

Communication Model in Regional-Based Sustainable Waste Management from a Public Health Perspective

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Article History

Submit: 24 December 2025

Accept: 29 December 2025

Abstract

The gap between the amount of waste input and waste management capacity in a region raises the risk of pollution and impacts public health. The circular economy concept is one of the main strategies in sustainable waste management. This study aims to evaluate and explore waste management actions that have been implemented in the Sumedang region, especially in the Jatinangor area. The study aims to obtain a conceptual model related to communication efforts in waste management that prioritizes sustainable principles while considering the social characteristics of the community in a region or area. This study uses a mixed methods design with a qualitative approach complemented by a quantitative approach within a participatory case study framework. The results of this study indicate that changes in community behavior in waste management can be analyzed by three main factors : attitudes, subjective norms, and perceived behavioral control which are reinforced by perceptions of risks and benefits. Regional social factors such as trust between residents, the influence of local figures, and informal communication shape collective norms through the process of constructing everyday social reality, which ultimately encourages the growth of a circular economy based on participation and adaptive partnerships at the village level. The resulting communication model in waste management demonstrates that waste management at the village level is not merely a technical process, but a social process formed through the construction of meaning, risk perception, and interactions between actors in a regional context. The novelty of this model lies in its holistic and transdisciplinary approach, which combines the dimensions of individual behavior, social networks, and social realities that are continuously negotiated in daily practice.

Keywords: waste management, health communication strategy, sustainability.

Introduction

Waste management is a major problem faced by many regions, including developing countries such as Indonesia (Addahlawi et al., 2020). This problem is driven by weak waste management behavior (Marlina, 2020), limited policy support (Maskun et al., 2022), weak social institutions (Napitupulu & Muhyidin, 2021), and inadequate infrastructure and processing capacity (Muksin & Engkus, 2020). Waste generation as a byproduct of human production and consumption often exceeds processing capacity, resulting in environmental pollution (Nanda et al., 2022) and public health impacts (Trisakti et al., 2020).

Efforts to improve waste management that prioritize environmental quality and community welfare are aligned with the Sustainable Development Goals (SDGs), which emphasize sustainable principles in policy and community action (Khairina et al., 2020). One widely adopted approach is the 3R model (Reduce, Reuse, Recycle) within the circular economy framework (Purwanti, 2021). This model emphasizes behavioral change at the actor level and requires comprehensive governance support, including infrastructure and appropriate policies.

In Indonesia, the government has encouraged behavioral change through the development of 3R Temporary Disposal Sites (TPS3R). However, this effort has not been accompanied by significant changes in waste disposal behavior at the household or community levels (Ayu et al., 2023). This condition is increasingly critical given the ongoing moratorium on Final Disposal Sites (TPA), which potentially exacerbates waste accumulation and its environmental and social impacts. Consequently, strengthening communication strategies to promote behavioral change in waste management becomes essential.

These challenges are more pronounced in areas with dynamic socio-regional characteristics, such as suburban regions characterized by high population mobility, diverse economic activities, and social change (Ginting et al., 2022). The Jatinangor–Sumedang area exemplifies this condition. Although designated as an urban area, it retains rural characteristics, particularly in residential zones. Economic activities supported by educational institutions have increased MSME retail activities and residential rentals, resulting in high waste generation from daily consumption and production activities.

Sayang Village, one of the suburban areas supporting Jatinangor, consists of 13 community units with a population of 6,437 people. The village generates approximately 932.5 kilograms of waste per day, which exceeds its processing capacity, while waste generation in the wider Jatinangor area reaches 14.8 tons per day (Hayyi et al., 2023). Key waste management problems identified in the village

include high migrant population activity, limited community involvement, inadequate infrastructure support, low awareness and knowledge, and suboptimal communication patterns and policy implementation. These issues are commonly found in regions with similar characteristics in Indonesia and other developing countries (Ayu et al., 2023).

Literature Review

Within the circular economy framework, a sustainable approach involves performance drivers and enablers embedded in actors, policies, and processes, and requires participatory stakeholder involvement (Maskun et al., 2022). Behavioral change is closely related to social processes and knowledge construction through daily experiences (Khairina et al., 2020). Communication plays a central role in transforming individual knowledge into collective practice through the stages of social reality construction: externalization, objectivation, and internalization (Ginting et al., 2022).

