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Market potential and processing economics of banana-fibre reusable sanitary pads in Raigarh district, Chhattisgarh

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Abstract

The increasing concern over environmental pollution, agricultural waste and the need for sustainable menstrual hygiene products has created interest in reusable and eco-friendly sanitary pads. Banana fibre, obtained from banana plant residues, represents a potential waste-to-wealth resource that can be utilised in the production of reusable sanitary pads. However, limited empirical evidence is available regarding the social acceptance, market potential, production economics and business challenges associated with banana-fibre reusable sanitary pads in Raigarh district of Chhattisgarh. The present study was undertaken to assess the sustainability and market potential of banana-fibre reusable sanitary pads, examine the production and business activities of the selected enterprise, estimate the processing cost involved in production and identify the major production and business challenges faced by the enterprise. The study was conducted in Raigarh district with special reference to Shanti Anand Wellness Private Limited during 2025–26. Primary data were collected from 74 respondents through a structured questionnaire, while enterprise-level information was obtained regarding production, procurement, processing, cost and business activities. The collected data were analysed using percentage analysis and mean score ranking based on a five-point Likert scale. The findings revealed that 85.14 per cent of respondents were aware of banana-fibre reusable sanitary pads, indicating a relatively high level of consumer awareness. Further, 74.32 per cent of respondents were either willing or highly willing to adopt banana-fibre reusable sanitary pads, indicating considerable market potential for the product. Medical/pharmacy shops were the most preferred purchase outlet, accounting for 43.24 per cent of respondents, followed by general/grocery stores at 27.03 per cent. The enterprise had a daily production capacity of 100 pads against actual production of around 60 pads per day, resulting in 60 per cent capacity utilisation. The annual production was estimated at 18,000 pads. The total annual production cost was ₹2,43,000, while gross return from the sale of 18,000 pads at ₹70 per pad was ₹12,60,000. The resulting net return was ₹10,17,000, with a Benefit–Cost (B:C) ratio of 4.18, indicating favourable economic returns and commercial viability.

The major challenges identified were lack of consumer awareness, actual production being lower than installed capacity, regular supply of raw materials, training requirements, limited product promotion, limited market reach and production-related constraints. The findings indicate that strengthening consumer awareness, improving production capacity, ensuring regular raw-material supply, enhancing product promotion and expanding retail and distribution networks can further improve the market potential and sustainability of banana-fibre reusable sanitary pads. Overall, the study demonstrates that banana-fibre reusable sanitary pads have promising social, environmental and economic potential and can contribute to waste-to-wealth initiatives, sustainable menstrual hygiene management and income generation in the study area.

Keywords: Banana fibre; reusable sanitary pads; sustainability; market potential; waste-to-wealth; consumer awareness; production economics; processing cost

1. Introduction

Menstrual hygiene management (MHM) is a fundamental aspect of women's health, dignity and well-being. Access to safe, hygienic and affordable menstrual products is essential for maintaining reproductive health, reducing the risk of infections and enabling women and adolescent girls to participate confidently in education, employment and daily activities. However, millions of women, particularly in rural and economically weaker sections, continue to face challenges due to limited access to quality menstrual hygiene products, inadequate awareness and poor sanitation facilities. The World Health Organization (WHO) and UNICEF have

recognized menstrual hygiene as an important component of public health and gender equality (WHO and UNICEF).

Conventional sanitary pads are primarily manufactured using plastic-based materials such as polyethylene, polypropylene and super absorbent polymers. Although these products are convenient, they generate a significant amount of non-biodegradable waste. A single disposable sanitary pad may take several hundred years to decompose, contributing to environmental pollution and increasing pressure on waste management systems. Growing environmental concerns and increasing awareness of sustainable development have encouraged researchers and entrepreneurs to explore

biodegradable and eco-friendly alternatives to conventional menstrual products (UNEP, 2021 and CPCB, 2022) ^[4, 1].

Banana fibre has emerged as a promising natural material for manufacturing sustainable sanitary pads. It is extracted from the banana pseudostem, an agricultural residue that is generally discarded after harvesting. Banana fibre possesses desirable characteristics such as high absorbency, biodegradability, softness, lightweight structure, breathability and antimicrobial properties, making it suitable for hygienic products. Utilization of banana fibre not only provides an environmentally friendly substitute for plastic-based materials but also promotes effective utilization of agricultural waste (Vigneswaran *et al.*, 2015) ^[23].

India is one of the world's largest producers of bananas, generating huge quantities of banana pseudostems every year. Most of this biomass is treated as agricultural waste despite its considerable commercial value. Converting banana waste into value-added products such as reusable sanitary pads represents an excellent example of the "Waste-to-Wealth" concept, supporting the principles of circular economy, resource efficiency and sustainable agribusiness. Such innovations contribute to environmental conservation while creating additional income opportunities for farmers and rural entrepreneurs (MoFPI, 2018 and NITI Aayog, 2022).

Hence, the present study attempts to empirically assess the market potential and processing economics of banana-fibre reusable sanitary pads in Raigarh District, Chhattisgarh. The objectives of the study were as follows:

1. To assess the social and market potential of banana-fibre reusable sanitary pads in the study area.
2. To estimate the cost of processing banana fibre in making reusable sanitary pads.

2. Research Gap

Although previous studies have examined menstrual hygiene, banana fibre technology and banana cultivation, very few have focused on the commercial production and market potential of banana-fibre reusable sanitary pads. Existing research provides limited information on production costs, consumer awareness, willingness to pay and business challenges at the enterprise level. Furthermore, no comprehensive study has evaluated these aspects for Shanti Anand Wellness Private Limited (Project AARUG) in Raigarh district. Therefore, this study aims to bridge this gap by assessing the sustainability, market potential and business feasibility of banana-fibre reusable sanitary pads.

