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Assessing River Care Awareness and Technology Engagement in a Rural Community in Malaysia: A Preliminary Study in Kampung Paya Rawa

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Abstract: This preliminary study examines residents' awareness of river stewardship and their engagement with technology in Kampung Paya Rawa, a rural community in Mukim Temin, Kedah, Malaysia. Conducted under the Celik Digital, Cakna Kebersihan campaign, the study assesses community knowledge, moral values, sense of responsibility, and technology-related awareness in relation to river conservation. Data were collected through face-to-face surveys with 51 residents over two days in April 2025, enabling direct engagement and a contextual understanding of local perspectives. A descriptive analysis was undertaken to evaluate awareness across the four dimensions. The findings indicate that the community demonstrates a moderate level of awareness in all areas assessed. Residents exhibit a strong emotional and cultural attachment to the river and generally recognise its importance for daily life and environmental sustainability. However, their knowledge of river management, flood risks, and responsible practices remains limited, indicating a gap between general awareness and informed action. Although there is a clear willingness to participate in river care activities, actual engagement appears limited. The study also identifies high smartphone ownership among residents, suggesting considerable potential for integrating digital tools to support environmental education, early warning systems, and community mobilisation, despite only moderate levels of technology-related knowledge. Overall, the findings suggest that combining environmental education with accessible digital initiatives could enhance river stewardship practices in rural communities. This study provides baseline insights to inform future interventions, community-based programmes, and policy-oriented efforts aimed at strengthening sustainable river management through the integration of awareness and technology.

Keywords: River Care; Environmental Awareness; Community Engagement; Rural Sustainability; Rural Technology Integration

1.0 Introduction

Research in Malaysia and across Southeast Asia increasingly indicates that environmental awareness alone does not guarantee meaningful or sustained pro-environmental behaviour. Several studies have shown that, although communities may express concern about environmental degradation, this concern often does not translate into consistent action without structured educational support. In the Malaysian context, Lye et al. (2024) demonstrate that household environmental practices are more strongly influenced by specific, task-oriented knowledge than by general awareness, suggesting that behavioural change is more likely when education is practical and directly linked to everyday decision-making. Similar findings are reported in education-focused studies, where positive attitudes towards environmental sustainability coexist with inconsistent behaviour, highlighting a persistent gap between knowledge and action (Yaacob, 2023).

Evidence from intervention-based studies further reinforces the role of environmental education as a catalyst for behavioural change. An experimental study conducted in Malaysia found that participants exposed to a structured environmental education programme demonstrated measurable improvements not only in environmental knowledge but also in attitudes and reported practices, indicating that repeated exposure and contextualised learning are essential for reinforcing responsible behaviour (Abdul Rahman et al., 2023). Comparable findings from Indonesia suggest that environmental knowledge contributes most effectively to behaviour change when learners are encouraged to apply it in real-life contexts, rather than treating it as abstract information (Erwinsyah, 2022). Collectively, these studies underscore the importance of educational approaches that move beyond awareness-raising towards action-oriented learning.

