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Women in Agri-Startups: Transforming crop waste into business opportunities

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Abstract

The increasing global emphasis on sustainability has driven agri-startups to explore innovative approaches for transforming agricultural by-products into valuable commodities. Value addition to crop biomass and farm waste presents an opportunity to enhance sustainability, reduce environmental impact, and generate new income streams. This study evaluates the perspectives of farm women in the Garo Hills of Meghalaya regarding waste utilization, their willingness to adopt sustainable practices, and their entrepreneurial interest in value-added products. Survey data revealed that 70.25% of respondents expressed a strong interest in using eco-friendly materials like plant fiber pots, compost, and biodegradable paper. Additionally, 54.88% identified value addition to farm waste as beneficial for income generation. Findings highlight the potential for Agri-entrepreneurship in waste valorisation and underscore the need for collaboration among stakeholders to maximize economic and environmental benefits.

Keywords: Crop biomass, farm waste, entrepreneurship, agro waste, waste utilization

Introduction

Global awareness of environmental sustainability has driven interest in developing eco-friendly, circular economic practices within agriculture. The shift from linear “produce and discard” models to circular systems, which focus on reusing waste, has spurred innovation across the agricultural sector. In India, where the agricultural sector provides employment for the majority of the population, waste management remains a critical issue. Although traditionally viewed as waste, crop biomass and farm waste offer potential raw materials for new products that meet both local and global demand for sustainable goods.

In the Garo Hills of Meghalaya, rural communities, especially women, are increasingly recognized as critical players in agriculture and waste management. The present study explores farm women's perspectives on adding value to farm waste and crop biomass. It assesses their willingness to adopt sustainable waste processing practices. The study also examines their interest in creating new income streams through value-added products. By leveraging these perspectives, the study aims to address waste management issues and foster innovation, ultimately contributing to a circular economy in the region.

Waste management has become an integral part of sustainable agricultural practices. Literature suggests that the agricultural sector generates a significant amount of biomass and other organic waste, which, if properly processed, can be transformed into useful products. Research has highlighted the importance of utilizing crop residues, which constitute a significant portion of agricultural waste, as valuable inputs for bioenergy

production, compost, and biodegradable materials (Gupta *et al.*, 2020) ^[20]. Farm women often play a central role in agriculture, particularly in small-scale farming. Women's contributions range from planting and harvesting to waste management, making them integral to efforts that seek to utilize agricultural by-products. Studies indicate that empowering rural women through training and access to technology can improve farm productivity and environmental outcomes (Singh & Raj, 2019) ^[21]. Entrepreneurship has gained traction as a solution for waste management in rural areas. Agricultural start-ups and community-based initiatives can turn waste into innovative, marketable products, creating economic opportunities for small-scale farmers (Kumar *et al.*, 2021; Swapnil Gupta *et al.*, 2019; Murugesan Mohana Keerthi-2024; Rajesh *et al.*, 2019; Lellapalli Rithesh-2020.) ^[4, 9, 8, 5, 3]. For the Garo Hills community, value-added products such as compost, plant fiber pots, and sustainable packaging materials represent untapped potential, offering income opportunities and reducing the reliance on traditional waste disposal methods.

Methodology

Locale of the Study

The Garo Hills, located in Meghalaya, India, is a predominantly Tribal area where agriculture forms the backbone of the local economy. This study was conducted with farm women actively involved in farming practices in the specific region. The area's unique agricultural practices, reliance on traditional knowledge, and existing challenges related to waste management made it a suitable location for the study.

Data collection was conducted through a survey in selected locales, employing direct interviews with a structured questionnaire to gather information on demographic, socio-economic, and employment details, as well as environmental, agricultural, cultural, and administrative aspects. A total of 800 families were selected from eight adopted villages, with 100 families surveyed per village. The study encompassed two districts: West Garo Hills and South West Garo Hills. Specifically, four blocks were chosen for data collection: Dalu and Gembegre blocks from West Garo Hills, and Zikzak and Rerapara blocks from South West Garo Hills.

Research Design and Data Collection

Present study employed a mixed-methods approach, utilizing both quantitative and qualitative data to gain a comprehensive understanding of the perspectives of farm women regarding waste utilization and sustainable practices. A structured questionnaire was developed and administered to a total of 800 farm women across the selected villages in the Garo Hills. The questionnaire was designed to gather quantitative data on several key areas, including respondents' perceptions of waste utilization, their potential interest in adopting sustainable agricultural practices, and their views on the perceived benefits of value addition to agricultural products. The questionnaire included a combination of closed-ended questions, which provided measurable data, and open-ended questions, allowing for a broader range of responses.