At the individual level, behavioral change can be explained through the Theory of Planned Behavior (TPB), which emphasizes the role of attitudes, intentions, and perceived behavioral control in shaping behavior (Muksin & Engkus, 2020). This concept highlights that behavioral change is influenced not only by social pressure but also by internal motivation and belief in one's ability to act (Purwanti, 2021). Complementarily, the Health Belief Model (HBM) explains behavior based on perceived consequences, benefits, incentives, and self-efficacy, which aligns with subjective norms in TPB (Rahmawati & Syamsu, 2021). Based on these perspectives, this study examines additional aspects of behavioral change, including descriptive norms, collective efficacy, incentives, social institutional facilitation, and socio-cultural characteristics. This research focuses on evaluating waste management efforts in Sayang Village, particularly communication strategies, using a qualitative case study approach. The study aims to develop a communication model that supports sustainable waste management by considering local social characteristics. Given the limited number of studies integrating behavioral, process, and policy aspects within specific socio-regional contexts, this research is expected to complement existing circular economy-based waste management studies and contribute to sustainable development, public health improvement, environmental conservation, and community welfare.

Method

This study examines communication patterns in waste management in Sayang Village, Jatinangor–Sumedang, using a mixed methods design that integrates qualitative and quantitative approaches. A case study method was employed to enable contextual analysis of cross-actor communication dynamics and factors influencing communication effectiveness in sustainable waste management (Yin, 2017). This

approach facilitates the identification of communication structures, actor positions, and information flows within both formal and informal social and organizational contexts (Wasserman & Faust, 1994). The research is grounded in a conceptual framework encompassing three dimensions of the circular economy: actors, policies, and processes (Choerudin, 2020). This framework integrates the Theory of Planned Behavior (TPB), the Health Belief Model (HBM), and the institutional process of externalization–objectivation–internalization in the construction of social reality (Berger & Luckmann, 2016). The concept of circular economy maturity—performance drivers and performance enablers—was also applied to identify individual and collective communication patterns relevant to sustainable waste management (Uhrenholt et al., 2022).

The research phase begins with data collection using a mixed methods triangulation model: (i) qualitative data collection through in-depth interviews, and (ii) quantitative data collection through questionnaires and analysis using descriptive statistical methods. All data will be compiled, analyzed, and constructed into a communication model that describes the problem and the intended solution. The research stages were designed to produce recommendations for communication models relevant to the socio-regional characteristics of the study area. The resulting model was reflected upon through discussions with informants to ensure confirmation and validation, and is expected to be replicable in regions with similar characteristics.

The research involved key informants representing waste-conscious communities, youth groups, village social institutions, and community members actively involved in waste management in Sayang Village. Expert informants included circular economy experts, representatives of government agencies related to waste management, and private waste management institutions in the Sumedang area. Informants were selected using purposive sampling based on their involvement in waste management activities.



Figure 1. Jatiningor Educational Area

The object of the research was communication strategies and governance in waste management in Sayang Village, including cross-actor communication strategies, cross-sector governance, and inter-actor communication patterns. The research location was Sayang Village, Jatiningor–Sumedang, an area characterized by a combination of rural, suburban, and urban features with relatively high waste output. Administratively, Sayang Village covers an area of 2.32 km² with a population of more than 9,480 people (2024), divided into three hamlets, 48 neighborhood units (RT), and 13 community units (RW). The village supports the Jatiningor educational area and hosts diverse economic activities that contribute to household and production-based waste generation.

The picture related to economic activity, both on the consumption and production side, is also related to the waste output produced in this region. Some related data are as follows: the average amount of household waste produced per day reaches approximately 1.17 tons, with a composition of 64.3% organic waste, 26.1% inorganic, and 9.6% residue. Approximately 68.4% of households have not yet sorted waste at the source, while another 31.6% have begun sorting, although not consistently. This village already has a waste awareness community and has initiated and implemented waste management, both in collaboration with educational institutions in the Jatiningor area and with waste management technology applicators (Susilawati et al., 2019). This collaboration includes community education, the establishment of a waste bank, and testing small-scale composting technology for densely populated areas.

