-make-dispose system (take-produce-dispose as waste) to (take-produce-recycle-reuse) so that discarded items do not become waste. Implementing a circular economy system primarily focuses on preventing the excessive consumption of natural resources and optimising energy and materials through recycling, integrating economic agents from the micro level of waste to the macro level in utilising the circular economy system [13-15].

The United Nations Environment Programme (UNEP) and the United Nations World Tourism Organisation (UNWTO) define sustainable tourism as tourism that considers current and future economic, social, and environmental impacts, considering visitors' needs, the industry, the environment, and communities. Sustainable tourism is concerned with managing tourism resources to enable equitable development and protect these resources for future generations. Tourism as an industry has several factors influencing tourism demand, including price, income, socio-cultural aspects, and the socio-political situation. Conversely, supply consists of attractions, natural elements of community life and culture, accessibility related to destination infrastructure, amenities at tourist sites, and tourism support institutions [16, 17].

In developing sustainable tourism, demand and supply must be combined with the willingness to accept and pay. Tourism is a complex system, where the relationships between components, actors, and stakeholders interact non-linearly and are influenced by rapid external changes, including natural disasters, changes in tourist behaviour, technological developments, and others. Tourism has been shown to generate increasing amounts of solid waste. Improper management can cause significant and irreversible direct and indirect environmental, economic, and social impacts. Waste problems at tourist destinations are thought to be caused by (1) a lack of facilities for processing or disposing of waste, (2) variations in waste generated depending on the tourism season, (3) tourist density, (4) limited land for waste disposal, and (5) other waste processing infrastructure. Research on sustainable waste management at tourist destinations is increasingly important because tourism generates large amounts of waste

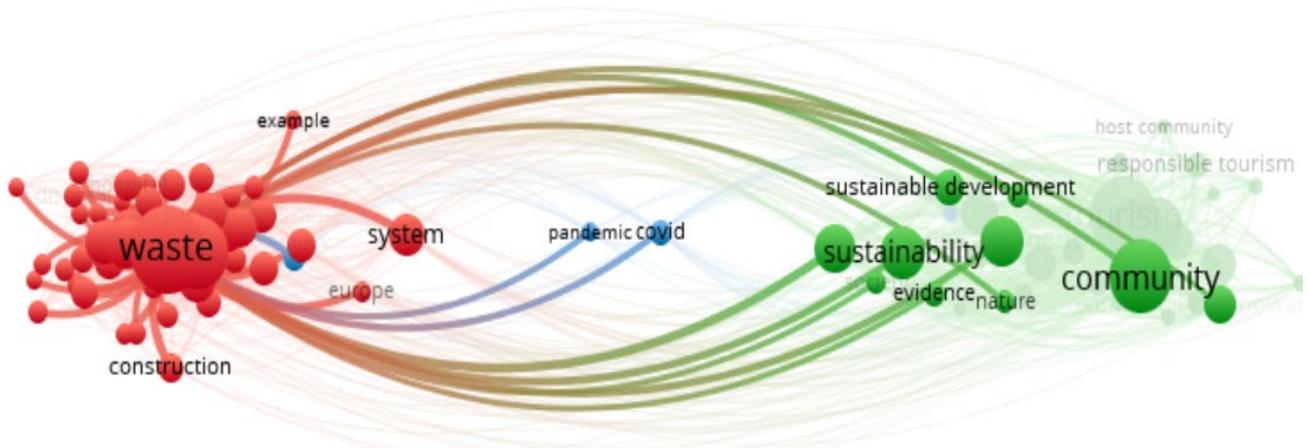
that damage the environment.