In addition to the quantitative survey, in-depth interviews were conducted with a subset of respondents to capture qualitative insights. These interviews aimed to explore the motivations, attitudes, and barriers that farm women face in adopting new practices. The interviews provided an opportunity for respondents to express their thoughts and experiences in their own words, offering richer context to the survey data. This qualitative component was crucial for understanding the nuances of their willingness to embrace sustainable practices and the challenges they encounter in the process.

Data Analysis

The analysis of data collected in this study involved both quantitative and qualitative methodologies to ensure a comprehensive understanding of the perspectives of farm women regarding waste utilization and sustainable practices. The quantitative data obtained from the structured surveys were analyzed using descriptive statistics. This involved calculating the frequency and percentage of respondents who expressed interest in various sustainable practices, such as the use of eco-friendly materials for manufacturing products and the potential for value addition from agricultural waste. Data analysis enabled the identification of patterns and trends in the responses, providing a quantitative basis for understanding the willingness of farm women to adopt sustainable methods in their agricultural activities. The qualitative data gathered from the in-depth interviews were subjected to thematic analysis. This process involved coding the interview transcripts to identify recurring themes and patterns in the respondents' perspectives on waste utilization and entrepreneurial opportunities. This thematic analysis provided deeper

insights into the motivations, attitudes, and challenges faced by farm women. By integrating qualitative findings with quantitative data, the study was able to present a holistic view of the factors influencing waste utilization and sustainable practices in the Garo Hills.

Results and Discussion

Demographic Profile

The demographic analysis of the respondents reveals valuable insights into the profile of individuals involved in farming within the community. The majority of participants were aged between 30 and 55 years, a demographic that typically embodies a balance of experience and adaptability. Most respondents had limited formal education, often reflecting broader systemic issues in educational access in rural areas. However, this lack of formal schooling was offset by extensive practical experience in agriculture, indicating a deep-rooted understanding of farming practices and local ecosystems.

In terms of landholdings, a significant number of respondents managed small farms, which are characteristic of many rural communities. The average family size was five members, emphasizing the importance of family labor in agricultural activities. Farming served as the primary source of income for these families, underscoring the critical role of agriculture in their economic sustainability and daily lives. This demographic information suggests that the respondents are not only deeply invested in their agricultural practices but also open to exploring sustainable innovations that could enhance their livelihoods.

Attitudes toward Sustainable Practices and Value Addition

The survey findings reveal a pronounced inclination among respondents toward adopting sustainable agricultural practices. Notably, 70.25% of respondents expressed a willingness to utilize eco-friendly materials for manufacturing products, such as nursery plant fiber pots, compost, and paper. This strong interest in green materials indicates a readiness to explore alternatives to traditional waste disposal methods, which are often detrimental to the environment. The enthusiasm for sustainable practices reflects a growing awareness of environmental issues and the benefits of reducing reliance on synthetic materials.

This readiness to embrace sustainability is a positive indicator for the potential adoption of value-added processes that rely on eco-friendly materials. The respondents' interest in green materials not only aligns with contemporary environmental goals but also presents an opportunity for integrating traditional knowledge with modern sustainable practices. This shift towards sustainability is crucial as it suggests that farmers are not just seeking to improve their income but are also concerned about their environmental impact, indicating a potential shift toward more responsible farming practices.

Perceived Benefits of Waste Valorization

The respondents recognized numerous economic and environmental benefits associated with waste valorization. Over half (54.88%) indicated that generating income through value addition from farm waste would be advantageous. This recognition of the economic potential

inherent in converting agricultural residues into marketable products demonstrates a pragmatic understanding of the challenges posed by waste management. Many respondents acknowledged that valorization could significantly alleviate their waste disposal burdens while simultaneously generating economic value.

The interest in producing items derived from plant-based waste, such as compost, plant fiber pots, and paper, highlights a specific preference among respondents for leveraging agro-waste in beneficial ways. This preference not only aligns with sustainable practices but also reflects a significant shift towards a circular economy mindset, where waste is not merely disposed of but transformed into valuable resources. The expressed openness to exploring various uses for agro-waste, crop biomass, and household waste indicates a willingness to innovate and diversify income sources, which is vital for enhancing economic resilience.

The study underscores the substantial opportunities for innovation in waste valorization. By empowering farm women to convert waste into marketable products, communities can effectively reduce waste while simultaneously boosting their economic resilience. Initiatives such as compost production and plant fiber manufacturing are particularly well-suited to the respondents' existing skills and available resources, suggesting that these practices could be adopted more easily and effectively within the community.

Crop Biomass and Farm Waste utilization

The data pertaining to value addition to crop biomass and farm waste unveils various perspectives and preferences among farmers, shedding light on opportunities for innovation and sustainable practices. Total 39% of farmers acknowledge the utility of utilizing processing waste to create high-fiber value-added products. This indicates a recognition of the potential to extract additional value from agricultural by-products, contributing to both waste reduction and the generation of income streams through value-added products.