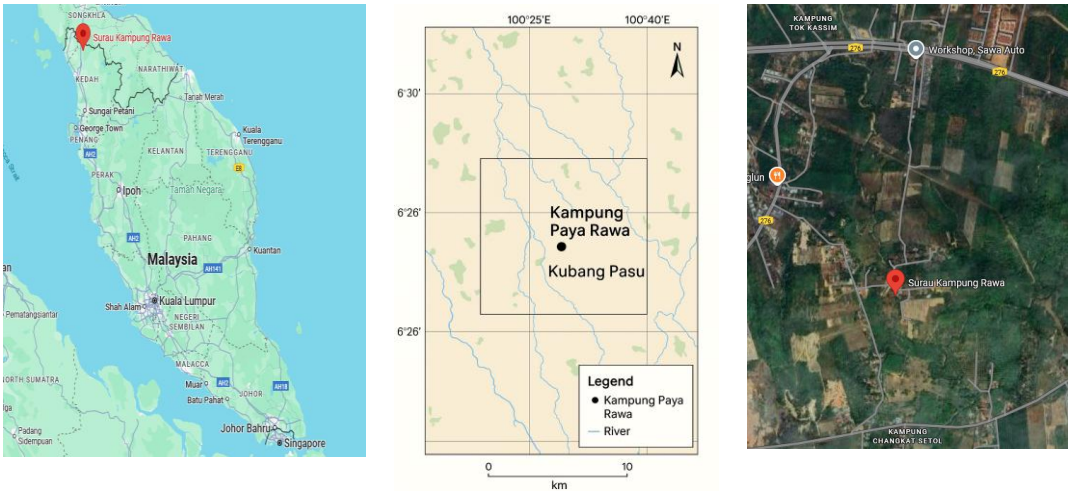
Alongside education, digital capability has become an increasingly important factor in community-based environmental engagement. Although smartphone ownership is now widespread in many rural Malaysian communities, digital literacy remains uneven, particularly in areas with lower levels of educational attainment. Samsuddin et al. (2021) note that limited confidence and skills in using digital tools can restrict meaningful participation in digitally mediated initiatives, including environmental campaigns and community reporting systems. This uneven readiness suggests that technology alone cannot drive behavioural change; rather, it must be carefully aligned with local capacities and supported by appropriate guidance. Despite growing recognition of these challenges, empirical studies that jointly examine environmental awareness, behavioural intention, and technology engagement within a single rural Malaysian community remain limited. Addressing this gap is essential for designing locally grounded interventions that integrate environmental education and digital tools in ways that are both accessible and effective.

2.0 Study Area

The study was conducted in Kampung Paya Rawa (6.43807° N, 100.45623° E), a traditional village located in Mukim Temin, Kedah, known for its close-knit community and strong cultural attachment to the surrounding natural environment, particularly the local river (field survey, 2025). Data collection was carried out over two days, on 18 and 19 April 2025, involving 51 residents. The village is characterised by a predominantly mature population, many of whom have lived there for decades, with some residing in the area for up to 70 years. This reflects a deep intergenerational connection to the land and its resources. These long-term residents possess valuable historical knowledge and cultural perspectives that shape their relationship with the river. Their strong sense of place and identity associated with the village makes Kampung Paya Rawa an appropriate case for examining how traditional values, environmental awareness, and modern technology intersect in rural river conservation efforts.

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Malaysia map | Kg. Paya Rawa map | Kg. Paya Rawa map

Figure 1: Study area map.

3.0 Materials and Methodology

3.1 Material

The study was conducted in Kampung Paya Rawa, a rural village located in the Kubang Pasu District, Kedah, Malaysia. Situated in northern Peninsular Malaysia near the Malaysia–Thailand border, the village is characterised by low-density residential settlements surrounded by agricultural land and small river systems (Department of Statistics Malaysia, 2023). The local climate is tropical, with relatively high annual rainfall influenced by the Northeast Monsoon between November and March, during which certain areas are prone to seasonal flooding (Malaysian Meteorological Department, 2024). These environmental characteristics make Kampung Paya Rawa a suitable setting for examining river-related awareness and community engagement in a rural context.

3.2 Methodology

This study employed a cross-sectional, community-based survey design to assess awareness of river stewardship and technology engagement among residents, as illustrated in Figure 2. Face-to-face surveys were conducted with 51 residents of Kampung Paya Rawa over two days in April 2025. This approach was selected to ensure clarity of responses, minimise non-response bias, and enable direct interaction between researchers and participants. Such engagement is particularly important in rural settings, where digital or self-administered surveys may limit participation or compromise data quality (Dillman et al., 2014; Creswell & Creswell, 2018).

The questionnaire was structured into several sections. The first section captured demographic characteristics, including age, gender, education level, and duration of residence, to establish the community profile. Subsequent sections assessed river stewardship awareness across four dimensions: knowledge, moral and emotional concern, sense of responsibility, and technology-related awareness. These dimensions were adapted from established environmental awareness and behaviour frameworks, which emphasise the progression from knowledge and values to behavioural intention and enabling conditions (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009).