The originality and novelty of this research can be

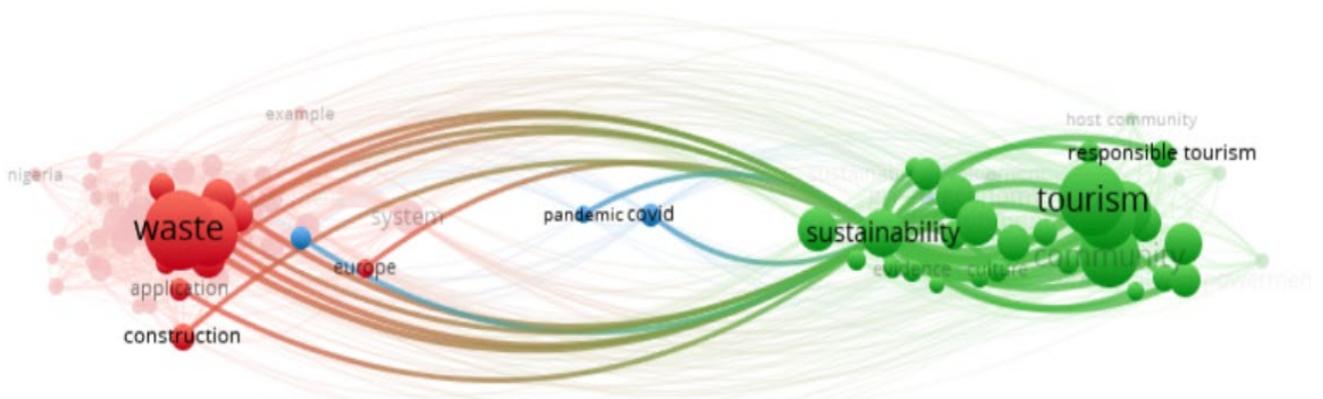
demonstrated by using the VosViewer tool and obtaining the results as shown in the following image [18-20].



(a) Research on the relationship between tourism and sustainability



(b) Research on the relationship between waste and environmental sustainability



(c) The relationship between waste management research and sustainable tourism

Figure 2. Research on the relationship between tourism, waste, and environmental sustainability

Figure 2 describes that research on the relationship between tourism and sustainability has been extensively conducted, as has waste management and sustainability research. However, research specifically and continuous discussion of the relationship between the circular economy, waste management, and sustainable tourism is minimal. Therefore, research on implementing a circular economy through a Waste Management Model in Sustainable Tourism Destinations is still rare and original, and will be new in this research. Another novelty in the research subject accommodates a combination of bottom-up, namely business actors, communities, and

tourism actors, with top-down, namely implemented government policies and programs, so that the formulation of the model that is the main objective of this research can be realised and implemented. This research uses the scope of Borobudur Temple, which has the highest number of visitors (foreign and domestic tourists) in Central Java. Borobudur Temple has advantages including: (1) As a cultural heritage that UNESCO has designated; (2) As one of the super priority destinations; (3) Has high cultural, social, and philosophical value, as well as wisdom; (4) has many supporting tourist destinations, both natural, cultural, and artificial heritage [21-

23].

Community participation can be categorised into two groups: direct and indirect. Direct participation includes reducing the use of non-biodegradable materials, sorting waste, transferring waste from the source to temporary storage, recycling waste, and cleanliness activities such as community service in the neighbourhood. Indirect participation can take the form of paying waste fees, attending workshops/training on waste management, and providing suggestions/feedback to the neighbourhood association regarding the community waste management system [24].

The participation of the community in waste management is closely related to individual characteristics and the influence of the individual's external environment. Several factors that influence community participation in waste management include 1) education level; 2) knowledge about waste management, which affects community participation in managing waste; 3) the community's perception of a healthy and clean environment, which influences their participation in maintaining cleanliness from waste, and 4) income, which is indirectly related to community participation in waste management [25].

3. RESEARCH METHODOLOGY

This research method is a sequential mixed method, which involves using qualitative and quantitative analysis tools conducted in succession to provide arguments using analytical tools. The first objective of this research is to map the waste management issues in the Borobudur Temple, which will be analysed using Atlas.Ti. In general, Atlas.Ti is valuable software for creating initial reflections, ideas, and knowledge constructions from the beginning of data exploration, mainly qualitative data, by coding, organising data, and facilitating sorting to support the analysis process in an organised, systematic, effective, and efficient manner in research. The second objective is to analyse the factors that influence the community around the Borobudur Temple's motivation for waste management participation, which will be analysed using probit regression analysis with the following model:

$$Y_i = \alpha_0 + \beta_1 dgeo_i + \beta_2 age_i + \beta_3 edu_i + \beta_4 inc_i + \beta_5 famnumber_i + \beta_6 contri_i + e_i$$

Probit analysis was chosen as the model because it is explicitly based on the concept of continuous latent variables that are not directly observed. Still, influence observed binary outcomes, meaning that binary decisions are manifestations of continuous psychological, economic, or social processes.

