

A Research-Based Production of Information Materials on Greywater Reuse for the Residents of Rizal Province

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ABSTRACT

This study examines the awareness, knowledge, attitude, and practices (AKAP) of household heads in selected municipalities/cities in Rizal Province regarding greywater reuse. Anchored on Social Judgment Theory and supported by the AKAP model, the research employed a quantitative descriptive-correlational design. Data were collected from household heads within the East Zone Concession area using a structured AKAP survey instrument.

Findings reveal that while respondents demonstrate moderate awareness and high level of knowledge of greywater reuse, gaps remain in technical understanding and practical application. Attitude toward greywater reuse were highly positive, however, actual practice remains limited. This suggest that there is a disconnect between perception and behavioral implementation. Significant relationships were also observed among awareness, knowledge, attitude, and practice. This confirms the interrelated nature of AKAP on practice adoption. Further, significant differences on AKAP level were observed when the respondents are grouped together according to age, educational attainment, occupation, and economic status. On one hand, gender and geographical location has no implication on AKAP levels.

The study concludes that effective communication strategies are necessary to bridge knowledge gaps and improve adoption of greywater reuse practices. Based on the findings, research-based information materials were developed to promote sustainable water management at the household level. The study contributes to environmental communication and supports policy efforts aligned with Sustainable Development Goals (SDG) on water conservation and environment.

Keywords: Greywater reuse, awareness, knowledge, attitude, practice, environmental communication, water sustainability, Rizal Province

I. INTRODUCTION

Water is a critical resource that sustains human life, economic development, and environmental stability. Despite the Philippines being geographically surrounded by water, access to safe and reliable freshwater remains uneven due to institutional fragmentation, infrastructure limitations, and rapid urbanization (Asian Development Bank, 2013). Increasing water demand, driven by population growth and climate-related disruptions, has intensified pressure on existing water systems. For instance, water consumption in the

East Zone concession increased from 144.16 to 168.28 liters per capita per day between 2015 and 2020. This reflects a growing strain on supply (MWSS RO, 2021).

Globally, water security is closely tied to sustainable development, particularly SDG 6, which emphasizes efficient water use and wastewater management. Wastewater reuse, including greywater reuse, has emerged as a viable strategy to address water scarcity while reducing environmental pollution (OECD, 2012). Greywater, which is defined as domestic wastewater from baths, sinks, and laundry, can be repurposed for non-potable uses such as irrigation and cleaning, thereby reducing freshwater demand and wastewater discharge (World Bank, 2003).

In the Philippines, water resource challenges are further exacerbated by rapid urban expansion, particularly in provinces such as Rizal. Increased residential development and population spillover from Metro Manila have significantly raised water demand while placing pressure on watersheds and water supply systems. The 2019 water crisis, caused by reduced reservoir levels due to El Niño, highlighted the vulnerability of the current system (MWSS, 2019). At the same time, inadequate wastewater management contributes to environmental degradation, particularly in water bodies such as Laguna de Bay.

Policy responses have begun to recognize the potential of wastewater reuse. Initiatives such as the proposed Greywater Treatment and Reuse Act of 2021 and campaigns by the Metropolitan Waterworks and Sewerage System Regulatory Office (MWSS Ro) aim to promote sustainable water use. However, these efforts face communication challenges, including limited public awareness, unclear messaging, and low engagement levels. Existing campaigns often focus on water conservation rather than explicitly promoting greywater reuse. This results in limited adoption at the household level.

Research indicates that public awareness, knowledge, and attitude significantly influence the acceptance of greywater reuse practices (Taher et al., 2019). However, there is limited empirical evidence on how households in Rizal Province perceive and practice greywater reuse. Without such baseline data, communication strategies and information materials may fail to address misconceptions and behavioral barriers effectively.

Given these gaps, this study examines the AKAP of household heads in selected areas of Rizal Province regarding greywater reuse. By understanding household-level perceptions and behaviors, the study aims to support the development of research-based information materials that promote sustainable water management practices.

Statement of the Objectives

The general objective of this study is to determine the level of AKAP of household heads in selected Rizal communities within the East Zone Concession regarding greywater reuse.