Table 1. Waste Management Statistics Table in Sayang Village, Jatinangor (Susilawati et al., 2019)

No.	Indicator	Quantity	Remark
1	Average daily waste generation	±1,17 tons/day	Accumulation of households
2	Composition of organic waste	64,3%	The majority comes from food and garden waste.
3	Composition of inorganic waste	26,1%	Plastic, paper, light metal
4	Composition of residual waste	9,6%	Diapers, multilayer packaging, etc.
5	Percentage of households that do not sort waste	68,4%	Still mixing all types of waste
6	Percentage of households that have started sorting	31,6%	Generally in RW (citizens association) that have received environmental education
7	Number of active waste care communities	1 community	Focus on education, waste banks, and compost processing
8	Collaborative partners	3 institution	Two from universities, one from a composting technology provider

Participation and Samples

Participants were selected using purposive sampling to include individuals with direct involvement in waste management communication and strategies. A total of 12 participants were interviewed, consisting of residents, local government representatives, academics, and private sector actors.

Table 2. Demographic Thematic Analysis

Category	Sub-Category	Number	Description
Gender	Male	18	Includes residents, community leaders, village officials, and academics
	Female	22	Majority are members of waste-conscious communities and community facilitators
Residential Status	Local residents	27	Have resided in the area for more than 10 years
	Migrant residents	13	Generally have resided for 3–10 years; some work or study in Jatinangor
Participant Group	General community	12	Includes both local and migrant residents
	Waste-conscious community	10	Actively involved in waste education and waste management practices
	Community leaders	5	Heads of neighborhood units (RW), religious

			leaders, or informal leaders actively engaged in community affairs
	Community facilitators	4	Responsible for facilitating outreach activities and providing technical guidance on waste management
	Village government officials	3	Village administrative officials responsible for environmental and sanitation affairs
	Relevant government agency officials	2	Officials from environmental-related agencies at the district (regency) level
	Academics	2	Researchers and lecturers involved in collaborative programs or community service activities
	Private sector	2	Representatives of companies partnering with the village in waste management
Length of Residence (Residents Only)	< 5 tahun	6	Generally migrant residents from outside Sumedang
	5–10 tahun	7	Includes migrant residents who have begun to actively participate in environmental activities
	> 10 tahun	20	Predominantly local residents and some community leaders
Education Level	Elementary–Junior High School	10	Generally local residents and community facilitators
	Senior High School / Vocational School	18	Includes community members and the general public
	Diploma–Bachelor's Degree	10	Village officials, community leaders, and community members
	Master's Degree and above	2	Academics and government agency officials

Total of 12 participants were interviewed in this study, with details of 7 residents, 3 local government representatives, 1 academic, and 1 private party. To complete the data quantitatively, the researcher collected data using a probability sampling technique with a stratified random sampling approach, through a questionnaire with a sample size of 99 respondents.

Access and Building Rapport

Access to informants was established over approximately three months through a community service approach focused on strengthening waste management in the Jatinangor area. Established relationships with community leaders, village officials, academics, private partners, and local government agencies facilitated interviews and participatory observations during ongoing community activities.

Data Collection Techniques

Data collection included in-depth interviews, focused interviews with key stakeholders, participant observation of communication interactions, and questionnaire distribution to residents. These techniques were integrated to capture both behavioral patterns and communication dynamics in waste management.

Data Analysis

Qualitative data were analyzed using thematic analysis (Braun & Clarke, 2006), supported by NVivo software for systematic coding and visualization. Quantitative data were processed using descriptive statistics with SPSS to complement qualitative findings. Data triangulation was applied through interviews, observations, and statistical analysis to ensure validity, and initial findings were reconfirmed with participants using member-checking techniques (Lincoln & Guba, 1985).

Results

Residents' waste management behavior shows positive development but remains constrained by structural and cultural challenges. Using the Theory of Planned Behavior (TPB), these dynamics are shaped by attitudes, subjective norms, and perceived behavioral control, which interact to form behavioral intentions and actual practices.

Perceived behavioral control remains uneven. Mr. D (27) pointed out that despite awareness of 3R practices, many residents perceive waste sorting as complicated. This indicates that limited skills, habits, and facilities constrain behavior, even when intentions exist. External control, such as reminders and regulations from village authorities (Mr. HS) and operational support at waste processing sites (TPS), helps reduce these barriers, although dependence on external assistance remains a challenge (Mr. Y). Private-sector collaboration, as described by Mr. MN, further strengthens behavioral consistency through incentives and coordinated systems. From the Health Belief Model (HBM) perspective, residents demonstrate awareness of environmental and health risks, perceive benefits from waste management, but also experience barriers related to complexity and time. Cues to action—such as collective activities and social invitations—reinforce self-efficacy, especially when supported by facilities and social encouragement.