In this study, the questionnaire representing variable Y consists of 10 questions, which are then calculated as percentages based on responses of yes or no. The use of probit ensures that each question serves as an indicator of variable Y, where Y is the probability of community participation obtained using several questions to determine the extent of the sample's role in waste management. The questions are arranged as follows: (1) Do you participate in the Community Self-Help Group for waste management? (Yes/No), (2) Do you contribute to the waste management fees? (Yes/No), (3) Do you sort waste at home (organic, plastic, paper)? (Yes/No), (4) Have you ever received training in managing organic/plastic/paper waste? (Yes/No), (5) Do you have a waste disposal/incineration site? (Yes/No), (6) Have you ever

received socialisation on waste management? (Yes/No), (7) Are you familiar with Reuse, Reduce, and Recycle? (Yes/No), (8) Have you ever implemented those concepts? (Yes/No), (9) Have you ever engaged in waste transactions (selling to scavengers)? (Yes/No), (10) Are you aware of any waste management regulations? (Yes/No).

If the answer is yes, it will receive 1 point (10%); if not, it will receive a score of 0. Another variables are: *dgeo* is the location of the respondent's residence is a dummy variable that consists of with d_1 is area around the Borobudur and d_0 is supporting area, *age* the age of the respondent. *edu* is the education level completed by the respondent with calculated in years of successful completion, *inc* is income, which means the total family income of the respondent, *famnumber* is the number of family dependents, and *contri* is contribution means the amount of waste fee paid by the respondent. The sampling technique used is stratified random sampling, where areas are divided into around and supporting areas, and 100 respondents are randomly selected.

The third objective is to analyse the role of stakeholders in the success of waste management, which is analysed using MACTOR (Matrix of Alliances and Conflicts Tactics, Objectives, and Recommendations) based on the influence among actors, dependencies among actors, and the actors' opinions regarding the objectives, differentiated as a direct influence, indirect influence, and potential influence. The mactor results consist of: (a) a map of influence and dependency among actors that will support the position of actors in the design, planning, implementation, and Evaluation of an activity; based on the strength of their influence, actors are categorised into dominant actors (high influence), dominated actors (high dependency), isolated actors (low influence and dependency), and relay actors (high influence and dependency); (b) a map of competitive power of actors that illustrates the intensity of an actor's influence over other actors determined by direct influence, direct dependency, indirect influence, and indirect dependency. The competitive power map also indicates the willingness of actors to use their power to control other actors; (c) The convergence analysis of actors illustrates the similarities in their attitudes towards the objectives [14, 26, 27].

Actors with similar attitudes will converge, while those with different ones will diverge. Convergence analysis is intended to identify potential alliance points among actors. A convergence map can be used to determine which actors can collaborate to avoid the possibility of conflict, and the latest analysis regarding the relationship of each actor to the objectives. The relationship between an actor and their goals is important because it indicates which goals the actor is focused on, thus showing their willingness to use their power to achieve those goals. Seventeen actors involved in waste management governance are as follows: (1) Regional Development Planning Agency (Bappeda); (2) Environmental Agency (DLH); (3) Public Works Agency (DPU); (4) Housing and Settlement Area Agency (Disperkim); (5) PT. Solusi Bangun Indonesia (PT SBI); (6) Village Apparatus; (7) Village-Owned Enterprises (BUMDes); (8) Community Leaders; (9) Community Group Managing Integrated Waste Disposal Site (Comm_TPST); (10) Community Group Managing Recycling Center (Comm_PDU); (11) Community Group without TPS3R/TPST/PDU facilities; (12) Waste Bank Manager; (13) Nongovernment organisation/NGO; (14) Borobudur Authority Implementing Agency; (15) Business actors; (16) Cooperatives; (17) entrepreneurs (PT BIMA).

The objectives consist of nine points, namely: (1) Waste is the concern of all stakeholders, (2) The role of the community in three aspects: waste reduction, waste sorting, and waste management, (3) The community must contribute to waste management by paying fees, (4) The government must allocate a minimum of 1% of the regional budget for waste management, (5) Regulations to limit the use of plastic packaging in retail stores and markets, (6) The government should have a platform for household waste management, (7) The socialisation of the 3 R is necessary, (8) The government organises training on the 3Rs, (9) The government holds exhibitions of the results of the 3 R processing periodically.