Specifically, the study aims to:

1. Describe the socio-demographic profile of household heads in terms of age, gender, educational attainment, occupation, and economic status;
2. Assess the level of awareness of household heads regarding greywater reuse;
3. Measure the level of knowledge of household heads regarding greywater reuse;
4. Determine the level of attitude of household heads toward greywater reuse;
5. Examine the level of practice of household heads in implementing greywater reuse;
6. Identify significant relationships among awareness, knowledge, attitude, and practice;
7. Determine significant differences in AKAP levels when grouped according to socio-demographic variables; and

8. Develop research-based information materials on household greywater reuse in Rizal Province.

Theoretical and Conceptual Frameworks

This study is anchored on Social Judgment Theory (SJT) and supported by the Awareness, Knowledge, Attitude, and Practice (AKAP) Model to explain how household heads evaluate and adopt greywater reuse practices.

Social Judgment Theory, developed by Muzafer Sherif and Carl Hovland (1961), explains how individuals interpret new information based on existing beliefs and experiences. According to the theory, individuals evaluate messages using internal reference points (anchors), leading to three possible outcomes: acceptance, non-commitment, or rejection. When applied to environmental communication, SJT suggests that household responses to greywater reuse depend on perceived risks, cultural beliefs, and trust in institutions. Messages aligned with existing beliefs are more likely to be accepted, while unfamiliar or conflicting information may be rejected.

Complementing SJT, the AKAP Model provides a structured framework for analyzing behavioral engagement. Rooted in diffusion and behavior change theories (Rogers, 2003), the model outlines four interconnected components: awareness, knowledge, attitude, and practice. Awareness refers to exposure to the concept of greywater reuse, while knowledge reflects understanding of its benefits and applications. Attitude represents the evaluative perception of the practice, and practice refers to actual implementation at the household level.

Although the model suggests a linear progression from awareness to practice, studies indicate that behavioral change is influenced by multiple factors, including social norms, perceived risks, and convenience (Kollmuss & Agyeman, 2002). Thus, awareness and knowledge do not always lead directly to adoption.

Figure 1. Conceptual Framework Integrating the AKAP Model and Social Judgment Theory



This study integrates SJT and the AKAP model to examine how household heads in Rizal Province process information about greywater reuse and translate it into behavior. Awareness and knowledge serve as inputs, attitude reflects evaluative judgment shaped by social and psychological factors, and practice represents the observable outcome. Socio-demographic characteristics are also considered as contextual variables that influence these relationships.

II. METHODOLOGY

This study employed a quantitative descriptive-correlational design to examine the AKAP of household heads regarding greywater reuse in selected municipalities of Rizal Province within the East Zone Concession. The design enabled the identification of patterns in household perceptions and the determination of relationships among AKAP variables, as well as differences across socio-demographic groups.

Respondents and Sampling

The population consisted of households with active water service connections (WSCs) in the East Zone Concession (N = 1,146,126), with 447,214 located in Rizal Province. Using Cochran's formula (95% confidence level, 5% margin of error, $p = 0.50$), a sample size of 384 household heads was determined. A probability sampling approach with proportional allocation was applied. Ten municipalities with sufficient WSCs were included, while areas with minimal or zero WSCs were excluded. Respondents were proportionally distributed based on WSC counts.

Data Collection and Instrumentation

Data were collected through a structured AKAP survey questionnaire administered via both online and pen-and-paper formats. The instrument consisted of 52 items across five sections: socio-demographic profile, awareness, knowledge, attitude, and practice.

- Awareness and attitude were measured using four-point Likert scales
- Knowledge was assessed through multiple-choice items
- Practice was measured using a four-point frequency scale

The instrument was validated by experts and pilot-tested to ensure reliability and clarity.

Data Collection Procedure

Survey distribution was conducted through multiple channels, including online platforms, barangay coordination, and community social media groups. Additional responses were gathered through house-to-house surveys to ensure broader participation. All responses were consolidated for analysis.

Data Analysis

Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize AKAP levels. Inferential analysis included:

- Spearman's rho to determine relationships among AKAP variables
- Mann-Whitney U test for differences between two groups
- Kruskal-Wallis H test for differences among multiple groups

These nonparametric tests were applied due to the nature of the data.

Ethical Considerations

The study adhered to ethical standards, including informed consent, voluntary participation, and confidentiality. In compliance with the Data Privacy Act of 2012, all data were anonymized and used solely for academic purposes. Responses were securely stored and reported in aggregate form.

III. RESULTS AND DISCUSSION

This section presents the findings on the AKAP of household heads in Rizal Province regarding greywater reuse, including relationships among variables and differences across socio-demographic groups.

Socio-Demographic Profile

The 384 respondents were distributed across ten municipalities, with the largest shares from Antipolo

(26.04%), Rodriguez (19.01%), and Cainta (14.84%). Most respondents were aged 26-35 (48.96%), followed by 18-25 (27.08%), indicating a predominantly young and economically active sample. Females comprised 57.29% of respondents.