The Social Construction of Reality framework explains how waste management practices evolve from individual actions (externalization), become institutionalized through facilities and regulations (objectivation), and are eventually internalized as collective norms. Integration of TPB, HBM, and social construction confirms that behavioral change results from interacting psychological, social, and institutional factors rather than a single determinant.

The thematic analysis table serving as the basis for the above analysis is presented as follows:

Table 3. Participation & Samples

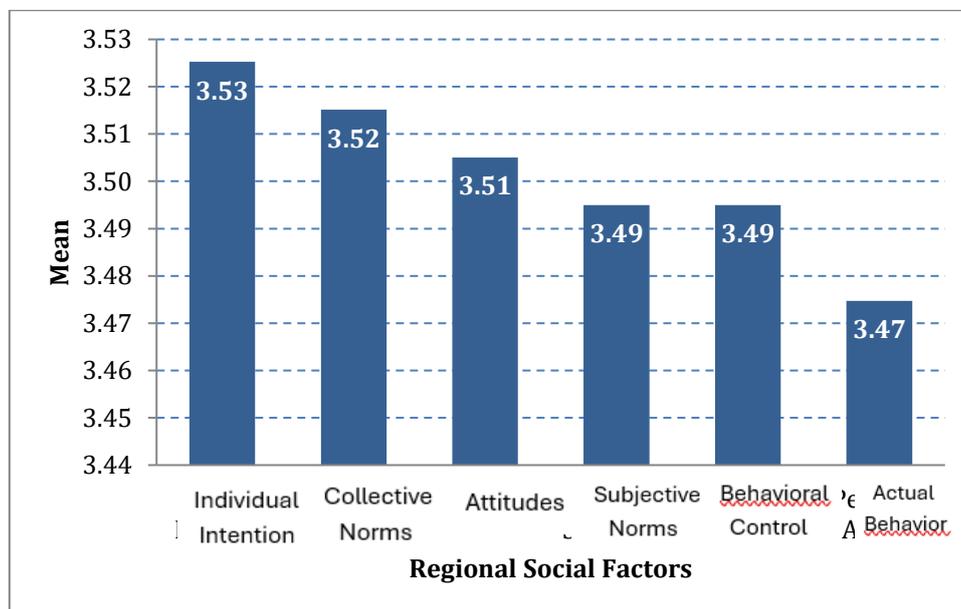
Informant	Statement	Theme / Theoretical Dimension	Meaning / Conclusion
Mrs. NS (25 years old)	"Wet waste is composted, and dry waste is easy because there are always collectors who take it."	TPB – Attitude toward behavior HBM – Perceived benefits	Waste management is perceived as easy to implement and provides direct benefits..
Mr. SF (55 years old)	"We collect plastic bottles; they can be sold. It's also good if there is a program like a waste bank... we can exchange them for items such as cooking oil or buy basic necessities."	TPB – Attitude toward behavior HBM – Perceived benefits SCR – Objectivation of economic value	Behavior is driven by economic incentives; the waste bank has become a recognized social system.
Mrs. T (42 years old)	"When we do it together with other residents, it's more motivating. When doing it alone, it's easy to feel lazy"	TPB – Subjective norms HBM – Cues to action SCR – Externalization of collective practices	Motivation increases in social contexts; collective action (gotong royong) acts as a trigger for behavior.
Mrs. YC (community member)	"Usually, children are involved together with PKK women and the elders who are more active. Young people tend to move only after being reminded by the RT or RW."	TPB – Subjective norms HBM – Cues to action SCR – Role of local actors	Social actors such as PKK, RT, and RW play a key role in encouraging norms and collective action.
Mr. D (27 years old)	"Some residents already have awareness about managing waste using the 3R approach, but many do not, mainly because they are not used to sorting waste... they consider it complicated."	TPB – Perceived behavioral control HBM – Perceived barriers	Technical difficulties and habitual constraints act as barriers; perceived control remains low..
Mr. HS (village official)	"We need to provide frequent reminders through RT, RW, youth groups, and PKK... we also establish regulations."	TPB – External control HBM – Cues to action SCR – Objectivation of regulations	Regulations and social reminders play an important role in supporting behavioral sustainability.
Mr. Y	"At the waste processing site (TPS), things are more	TPB – External control	Dependence on external assistance