Awareness items were measured using a seven-point Likert scale, a format widely applied in environmental perception and awareness studies due to its sensitivity in capturing variations in attitudes and perceived responsibility (Likert, 1932; Awang et al., 2018). The scale enabled respondents to indicate their level of agreement with statements related to river pollution, flood risk, moral responsibility, willingness to act, and the perceived usefulness of technology. In addition, technology engagement was assessed through questions on smartphone ownership and perceived ability to use digital tools for river monitoring and risk reduction. This reflects recent approaches that link environmental action with digital readiness in rural communities (Samsuddin et al., 2021).

Overall, the selected methodology provides an initial yet comprehensive overview of community awareness, behavioural intention, and technological readiness in relation to river conservation. To enhance transparency and reader engagement, photographs documenting the survey activities and the study site are included to illustrate the fieldwork context and community setting.

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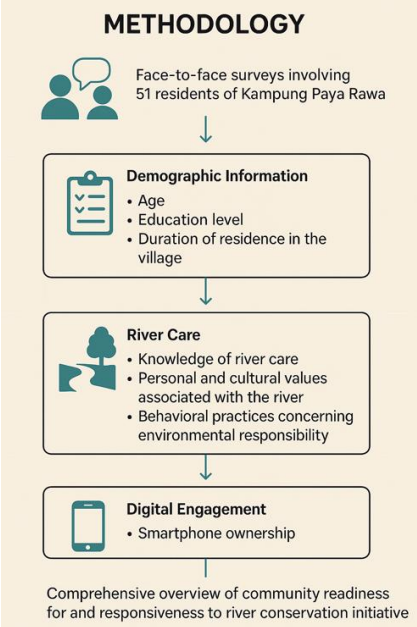


Figure 2: Research Design

4.0 Results

4.1 Demographic result

4.1.1 Age and Gender

Data collection was conducted in Kampung Paya Rawa, Mukim Temin, on 18 and 19 April 2025, involving 51 respondents. The age distribution indicates a mean age of 54 years, with the youngest respondent aged 21 and the oldest 77. The pie chart below illustrates this distribution, showing that the oldest age group constitutes the largest proportion, followed by the middle-aged group, while the youngest group represents the smallest share. The gender distribution among the respondents shows a slightly higher proportion of females than males. Of the total sample, 27 respondents (52.9%) are female, while 24 respondents (47.1%) are male. This relatively balanced distribution suggests that both genders are well represented in the survey, with females comprising just over half of the participants. The small difference between the two groups indicates that the findings reasonably reflect the perspectives of both male and female respondents.

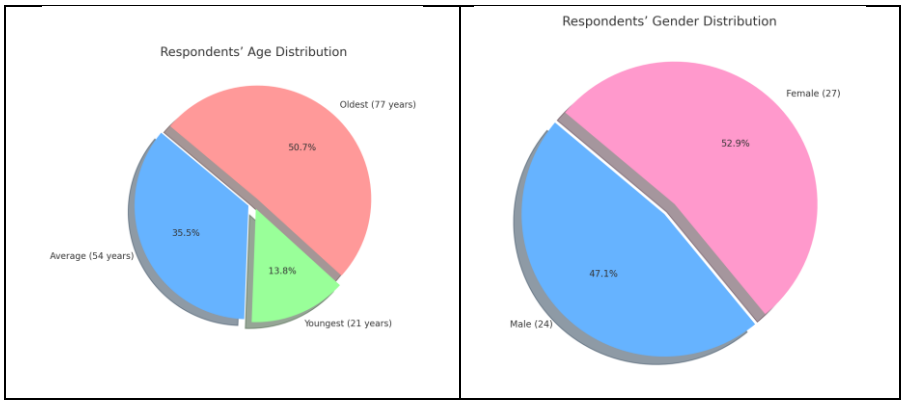


Figure 3: Age and Gender

4.1.2 Education level

Figure 4 illustrates the distribution of education levels among the 51 respondents in Kampung Paya Rawa. The majority of respondents have completed secondary education as their highest level of attainment, accounting for 56.9% of the sample. This indicates that more than half of the community has achieved a secondary level of education. Primary school graduates represent the second-largest group (19.6%), reflecting a notable proportion of respondents with only basic formal education. A smaller proportion of respondents have attained post-secondary qualifications, with 7.8% holding a bachelor's degree and 3.9% having completed a diploma.