In terms of education, nearly half were college graduates (47.14%), which suggest that relatively high educational attainment. Most respondents were employed, primarily in the private sector (46.35%). Income distribution showed that the majority belonged to lower-middle to middle-income groups. These characteristics suggest a population with moderate to high exposure to environmental information and active involvement in household resource management.

Awareness on Greywater Reuse

Respondents demonstrated an overall awareness level of 2.81 (Aware). High awareness was observed in understanding that greywater contributes to water conservation and is not suitable for drinking. However, lower awareness was noted in institutional promotion and media exposure.

This indicates that awareness is largely derived from general environmental knowledge rather than formal campaigns. From SJT perspective, greywater reuse falls within respondents' latitude of acceptance, which aligns with existing beliefs about water conservation.

Knowledge of Greywater Reuse

Knowledge levels were high (mean = 8.51/10), with 90.36% of respondents scoring in the high category. Respondents demonstrated strong understanding of uses, benefits, and risks of greywater reuse.

However, lower scores were observed in procedural aspects such as filtration and safe handling, indicating a gap between conceptual and practical knowledge. This was supported by related literature which suggest that knowledge alone does not guarantee behavioral adoption.

Attitude Towards Greywater Reuse

Respondents exhibited a highly positive attitude (WM = 3.53). Strong agreement was observed regarding environmental benefits, water conservation, and willingness to learn and adopt greywater reuse.

This suggests that greywater reuse is strongly positioned within the latitude of acceptance and indicates that minimal resistance to adoption and strong support for related policies and programs.

Practices of Greywater Reuse

Despite high awareness, knowledge, and attitude, practices were only moderately implemented (WM = 2.98). Common practices included reuse for cleaning, watering plants, and toilet flushing.

Safety practices, such as avoiding drinking use and prolonged storage, were highly observed. However, lower engagement was noted in practices that requires effort or infrastructure (e.g., water collection and filtration).

This indicates that convenience and practicality significantly influence behavior. Consistent with SJT, many practices fall within the latitude of non-commitment, where individuals are favorable but not fully engaged.

Relationships Among AKAP Variables

Spearman's rho analysis showed significant but weak positive relationships:

- Awareness and Knowledge ($\rho = 0.290$)
- Knowledge and Attitude ($\rho = 0.229$)
- Attitude and Practice ($\rho = 0.369$)

These findings confirm that while AKAP variables are interconnected, their influence on behavior is limited. This supports environmental behavior theory that positive perceptions do not automatically translate into practice due to barriers such as uncertainty and convenience.

Differences Across Socio-Demographic Variables

No significant differences were found across municipality and gender. This suggests uniform perceptions across locations and sexes.

Significant differences were observed across:

- Age - younger groups showed higher awareness and knowledge
- Education - higher education linked to better knowledge and attitude
- Occupation - government employees and retirees showed higher engagement
- Economic status - lower-income groups demonstrated higher practice levels

These findings indicate that individual and socio-economic factors, rather than geographic location, shape engagement with greywater reuse.

Notably, lower-income households showed stronger practice levels, which suggest that economic motivation drives conservation behavior, while higher-income groups exhibit stronger knowledge but lower implementation.

Implications for Communication and Practice

The findings reveal a clear knowledge-practice gap. While respondents are aware, knowledgeable, and positive toward greywater reuse, actual implementation remains moderate.

This gap is influenced by lack of procedural knowledge, perceived effort and inconvenience, and limited access to practical guidance.

To address this, targeted communication strategies are necessary to provide simple, step-by-step guidance, emphasize safe and practical applications, align messages with economic and environmental benefits.

Development of Information Materials

Based on the findings, the study developed research-based information materials (posters, brochures, and a comic book) to promote greywater reuse.

These materials aim to:

- Simplify greywater concepts
- Address safety concerns
- Provide practical instructions
- Encourage household-level practice

The materials were designed using simple language, visual illustrations, and step-by-step guidance to improve accessibility and engagement. Multi-channel dissemination (barangays, schools, and digital platforms) is recommended to maximize reach.

Conclusions

Based on the analysis of the findings, the following conclusions are drawn:

1. On Socio-Demographic Profile of the Respondents from Rizal Province

The respondents are largely composed of economically active household heads that belongs to young and middle adulthood groups with high levels of educational attainment and belonging to lower- to middle-income households. Many respondents are employed in the private sector and contribute actively to household decision-making related to daily resource use. These demographic characteristics suggest that the respondents possess the cognitive capacity and social position to influence household water management practices. This makes them an important group for promoting sustainable water use behaviors.