	complicated, especially when operational assistance ends and we have to operate independently.”	HBM – Perceived barriers	– Hinders operational independence.
Mr. MN (private sector)	“We also collaborate with the TPS so that collection can be carried out more intensively at a single point.”	TPB – External control SCR – Objectivation of collaboration	The role of the private sector strengthens collective systems and expands operational reach.

Regional Social Factors

The interview findings involving various actors in a village context related to waste management indicate that regional social factors play a crucial role in shaping the dynamics of participation, understanding, and residents’ environmental practices. These factors refer to local and contextual social dimensions, such as the social characteristics of the community, relationships among residents (both local and migrant), the presence of key figures, and formal as well as informal communication networks. This process does not rely solely on structural or technocratic approaches, but rather operates through lived social logics, as reflected in interactions, trust, and collaboration among community members.

Table 4. Regional Social Factor



Qualitative findings indicate that regional social factors—such as community characteristics, local–migrant relations, key figures, and formal–informal communication networks—are central to waste management dynamics. These processes operate through trust, interaction, and collaboration rather than purely technocratic mechanisms. Quantitative data from 99 respondents reinforce these

findings. Individual intention shows the highest mean score (3.53), followed by collective norms (3.52) and attitudes (3.51), indicating strong internal motivation supported by a conducive social environment. Subjective norms (3.49) reflect significant social pressure from family and neighbors, while perceived behavioral control (3.49) suggests increasing confidence supported by information, facilities, and institutional backing. Actual behavior (3.47) remains slightly lower, indicating a gap between intention and consistent practice. This gap highlights the importance of regional social capacity. As noted by village officials, discussion, exemplification, and social networks often matter more than budgetary interventions. Policies must therefore be adaptive to local social contexts rather than purely formal.

Both quantitative and qualitative findings consistently affirm that sustainable waste management at the village level cannot be separated from the social structures and dynamics inherent to the region. Relationships among residents, openness to cross-group collaboration (local residents, migrants, and students), and the presence of two-way communication between the community and government officials emerge as key factors in shaping a participatory ecosystem. In other words, the success of waste management is not solely the result of technical interventions, but also a product of socially grounded engineering rooted in regional contexts.

The variables included in the cluster analysis model in this study consist of four categorical variables and six numerical variables. The categorical variables are as follows:

Tabel 5. Categorical Variable

Aspect	Variable	Data Type
Demographic	Gender	Categorical
	Residential Status	Categorical
	Length of Residence	Categorical
	Education Level	Categorical
Regional Social Factors	Individual Intention	Numerical
	Collective Norms	Numerical
	Attitudes	Numerical
	Subjective Norms	Numerical
	Behavioral Control	Numerical
	Actual Behavior	Numerical

Using SPSS software, the respondent clustering results were obtained using the TwoStep Cluster method as follows:

Tabel 6. Cluster Distribution

	N	% of Combined	% of Total
Cluster 1	39	39,4%	39,4%
Cluster 2	27	27,3%	27,3%
Cluster 3	33	33,3%	33,3%
Combined	99	100,0%	100,0%
Total	99		100,0%

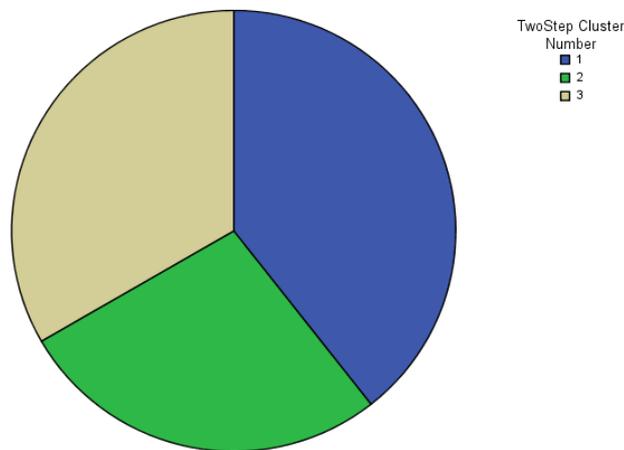


Figure 3. Cluster Size

Based on the results of the clustering process applied to the research data, three clusters were identified. As shown in the table above, the majority of respondents—39 individuals or 39.4%—belong to Cluster 1, while the minority—27 individuals or 27.3%—are categorized as members of Cluster 2.