Overall, the distribution shows that the community's educational profile is largely concentrated at the secondary level or below, with limited participation in tertiary education. This pattern provides important context for interpreting variations in environmental knowledge and technology awareness discussed in subsequent sections, as educational background may influence access to information, understanding of environmental issues, and confidence in using digital tools.

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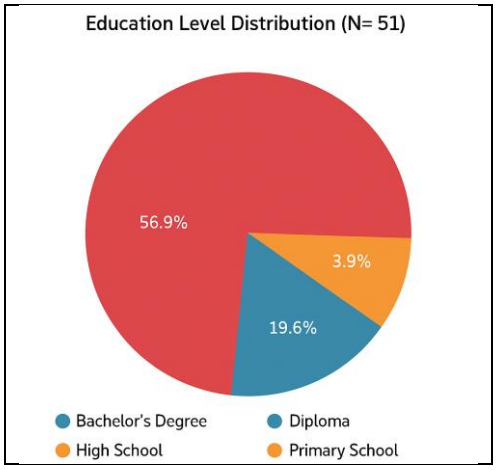


Figure 4: Education Level

4.1.3 Duration of residence

The population of Kampung Paya Rawa exhibits a wide range in the duration of residence among its inhabitants. Figure 5 presents this distribution, revealing diverse settlement histories within the community. Several respondents reported long-term residence of up to 70 years, indicating deep-rooted ties to the village and extensive familiarity with the local river and surrounding environment. At the same time, a smaller group of respondents has resided in the village for between 3 and 10 years, suggesting the presence of newer residents with varying levels of attachment and environmental experience.

Across the sample, the mean duration of residence is approximately 33 years, highlighting the overall stability of the community. The largest groups are concentrated in the 21–30-year and 31–40-year residence categories, reflecting a population with sustained, multi-decade engagement with the local environment. This long-term residency profile suggests that many respondents have accumulated experiential knowledge of river conditions, seasonal variations, and environmental challenges, which is important for interpreting findings related to awareness and responsibility.

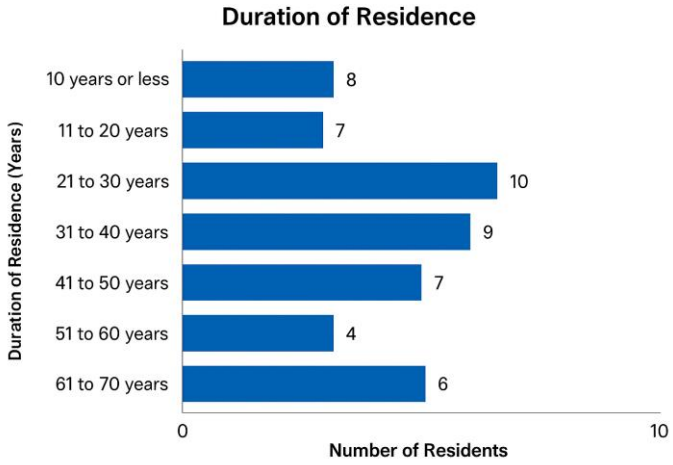


Figure 5: Duration of residence.

4.1.4 Smartphone Ownership

Figure 6 presents the level of smartphone ownership among respondents. A substantial majority of participants (78.4%, or 40 respondents) reported owning a smartphone, while 21.6% (11 respondents) indicated that they did not own one. This distribution suggests relatively high mobile technology penetration within the community, despite its rural setting.

The high rate of smartphone ownership indicates that digital platforms could be effectively utilised to support environmental awareness initiatives, information sharing, and community coordination related to river stewardship. However, the presence of a notable minority without smartphone access highlights the need for inclusive approaches that combine digital tools with face-to-face or community-based engagement. This finding provides important context for interpreting the technology-related awareness results discussed later in the paper.