Furthermore, a significant majority, comprising 70.25% of respondents, express interest in utilizing green materials for manufacturing plant fiber pots and packaging materials. This reflects a growing emphasis on sustainable packaging solutions and a desire to reduce reliance on non-biodegradable materials, aligning with broader environmental conservation efforts.

Additionally, 21.37% of respondents see potential in utilizing crop biomass for the development of composites, paper, and other products. This suggests a willingness to explore alternative uses for agricultural residues, fostering innovation in material science and contributing to the circular economy by repurposing waste materials. Promotion of mechanization for crop residue management is deemed important by another 19.25% of respondents. This underscores the need for technological solutions to address challenges related to crop residue disposal, such as stubble burning, while promoting more sustainable practices that preserve soil health and air quality. Data reveals the importance of exploring innovative approaches to value addition in agriculture and waste management, while also emphasizing the broader shift towards sustainability and

environmental stewardship within the agricultural sector. By leveraging these opportunities and embracing sustainable practices, farmers can enhance resource efficiency, generate additional income through startups, and contribute to the resilience and sustainability of agricultural systems

Value added products for startups

Data indicates that approximately 56.62% of respondents perceive utility in consumer products derived from agro waste. Agro waste refers to the by-products generated during agricultural activities, such as crop residues, husks, and stalks. The positive response suggests a recognition of the potential to convert agricultural waste into value-added products that meet consumer needs and preferences. Examples of such products may include biodegradable packaging materials, biomass briquettes for fuel, or natural fibers for textiles. The interest in consumer utility products from agro waste reflects a commitment to waste valorization and resource optimization in agriculture, contributing to sustainable resource management and economic diversification. With a positive response rate of 60.12%, respondents express a favorable attitude towards value addition processes applied to crop biomass and farm waste. This encompasses various techniques and technologies aimed at converting agricultural residues and by-products into higher-value products with increased marketability and utility. Value addition may involve processes such as composting, biofuel production, or extraction of bioactive compounds for pharmaceutical or industrial applications. The positive response underscores a recognition of the economic, environmental, and social benefits associated with value addition in agriculture, including waste reduction, income generation, and sustainable livelihoods for farmers.

The positive response rate of 88.62% indicates a high level of interest in value-added products derived from household waste, encompassing both degradable and non-degradable materials. Household waste includes a wide range of discarded items, such as food scraps, packaging materials, plastics, and paper products. The positive response suggests a recognition of the potential to convert household waste into useful products through recycling, upcycling, or conversion processes. Examples of value-added products from household waste may include recycled paper products, composted organic matter for soil amendment, or repurposed plastic materials for construction or crafts. The high level of interest reflects a growing awareness of the environmental and economic benefits of waste valorization, including waste diversion from landfills, resource conservation, and creation of new market opportunities for recycled materials.

Therefore, it is concluded that the data indicates a favorable attitude towards value-added products derived from various waste streams, including agro waste, crop biomass, farm waste, and household waste. Respondents recognize the potential to convert waste materials into valuable resources through innovative technologies and value addition processes, supporting sustainable development goals such as waste management, resource conservation, and economic diversification. The findings underscore the importance of promoting circular economy principles and fostering collaborations between stakeholders to unlock the economic

and environmental potential of waste valorization in agriculture and households.

Challenges to Implementation

Despite the potential benefits identified, respondents also pointed out several challenges hindering the implementation of waste valorization practices. A significant barrier was the lack of access to advanced technology, which is essential for efficient processing and production of value-added products. Additionally, there was limited knowledge regarding appropriate processing techniques, which could prevent farmers from maximizing the potential of their waste materials. Addressing these barriers will require a concerted effort among various stakeholders, including government agencies, educational institutions, and NGOs. Collaborative initiatives aimed at providing training, resources, and infrastructure will be essential for enabling farm women to overcome these challenges and successfully implement sustainable waste utilization practices.

To effectively harness the potential of waste valorization, partnerships among stakeholders such as government bodies, startups, NGOs, and research institutions are vital. Such collaboration can enhance market access, provide financial support, and facilitate technical training, ultimately empowering farm women to achieve sustainable waste utilization. By fostering an environment of collaboration and innovation, the community can work towards realizing the benefits of waste valorization while contributing to broader environmental and economic sustainability goals.

Conclusion

Thus, present study highlights a promising interest among farm women in the Garo Hills for sustainable practices and waste valorization. A majority of respondents recognize the potential of crop biomass and farm waste as valuable resources, indicating an openness to incorporating value-added products into their agricultural practices. These findings suggest that with the right support and resources, farm women can lead the transition to a circular economy, where agricultural by-products become inputs for new products, reducing waste and generating income. Policymakers should consider targeted interventions that facilitate access to technology, training, and markets to enable farm women to capitalize on these opportunities, thereby contributing to sustainable development in rural communities.

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