Based on the clustering results the Gender variable does not significantly contribute to the formation of any cluster, including Cluster 1, Cluster 2, or Cluster 3. The Residential Status variable significantly contributes to the formation of Cluster 1, which is dominated by local residents, and Cluster 2, which is also dominated by local residents, as well as to the formation of Cluster 3, which is dominated by migrant residents.

Based on the clustering results of the numerical variables, Individual Intention, Attitudes, Subjective Norms, and Actual Behavior do not significantly contribute to the formation of any cluster (Cluster 1, Cluster 2, or Cluster 3). In contrast, Collective Norms and Behavioral Control show selective contributions. Collective Norms do not significantly contribute to Cluster 1, contribute positively and significantly to Cluster 2,

and contribute negatively and significantly to Cluster 3. Behavioral Control does not significantly contribute to Cluster 1 or Cluster 3, but contributes positively and significantly to Cluster 2. These results indicate that cluster differentiation is primarily shaped by collective social dynamics and perceived behavioral control, rather than by individual intention, attitudes, subjective norms, or actual behavior.

The overall clustering results described above are summarized in the following table presenting a summary of the clustering outcomes for the variables:

Tabel 7. Cluster Result

<i>Cluster</i>	Constituent Variables	Data Type	Tendency / Dominant Characteristics
Cluster 1 (<i>n</i> =30)	Residential Status	Categorical	Local residents
	Education Level		Senior High School / Vocational School (SMA/SMK)
Cluster 2 (<i>n</i> =27)	Residential Status	Categorical	Local residents
	Education Level		Diploma–Bachelor’s Degree (D3–S1)
	Collective Norms	Numerical	3,78 ± 0,424
	Behavioral Control		3,74 ± 0,447
Cluster 3 (<i>n</i> =33)	Residential Status	Categorical	Migrant residents
	Length of Residence		< 5 years

Maturity Components in The Circular Economy Concept

Residents function not only as system users but also as drivers of the circular economy. High attitude (3.51) and intention (3.53) scores reflect awareness shaped by social support, subjective norms (3.49), and collective encouragement. Actual participation in collection, sorting, and treatment is reinforced through communal activities, waste banks, and training. In this context, the strength of local actors lies not only in their role as system users, but also as producers, managers, and promoters of a community-based circular economy. At the village level, policies emerge from social dialogue rather than solely formal regulations. Limited budgets are compensated by local strategies emphasizing cadres, training, and facilitation. Formal infrastructure (TPS3R, bins) operates alongside unwritten social norms, while partnerships among government, community leaders, students, and residents build collective capacity.

Communication Model and Waste Governance

Based on the analysis conducted, the formulation of the communication model in waste governance can be described as follows:

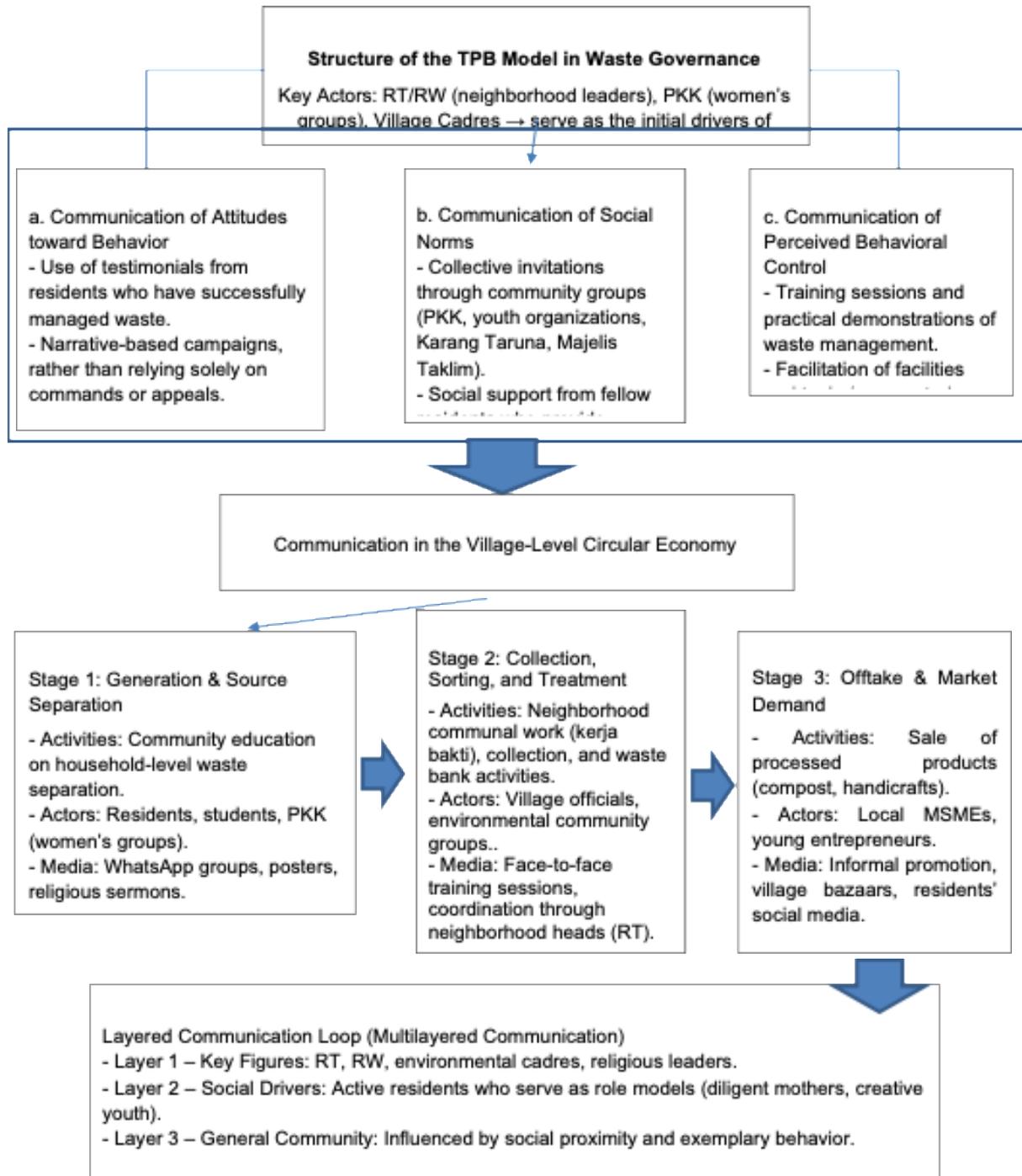


Figure 4. TPB Model

Conclusion

This study examines waste governance practices in the Jatinangor area, Sumedang Regency, by applying the Theory of Planned Behavior (TPB), incorporating regional social factors, and using a circular economy framework. The findings show that waste management behavior is shaped by the interaction of psychological, social, and structural dimensions, including positive attitudes toward environmental and economic benefits, subjective norms reinforced by local figures and community groups, and perceived behavioral control related to access to facilities and institutional support. The Health Belief Model (HBM) complements this explanation by showing that residents' awareness of health and environmental risks, combined with perceived benefits and educational support, strengthens behavioral intentions, while technical and habitual barriers gradually diminish as self-efficacy increases through training and social reinforcement.

Waste governance in Jatinangor is strongly influenced by regional social dynamics and collective collaboration rather than solely by formal regulations or market-based mechanisms. Trust-based relationships, informal communication, and participatory practices support the development of a locally grounded circular economy, in which waste management activities generate new value through reuse and recycling. Through ongoing social interaction, these practices become internalized as shared norms and social identities, reinforcing a sustainable communication model based on value internalization, participatory interaction, and dialogic infrastructure that connects residents, institutions, and stakeholders.

Acknowledgement:

This study has no conflicts of interest and funding was obtained from internal educational institution funds. The first author contributed to the data collection and analysis process, the second author contributed to the data analysis and acted as the corresponding author, and the third author contributed as the data processor.

Declaration of AI Involvement :

This study did not use AI tools in the data processing or writing process.

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