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Social adoption of ecotechnology for the self-management of water in community spaces and processes

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INTRODUCTION & AIM

Access to essential resources, including water and sustainable energy, remains inadequate across Mexico. Rural communities often lack sufficient access to basic resources, with about 46.2% of Mexico's population living below the poverty line, facing a deficiency in water access and basic services (CONEVAL, 2016). Industrialized technology approaches often disregard community-specific needs, leaving gaps in addressing local resource management sustainably (Leff, 2000). Ecotechnology, particularly for water, allows communities to adopt low-impact, culturally congruent solutions that support self-management, environmental respect, and resilience. This research emphasizes the role of ecotechnology in environmental conservation and social empowerment, presenting a viable, equitable approach for water access and self-sufficiency (Rogers, 2003; Gavito et al., 2017; Vega Encabo, 2004).

OBJECTIVE

This study aims to analyze and promote the social adoption of water-focused ecotechnologies to bolster water management and resilience in rural communities. Implemented technologies include rainwater harvestinwithg systems, cisterns, filters, and ecological dry toilets. By aligning these technologies local cultural, environmental, and social dynamics, we aim to empower communities to manage their water resources autonomously and sustainably (UNESCO-UNEP, 1997; Ortiz & Masera, 2014).

METHOD

1. Comprehensive Literature Review

An extensive literature review explored social and technological frameworks, focusing on social adoption processes, technology transfer, and the interplay between technological and cultural knowledge. This review covered foundational theories on social and technological acceptance, as well as ecological knowledge, essential for fostering sustained and meaningful adoption. Core references include work by Leff (2004) on sustainable rationality and Olivé's (2012) insights on integrating traditional knowledge with modern ecological practices. The review underscores the need to contextualize technology within a community's sociocultural structure, fostering a holistic process that combines technical education, community empowerment, and cultural compatibility (Freire, 1976; Torres & Cruz-Castillo, 1999).

2. Development of Community-Centric Tools

•**Questionnaires**: Three levels of questionnaires were developed to gauge community perceptions and willingness regarding water resource issues and the adoption of ecotechnologies. The first section addresses awareness and local concerns on water scarcity; the second section introduces ecotechnologies to assess knowledge and interest; and the third evaluates potential impacts on the quality of life (Álvarez-Castañón & Tagle-Zamora, 2019).

•**Training Workshops**: Workshops were structured in stages to educate community leaders and volunteers in ecotechnology installation, maintenance, and community engagement. Initial sessions trained local facilitators to build alliances, followed by community workshops on ecotechnologies to foster widespread understanding and support for sustainable practices (Ponce & Vega, 2009; UNESCO, 2012).

•**Ecotechnology Manual for Water**: This educational manual includes practical guidance on ecotechnology implementation, presenting accessible and user-friendly steps for SCALL systems, filters, and eco-toilets. It emphasizes eco-friendly practices that align with local knowledge and environmental needs (Espejel & Castillo, 2008; Morfín, 2014).

3. Community Implementation Process

Guanajuato's rural communities were selected as pilot sites for ecotechnology applications. Variables such as local customs, technical knowledge, environmental constraints, and socioeconomic factors were considered in evaluating each ecotechnology's appropriateness. The flexibility and adaptability of these systems were emphasized to ensure their practical fit and cultural relevance in each community context (Vink, 1975; Tagle-Zamora, 2016).

RESULTS

Key Attributes of Social Adoption

Through community assessments and workshops, five attributes were identified as crucial for successful social adoption (Rogers, 2003):

•**Relative Advantage**: Ecotechnologies demonstrated clear benefits over traditional methods, such as cost savings compared to annual water truck purchases.
•**Compatibility**: The alignment of ecotechnologies with existing community values and daily routines positively influenced adoption.
•**Complexity**: Ensuring the simplicity and ease of ecotechnology use was essential, with residents reporting comfort and understanding in using SCALL systems.
•**Reliability**: Stable, secure technology use contributed to a positive user experience, fostering greater adoption.
•**Observability**: Directly observable benefits, including reduced water costs and increased water security, helped to reinforce community trust and interest in these technologies.

Factors of Success in Technology Transfer

The findings suggest that ecotechnology adoption is maximized with strong participatory methods and continuous education. Key factors included:

•**Active Community Participation**: Community members were involved at each stage, from identifying water issues to evaluating ecotechnology outcomes, fostering a sense of ownership and commitment (Sandoval-Moreno & Günther, 2015; Mata et al., 2007).
•**Environmental Education**: Educational tools provided valuable insights into sustainable practices, strengthening local knowledge and encouraging long-term use of ecotechnologies (Ortiz & Masera, 2014).
•**Adaptability of Ecotechnologies**: Community-specific adaptations were made to ensure resource accessibility and longevity, adapting to the unique environmental, economic, and social characteristics of each location (Vega Encabo, 2004; Pacheco & Gómez, 2007).

DISCUSSION & CONCLUSION

Ecotechnologies for water self-management transcend technical solutions, promoting socio-cultural transformation and resource independence. The findings indicate that water-related ecotechnologies are highly effective in creating sustainable and resilient communities, especially when aligned with environmental education and active local participation. These socially inclusive approaches ensure technology is perceived not just as a tool, but as a means for cultural and ecological improvement, fostering a community-centered approach to water management (Freire, 1976; Gavito et al., 2017).

FUTURE WORK

Scaling this model to broader rural and peri-urban communities across Mexico requires tailoring to local contexts, prioritizing participatory implementation. Public policy support for technology transfer and community capacity building is essential to empower these communities and ensure that ecotechnologies contribute meaningfully to the Sustainable Development Goals (Fressoli et al., 2013; González, 2015).

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