4. RESULT AND DISCUSSION

Waste management initially followed a collect-transport-dispose pattern. However, with the growing understanding of the circular economy, the model has shifted to the application of reduction, reuse, and recycling that involves the community [28]. Hopefully, it will change perspectives and treat waste as an alternative resource that can be reused as much as possible,

whether directly, through recycling processes, or other methods. The stages of waste management, namely sorting, collection, transportation, processing, and final disposal, are carried out gradually and planned based on clear policies and strategies. Waste management, especially household waste, requires the involvement of all stakeholders, including the Government, Business Actors, the Community, Academics, and the Media, commonly referred to as Pentahelix. One of the creative ideas from the community is waste management through a waste bank, a concept for collecting and sorting dry waste [29-31]. It is managed like a bank, but instead of depositing money, people deposit waste. The waste sent by the community will be processed into several types: (a) directly sold to factories for recycling, (b) made into crafts with practical creativity, and (c) sold directly to those in need.

The waste issue is very complex, starting from the source, which is waste-generating units, especially households, and the waste management process, until the waste is finally turned into products with economic value. The literature review results, in-depth interviews, and focus group discussions were processed using Atlas.Ti, and the findings are as shown in the following Figure 3 [32].

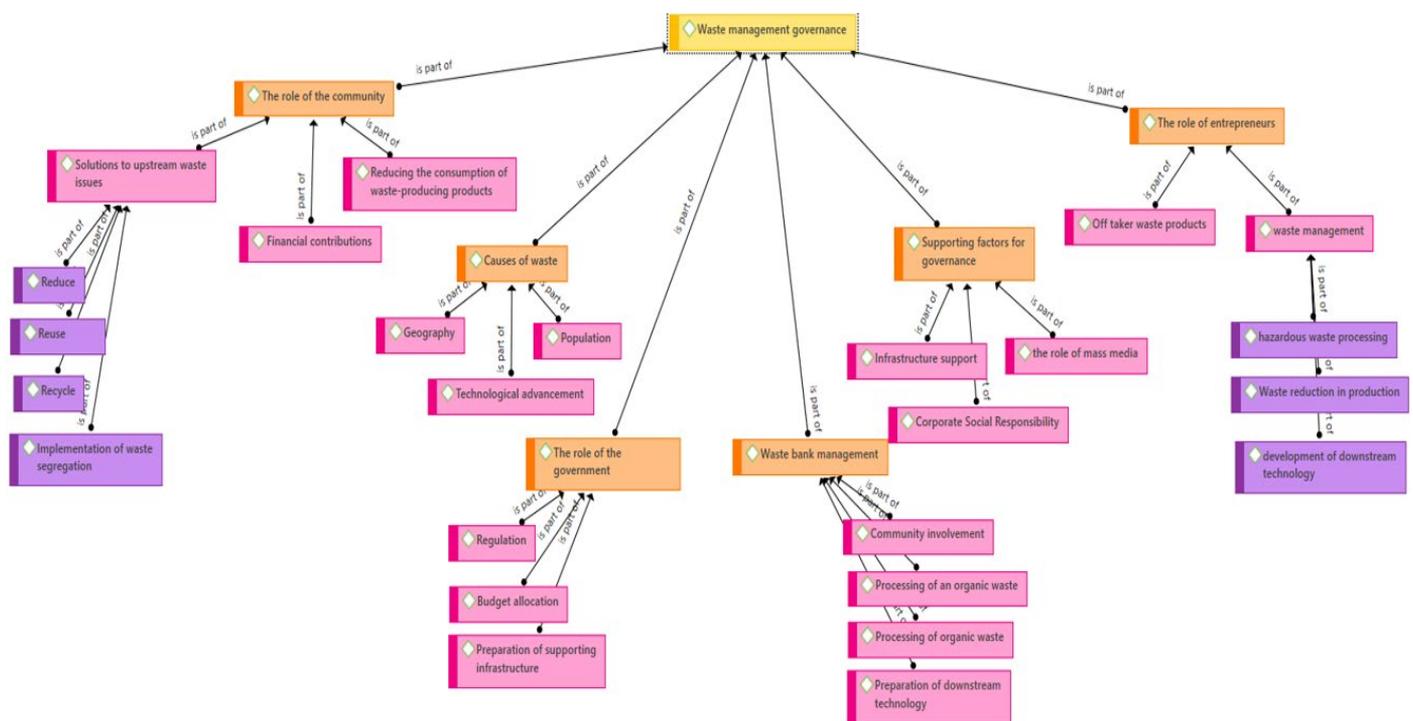


Figure 3. Identification of issues and support for waste management governance using Atlas.Ti