2. On the level of awareness of greywater reuse

The findings indicate that household heads in Rizal Province possess a general awareness of greywater reuse and its role in water conservation. Respondents recognize that greywater originates from household activities such as bathing, laundry, and sink use and can be reused for non-potable purposes. However, awareness appears to be shaped more by general environmental understanding rather than exposure to communication initiatives from the institutions. This suggests that while the concept of greywater reuse has entered the public consciousness, government-led campaigns and organized communication efforts remain limited.

3. On the level of knowledge of greywater reuse

The respondents showed a high level of knowledge regarding greywater reuse, particularly in understanding its environmental benefits, appropriate applications, and potential health risks. This indicates that the population already possesses a strong conceptual understanding of greywater reuse. However, the findings also revealed a distinction between conceptual knowledge and procedural knowledge. While respondents understand what greywater reuse is and why it is beneficial, there remains some uncertainty regarding the practical steps required to safely implement reuse practices within the household setting.

4. On the level of attitude toward greywater reuse

The respondents exhibited a very positive attitude toward greywater reuse. Respondents believed that greywater reuse contributes to water conservation and environmental protection, and many expressed willingness to learn and apply proper reuse methods. This suggests that greywater reuse is viewed as a practical and acceptable approach to manage household water resource

5. On the level of practice of greywater reuse

Greywater reuse practices are present among households but are implemented at a moderate level. Respondents tend to adopt simple and convenient practices that can easily be integrated into existing household routines, such as using greywater for toilet flushing, watering plants, and cleaning outdoor areas. In contrast, practices that require additional effort, storage systems, or behavioral adjustments are less commonly adopted. This suggests that while households accept the idea of greywater reuse, practical considerations such as convenience, time, and resources influence the extent to which knowledge and attitude are translated into consistent practice.

6. On the significant relationships among AKAP

The findings confirm that awareness, knowledge, attitude, and practices function as interconnected components in influencing the Rizal residents engagement with greywater reuse. Awareness contributes to the development of knowledge regarding the concept and potential benefits of greywater reuse, while knowledge appears to influence attitude toward the adoption of the practice. Attitude, in turn, were found to be associated with the possibility of implementing greywater reuse practices within the household. Among the relationships examined, attitude demonstrated the strongest association with practice. This suggest that favorable perceptions of greywater reuse increase the possibility of greywater adoption.

However, the weak strength of the correlations indicates that positive attitude and knowledge alone may not necessarily result in consistent implementation of greywater reuse practice. According to Social Judgment Theory, individuals evaluate new ideas and practices relative to their existing beliefs and experiences. In the context of greywater reuse, the practice may be recognized as beneficial but may still be positioned within individuals' latitude of non-commitment, where the concept is neither rejected nor fully adopted. As a result, although households may express positive evaluations of greywater reuse,

uncertainties related to safety, practicality, or household routines may limit the consistent application of the practice.

These suggest that additional communication efforts and practical guidance on safe and convenient greywater reuse practices may help shift perceptions toward the latitude of acceptance, thereby encouraging greater adoption of greywater reuse practices among households.

7. On the significant differences in AKAP when grouped according to socio-demographic variables

The study also revealed that the practice of greywater reuse varies across several socio-demographic profiles. Significant differences were observed when respondents were grouped according to age, educational attainment, occupation, and economic status. These differences suggest that exposure to environmental information, economic considerations, and occupational experiences influence how households evaluate and practice greywater reuse. However, no significant differences were observed across municipality and gender. This indicates that the general acceptance of greywater reuse is relatively consistent across geographic locations and between male and female household heads.

Considering the foregoing, the findings suggested that household heads in Rizal Province within the East Zone are open to the concept of greywater reuse and they recognize its value as a water conservation initiative. Awareness, knowledge, and attitude toward the practice are already well established. This indicates that the concept is largely accepted within household evaluative frameworks. However, the moderate level of practice indicates that the transition from understanding and acceptance to consistent behavioral adoption is influenced by practical considerations such as convenience, household routines, and access to simple implementation methods. To help bridge the gap between favorable perceptions and sustained greywater reuse practices, there is a need to strengthen practical guidance, accessible information materials, and household-level support mechanisms.

Finally, based on the results of the assessment of AKAP levels in the province of Rizal, the researcher concludes that there is a need to develop information materials focusing on key greywater reuse practices, particularly the following:

1. Ways to make the greywater safe
2. Collecting and reusing bathwater
3. Collecting and reusing handwashing water
4. Teaching others in proper greywater reuse

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