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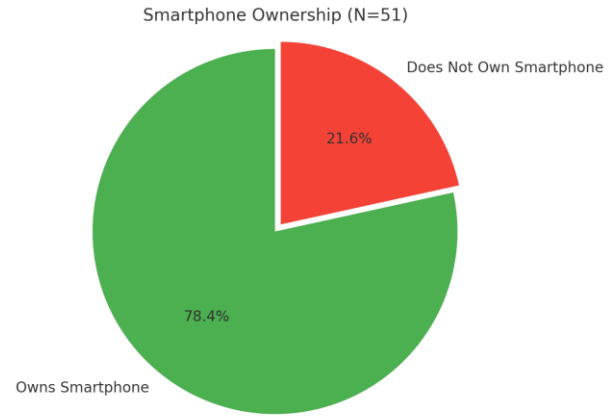


Figure 6: Smartphone ownership.

4.2 Knowledge

Table 1 presents the mean scores for river stewardship knowledge among residents of Kampung Paya Rawa. Overall, respondents demonstrated a moderate level of knowledge regarding river-related issues, with an overall mean score of 4.50. Among the indicators, awareness of the main causes of river pollution recorded the highest mean score (M = 4.59), suggesting that most respondents are generally familiar with common pollution sources, such as waste disposal and domestic activities. Understanding of how rivers contribute to flooding also showed a moderate level (M = 4.47), indicating a basic awareness of flood risks associated with river systems. Knowledge of institutional responsibility, specifically awareness of agencies responsible for river management, recorded the lowest mean score (M = 4.33), although it remains within the moderate range. This pattern suggests that while respondents possess general environmental knowledge related to rivers, their understanding of governance and management structures is comparatively limited.

Table 1: Mean scores for river care awareness indicators

No.	Awareness Indicator	Mean (m)	Awareness Level
1	I know the main causes of river pollution	4.59	Moderate
2	I understand how rivers can cause flooding	4.47	Moderate
3	I know which agencies are responsible for river management	4.33	Moderate
	Overall Awareness	**4.50**	**Moderate**

4.3 Care moral

The results for moral and emotional awareness related to river stewardship are summarised in Table 2. The overall mean score of 4.60 indicates a moderate level of moral concern regarding river conditions. The highest mean score was observed for the statement, “Caring for the river is a moral responsibility” (M = 4.67), indicating a shared normative belief that protecting the river is an ethical obligation. Respondents also expressed concern when encountering polluted rivers (M = 4.59), suggesting emotional sensitivity to environmental degradation. Feelings of pride associated with having a clean river in the village recorded a slightly lower, yet still moderate, mean score (M = 4.45). Collectively, these findings suggest that emotional attachment and moral values related to the river are present within the community, although they are not strongly pronounced.

Table 2: Mean scores for river care moral and emotional awareness.

No.	Awareness Indicator	Mean (m)	Awareness Level
1	Caring for the river is a moral responsibility	4.67	Moderate
2	I feel worried when I see a polluted river	4.59	Moderate
3	I feel proud if the river in this village is clean	4.45	Moderate
	Overall Awareness	**4.60**	**Moderate**

4.4 Responsibility

Table 3 outlines respondents’ perceived responsibility towards river stewardship. The overall mean score of 4.64 reflects a moderate sense of personal responsibility. Willingness to participate in river-cleaning activities recorded the highest mean score (M = 4.78), indicating a generally positive attitude towards collective action. Advising others not to dispose of waste in the river (M = 4.57) and the belief that individual actions can help protect the river (M = 4.57) also fall within the moderate range. These results suggest that respondents recognise their potential role in river conservation. However, the moderate scores indicate that this recognition may not consistently translate into proactive or sustained behaviour.

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Table 3: Mean scores for river care responsibility awareness.