The image shows that the main factors contributing to the increase in waste generation include the rising population, which drives up consumption, indicating an increase in household waste. Geographic factors indicate reduced waste in rural areas where waste is managed independently through burning or landfilling. In contrast, urban areas create more problems due to more limited space. The third factor is that technological advancement has positive and negative impacts on waste management. Environmentally friendly technology will reduce waste; however, on the contrary, using technology can result in wastefulness and a significant increase in waste, potentially exacerbating the waste problem [33].

Governance requires the roles of each stakeholder, which consist of: (1) The role of the government, which includes (a) the creation of regulations or the drafting of laws as guidelines

in the management and processing of waste, particularly household waste and environmental protection; (b) the allocation of budgets to support waste management; (c) the preparation of supporting infrastructure, including physical construction such as the development of landfills, waste management facilities, and others, as well as the development of waste management institutions and the establishment of networks to ensure effective governance.

(2) The role of the community, with key responsibilities including (a) contributing solutions to upstream waste issues, which encompass (i) the implementation of waste segregation; (ii) reuse of items or non-single-use products; (iii) reduction of the use of waste-producing items, especially plastics that are difficult to decompose; (iv) recycling waste for reuse; (b) reducing the consumption of waste-generating goods; and (c)

contributing funds or fees to achieve a clean environment [34].

(3) The role of business actors, which includes (a) collectors of processed waste (off-takers) and (b) management of business waste, including (i) processing hazardous waste before disposal to prevent environmental poisoning; (ii) reducing production waste; (iii) developing downstream technology.

Supporting factors for success in waste management include (a) good infrastructure support provided by both the government and the community, (b) the provision of corporate social responsibility in waste management, and (c) the enhancement of the media's role in supporting socialisation and providing information on how to manage waste and engage in circular economy activities. The last Identification

is the role of the community in the form of waste bank management, which consists of four leading roles: (a) Preparation of downstream technology, (b) processing of organic waste, (c) processing of inorganic waste, and (d) community involvement. Waste banks are important in reducing waste and creating a clean environment. Nationally, the number of waste banks in Indonesia is 27,631 units. The weaknesses of waste banks that prevent them from operating optimally are particularly in communication among stakeholders, including community participation. Although stakeholders and implementing agents have understood the intentions and objectives of the waste bank program, socialisation in the community is still considered suboptimal [3, 24].

Table 1. Results of the regression on community motivation in waste management

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	0.347198	0.135980	2.553303	0.0124
Age	-0.000774	0.002016	-0.383911	0.7020
Income	-2.41E-09	1.42E-08	-0.170469	0.8650
Education	0.016955	0.007933	2.137396	0.0353
Number of families	0.030329	0.015071	2.012419	0.0472
Location	0.113314	0.054443	2.081325	0.0403
Contribution	-4.37E-06	1.67E-06	-2.615846	0.0105
R-squared		0.168771		
Adjusted R-squared		0.112096		

Table 1 shows that the six variables collectively impact community participation in waste management through the 3Rs. This is indicated by the F test probability within the α 5% range. Meanwhile, 5 (five) variables have a significant partial effect: (1) the constant has a positive and significant effect, (2) education has a positive and significant effect, (3) family burden has a positive and significant effect, (4) location has a positive and significant effect, and (5) contributions have a negative and significant effect. The variables that are not significant are age and income [35].

The age variable does not have a significant effect because individuals from different age groups can have relatively similar perceptions if they are exposed to the same information, live in the same social environment, and experience the same waste management system.

Income does not have a significant effect because waste management is categorized as a public or quasi-public good, whose benefits and impacts are felt collectively by the entire community regardless of income level. Because waste management services are non-exclusive and applied uniformly within a region, individual economic capacity (income) has no effect.