No.	Awareness Indicator	Mean (m)	Awareness Level
1	I am willing to participate in river cleaning activities	4.78	Moderate
2	I will advise people who throw trash into the river	4.57	Moderate
3	My actions can help protect the river in this village	4.57	Moderate
	Overall Awareness	**4.64**	**Moderate**

4.5 Technology

Table 4 presents the findings on technology-related awareness associated with river stewardship. The overall mean score of 4.31 indicates a moderate level of technology-related awareness. Respondents demonstrated moderate awareness of applications or websites that provide early flood warnings (M = 4.45), as well as the belief that technology can help reduce disaster risks within the community (M = 4.45). In contrast, knowledge of how to use technology to monitor river conditions recorded the lowest mean score (M = 4.04), suggesting limited practical familiarity with such tools. Despite relatively high smartphone ownership within the community, these findings indicate that awareness of the potential of technology exists, but practical knowledge and actual usage remain limited.

Table 4: Mean scores for technology awareness in river care.

No.	Awareness Indicator	Mean (m)	Awareness Level
1	I know applications or websites that provide early flood warnings	4.45	Moderate
2	I know how to use technology to monitor river conditions	4.04	Moderate
3	I believe technology can help the community reduce disaster risks	4.45	Moderate
	Overall Awareness	**4.31**	**Moderate**

5.0 Discussion

This study provides preliminary insights into river stewardship awareness in Kampung Paya Rawa by examining four interrelated dimensions: knowledge, moral and emotional concern, perceived responsibility, and technology awareness. The consistently moderate levels across all dimensions suggest that the community possesses a foundational awareness of river conservation issues. However, this awareness has not fully translated into strong, habitual pro-environmental behaviour. This pattern reflects the widely documented awareness–behaviour gap, whereby knowledge and concern alone are insufficient to generate sustained action without enabling social, institutional, and technological conditions (Kollmuss & Agyeman, 2002; Steg et al., 2015).

From a theoretical perspective, awareness–behaviour models propose that environmental knowledge influences behaviour indirectly through values, norms, and perceived behavioural control (Ajzen, 1991; Steg & Vlek, 2009). In this study, respondents demonstrated moderate knowledge of river pollution and flood risks, indicating that experiential exposure has contributed to a basic level of understanding. However, lower familiarity with institutional responsibilities suggests a limited cognitive linkage between personal awareness and formal river governance. Similar patterns have been observed in rural environmental studies in Malaysia and across Southeast Asia, where knowledge tends to be situational rather than systemic, thereby limiting its capacity to support informed action (Ahmad et al., 2020; Lye et al., 2024).

The moral and emotional dimension emerged as relatively stronger than knowledge alone, with respondents expressing concern, pride, and a sense of ethical responsibility towards the river. This finding is consistent with research indicating that emotional attachment and place-based identity are key precursors to environmental stewardship, particularly in rural contexts where natural resources are closely embedded in daily life (Chan et al., 2016; Tan & Lee, 2019). However, the moderate rather than high scores suggest that emotional concern, while necessary, may not be sufficient to sustain long-term conservation behaviour without reinforcement through social norms and collective practices.

The findings related to perceived responsibility further reflect this dynamic. Respondents reported a moderate willingness to participate in river-cleaning activities and to discourage harmful behaviours, indicating positive behavioural intention. According to community stewardship theory, such intentions often depend on perceived collective efficacy and the availability of opportunities for participation, rather than individual motivation alone (Berkes, 2009; Raymond et al., 2016). In rural communities, the absence of structured programmes or regular collective activities may constrain the translation of intention into consistent action, a pattern also observed in previous Malaysian studies (Ahmad et al., 2020).

Technology awareness represents a potentially enabling factor within the awareness–behaviour framework. Despite relatively high smartphone ownership in Kampung Paya Rawa, respondents reported only moderate confidence in using technology for river monitoring and risk reduction. This finding aligns with studies showing that digital access does not necessarily translate into functional digital literacy, particularly in rural or low-education contexts (Samsuddin et al., 2021; van Deursen & van Dijk, 2019). From a behavioural perspective, technology can enhance perceived behavioural control by reducing information and coordination barriers; however, this effect depends on usability, relevance, and local capacity (Venkatesh et al., 2012). The findings therefore suggest that digital tools have significant potential to strengthen river stewardship, but only when supported by training and community-oriented desig.

Overall, the results align with both international and regional literature demonstrating that environmental behaviour is shaped by the interaction of cognitive, emotional, social, and enabling factors, rather than awareness alone (Steg et al., 2015; Kollmuss & Agyeman, 2002). While earlier Malaysian studies have documented moderate environmental awareness in rural communities (Ahmad et al., 2020; Tan & Lee, 2019), this study extends existing knowledge by explicitly incorporating technology engagement into river stewardship awareness. In doing so, it responds to recent calls to integrate digital readiness into community-based environmental research, particularly in developing and rural contexts (Lye et al., 2024; Samsuddin et al., 2021).

As a preliminary study, several limitations should be acknowledged. The sample size restricts statistical generalisation, and the cross-sectional design captures awareness at a single point in time. Self-reported measures may also overestimate positive attitudes and intentions. Future research should adopt longitudinal or mixed-method approaches to examine how awareness evolves following targeted educational or digital interventions. Incorporating behavioural observations and environmental indicators would further strengthen the linkage between perceived awareness and actual conservation outcomes.

Future work may also benefit from explicitly testing awareness–behaviour or stewardship-based models using inferential approaches, enabling a more precise identification of pathways from knowledge and emotion to action. Integrating traditional ecological knowledge from long-term residents with digital tools may offer a culturally grounded strategy for strengthening river stewardship practices in rural communities.

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6.0 Conclusions

This preliminary study provides empirical evidence on river stewardship awareness and technology engagement within a rural Malaysian community, highlighting how knowledge, moral values, perceived responsibility, and digital readiness interact in shaping community-based river stewardship. The findings indicate that residents of Kampung Paya Rawa demonstrate a moderate level of awareness across all examined dimensions, supported by a strong emotional attachment to the local river and a general willingness to engage in conservation-related activities. However, the results also suggest that this awareness has not yet translated into consistently strong or sustained pro-environmental behaviour, underscoring the persistence of an awareness–action gap in rural environmental contexts.

The study makes several contributions. First, it extends existing research on river stewardship and environmental awareness by incorporating technology awareness as a core dimension alongside traditional cognitive and moral factors. This integration responds to emerging calls in the literature to consider digital readiness as an enabling condition for environmental action, particularly in rural communities where smartphone access is increasing but functional digital literacy remains uneven. Second, the study provides context-specific baseline evidence from a rural Malaysian setting, which remains underrepresented in empirical river stewardship research. By documenting awareness patterns and the potential for digital engagement at the community level, the findings offer a practical reference point for designing targeted interventions rather than generic, one-size-fits-all programmes.

From a practical perspective, the results suggest that river conservation initiatives in rural areas should move beyond awareness-raising campaigns and adopt more integrated strategies that combine environmental education, community participation mechanisms, and accessible digital tools. Policymakers, local authorities, and non-governmental organisations may use these findings to develop locally appropriate programmes that enhance knowledge, strengthen collective responsibility, and improve the effective use of technology for river monitoring, early warning, and community mobilisation.

While limited in scale, this study provides a foundation for future research by identifying key dimensions and relationships relevant to rural river stewardship. Subsequent studies may build on this work by employing larger samples, longitudinal designs, or mixed-method approaches to examine how awareness evolves and how digital interventions influence actual conservation behaviour. Overall, the study contributes to a more nuanced understanding of rural river stewardship by emphasising the importance of aligning environmental awareness with behavioural enablers and technological capacity.

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Data Availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Conceptualisation: S. Salleh; Methodology: S. Salleh and N. S. Mansor; Data curation: H. Awang; Formal analysis: F. Razak; Writing – original draft: S. Salleh; Writing – review and editing: S. Salleh, N. S. Mansor, H. Awang, F. Razak, N. Ariffin, and R. Karim; Supervision: R. Karim; Final approval: All authors.

Conflicts of Interest: There are no conflicts of interest in this study.

Ethics Statement: All participants provided informed consent before taking part in the questionnaire survey or interviews. Participation was voluntary, and participants could withdraw at any time. Participant confidentiality and anonymity were maintained, and all data were used solely for research purposes.

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