The detailed results of the data processing are as follows: (1) The education variable has an impact on awareness in waste management, with a coefficient value of 0.016955, meaning that if a respondent's education level increases by one year, their awareness in waste management will increase by 0.0169 points. Based on the results of in-depth interviews, it was found that education influences motivation and leads to a higher level of awareness in terms/participation for waste management compared to those with lower education levels. (2) The number of family dependents affects waste management awareness, with a coefficient of 0.0303. This means that if the number of dependents in a family increases by one person, the awareness of waste management in households will increase by 0.0303 points.

The amount of waste an individual generates per day is 0.5

kg, so the more dependents in a family, the more waste will be produced by the household. The amount of waste generated increases proportionately to the number of family members, which is why community participation in waste management is significant and positive. (3) The location variable is a dummy that compares two areas: the support and the surrounding areas. The results show that it is insignificant, meaning there is a difference in community participation in waste management with a positive value, indicating that the location variable influences waste management awareness; areas with a greater awareness of household waste management than support areas. Based on in-depth interviews and focus group discussions, it was found that the government and urban communities are committed to waste management, with the government providing attention in the form of socialisation, literacy, and institutional support such as regulations, infrastructure, and financing. An important commitment because it will encourage the community to actively participate in waste management, especially with the 3 R model. (4) The variable of community funding contributions has a significant and negative coefficient, meaning that the higher the fees, the lower the participation in awareness of waste management at the household level. The coefficient is 0.0437, which means that if the cost increases by 10,000 IDR, households' awareness of independent waste management will decrease by 0.437 points. This happens because households paying the fees feel less responsible for waste issues. Communities that pay waste management fees tend to exhibit lower levels of active concern and engagement in waste management. This pattern can be partially explained by a shift in perceived responsibility from the collective community to service providers, including local governments, sanitation workers, and third-party contractors. From the perspective of role theory, residents increasingly position themselves as consumers of public services rather than as co-producers of waste management outcomes. This role redefinition weakens their sense of ownership and collective

responsibility for waste-related problems.

Research findings indicate that several factors influence the quality of waste management services provided by the government, such as the lack of government policies/strategies and their coordination, financial support, low participation from the private sector, inefficiency, and low public awareness. Community participation is recognised as a factor contributing to the success of waste management. Community participation in waste management is crucial to the success of the services [36, 37].

The low R-square indicates that the variables analyzed explain only a small portion of the variation in social

phenomena. The implication is that public policy, primarily environmental, social, or economic policy, must be designed to be multidimensional and cross-sectoral. Therefore, macro analysis is needed, which is why this study also uses a third analysis, namely mactor.

The third objective is to analyse stakeholders' role in the success of waste management in the Borobudur Temple using the mactor method. The relationship map, which illustrates influence and dependence, shows the position of each actor regarding the values chosen for each objective. The processed data from the sources resulted in a relationship map in four quadrants as follows:

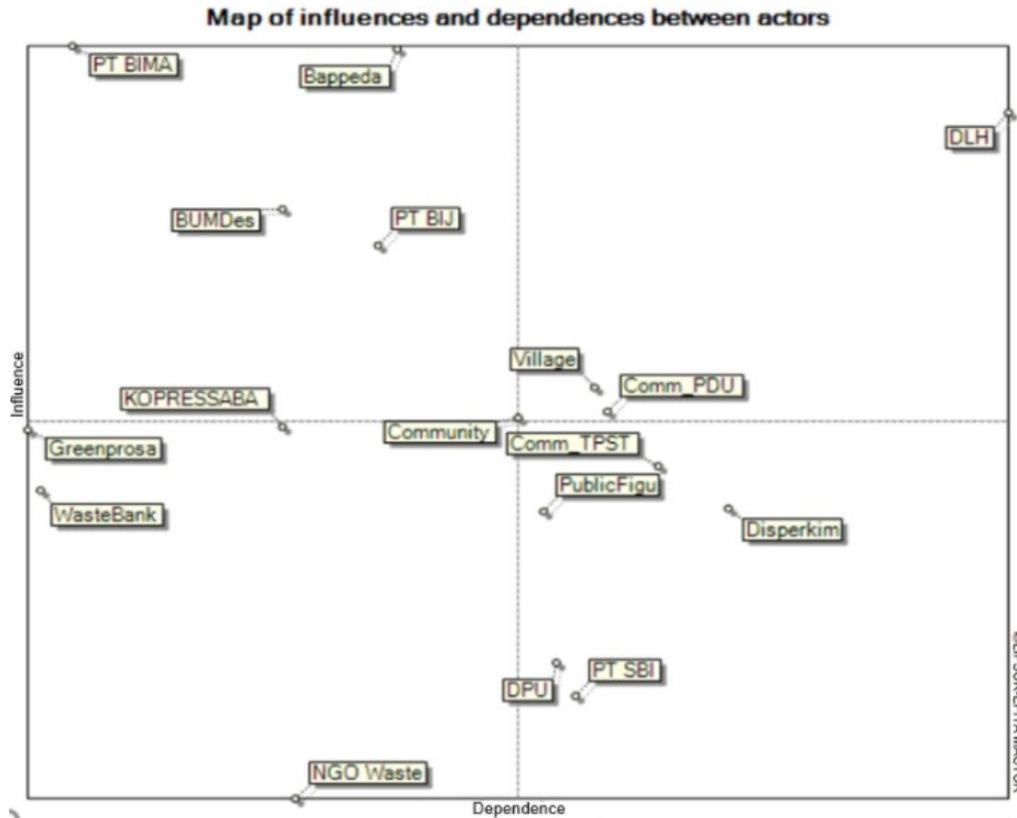


Figure 4. Stakeholder quadrants in waste governance in Borobudur Temple

The first quadrant in Figure 4 consists of actors with high influence and low dependence. This quadrant shows actors who possess independence; their activities are not dependent on other actors and even influence other actors. Therefore, actors in this position have the potential to support the establishment of regulations and policies, particularly in the success of waste management governance, namely PT Bima, Borobudur Authority Implementing Agency, BUMDes, and Bappeda. The second quadrant consists of actors with high influence and high dependence. This quadrant shows actors with high influence in implementing sustainable tourism development. Still, they cannot stand alone due to their high dependency on other actors, especially those with similar goals (Third Order). Actors in this quadrant collaborate and have a common thread indicated by relationships of dependence and mutual influence. The third quadrant is the Actors; in this quadrant, the actors have the potential to become executors or implementers in waste management governance, where the executors carry out the programs that regulators have prepared.

The actors/participants in this quadrant consist of the Environmental and Cleanliness Agency, the village

government, and the community management group (KSM). These actors have low influence and high dependency. This quadrant shows the actors who are implementers in the success of waste management tools, namely the Public Works Department (DPU), PT SBI, the Department of Housing and Settlement (Dinperkim), community leaders, and the Waste Management Technical Implementation Unit (KSM). The fourth quadrant consists of actors with low influence and low dependence. This quadrant shows actors that serve as a supporting system but do not have direct involvement in the success of waste management governance, namely Greenprosa, Waste Banks, Non-Governmental Organizations (NGOs) in the waste sector, Cooperation, and communities without facilities such as Final Disposal Sites (TPU), Temporary Waste Collection Points (TPS3R), or Integrated Waste Treatment Sites (TPST) [38].

5. CONCLUSION

Waste management requires the role of each stakeholder as follows: the government acts as the driving force behind

governance activities, while the community participates in supporting the reduction of waste production from the source by implementing reduction, reusing, recycling, reducing consumption, and contributing to waste funds to achieve a clean environment. Community empowerment through the management of waste banks consists of four leading roles: (a) preparation of downstream technology, (b) processing of organic waste, (c) processing of inorganic waste, and (d) community involvement. Waste banks are important in reducing waste and creating a clean environment. All of variables simultaneous impact community participation in waste management through the 3Rs, Meanwhile, 5 (five) variables have a significant partial effect namely the constant has a positive and significant effect, education has a positive and significant effect, family burden has a positive and significant effect, location has a positive and significant effect, and contributions have a negative and significant effect. The variables that are not significant are age and income. The Operator plays a role in two activities: (i) off-taker waste management and (ii) business waste management, especially hazardous waste treatment before disposal so that it does not poison the environment, production waste reduction, and the development of appropriate technology in waste management. Other supporting factors consist of (a) infrastructure support provided by both the central government and community empowerment, (b) the provision of corporate social responsibility in waste management, and (c) the increased role of media that supports socialisation and provides information on how to manage waste and engage in circular economy activities.

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