3. Materials and Methods

3.1 Study area

Raigarh district of Chhattisgarh was purposively chosen as the study area. The district was selected primarily because of the presence of Shanti Anand Wellness Private Limited, which is involved in the development of reusable sanitary pads using banana fibre. The enterprise provides a relevant case for examining the application of a waste-to-wealth approach in agribusiness and for assessing the sustainability and market potential of banana-fibre-based sanitary products.

3.2 Sampling procedure and justification

A purposive (judgmental) sampling design was used, with 74 respondents selected from, Raigarh district consumers and potential users of sanitary hygiene products, along with stakeholders linked to Shanti Anand Wellness Private Limited (Project AARUG). Given the absence of a formal sampling frame for this consumer group and resource constraints, non-random purposive selection was adopted as a practical alternative. The sample size is consistent with comparable studies, such as Achuthan *et al.* (2021) ^[1] and Tiwari (2024) ^[21] on banana-fibre sanitary pads in India.

3.3 Questionnaire design

Data were collected through a structured questionnaire comprising three sections. Section A captured the respondent's demographic profile, including age, education, occupation, income, and source of awareness about reusable sanitary pads. Section B assessed awareness and usage, covering familiarity with banana-fibre reusable pads, current product used, and willingness to switch along with the reason. Section C examined purchase behaviour, including affordable price range, factors influencing purchase decisions, preferred place of purchase, and perceived economic and social acceptance of reusable sanitary products.

3.4 Statistical tools and technique

The collected data were coded, tabulated and analyzed using a spreadsheet and statistical software.

The following statistical techniques were used:

Percentage analysis: $\text{Percentage (\%)} = (\text{Frequency} / \text{Total Respondents}) \times 100$, used for distribution across variables.

Likert Scale: $\text{Weighted Mean Score} = \frac{\sum (\text{Frequency} \times \text{Score})}{\text{Total Number of Respondents}}$

Cost Analysis: $\text{Total Cost} = \text{Fixed Cost} + \text{Variable Cost}$

Benefit-Cost Ratio: $\text{BCR} = \text{Gross Return} \div \text{Total Cost}$

4. Results

Table 1: Age-wise distribution of respondents (N=74)

Age group	Frequency	Percentage (%)
Below 18	4	5.41
18–25	49	66.22
26–35	16	21.62
36–45	4	5.41
Above 45	1	1.35
Total	74	100

The majority of respondents (66.22%) belonged to the 18–25 years age group, followed by 21.62% in the 26–35 years group. Thus, the respondents were predominantly young adults.

Consumer Awareness of Banana-Fibre Reusable Sanitary Pads

Table 4: Consumer Awareness (n=74)

S. No.	Consumer Awareness	Frequency	Percentage (%)
1	Yes	63	85.14
2	No	11	14.86
Total		74	100

Source: Primary Data (2025-26)

The high level of awareness (85.14%) indicates good consumer familiarity and favourable market potential for banana-fibre reusable sanitary pads in the study area. However, 14.86% of respondents were still unaware, suggesting the need for awareness programmes, product demonstrations and promotional activities to improve consumer knowledge and acceptance.

Type of Menstrual Products Used

Table 2: Type of Menstrual Products Used by Respondents (n=74)

S. No.	Menstrual Product Currently Used	Frequency	Percentage (%)
1	Disposable sanitary pads	44	59.46
2	Reusable cloth pad	7	9.46
3	Banana-fibre reusable	20	27.03
4	Other menstrual pad	3	4.05
	Total	74	100

Source: Primary Data (2025-26)

Disposable sanitary pads were the most commonly used

Table 4: Market Preference for Different Types of Sanitary Pads

Age Group	Disposable Sanitary Pad	Reusable Cloth Pad	Banana-fibre Reusable Sanitary Pad	Other	Total
Below 18	3	0	1	0	4
18–25	28	5	15	2	49
26–35	10	2	4	0	16
36–45	3	0	1	0	4
Above 45	0	0	0	1	1
Total	44	7	20	3	74

Source: Primary Data (2025-26)

The findings show that the 18–25 years age group formed the major share of respondents, with 15 respondents preferring banana-fibre reusable sanitary pads. Disposable sanitary pads were preferred by 30 respondents in the same age group. The results indicate that younger consumers, particularly those

menstrual product (59.46%), followed by banana-fibre reusable pads (27.03%), reusable cloth pads (9.46%) and other menstrual pads (4.05%). The use of banana-fibre reusable pads by more than one-fourth of the respondents indicates existing consumer acceptance and potential for market expansion of sustainable menstrual products in the study area.

Willingness to Adopt

Table 3: Willingness to Pay for Banana-Fibre Reusable Sanitary Pads (n=74)

S. No.	Price	Frequency	Percentage to total
1	50 – 100	49	66.22
2	100 – 200	19	25.68
3	200 – 300	4	5.41
4	Above 300	2	2.70
	Total	74	100

Source: Primary Data (2025-26)

Majority of respondents (66.22%) were willing to pay ₹50–100, followed by 25.68% willing to pay ₹100–200. Only 5.41% and 2.70% were willing to pay ₹200–300 and above ₹300, respectively. The findings indicate that affordability is an important consideration for consumers, suggesting that competitive pricing may support wider adoption and market potential of banana-fibre reusable sanitary pads.

Age-wise Distribution of Respondents According to Market Preference for Different Types of Sanitary Pads

aged 18–25 years, represent an important potential market for banana-fibre reusable sanitary pads.

Cost of Production of Banana-Fibre Reusable Sanitary Pads

Table 5: Cost of Production of Banana-Fibre Reusable Sanitary Pads (n=74)

Particulars	Cost (₹) per pad
Banana Fiber	2.5
Cotton Cloth	3
Stitching & Labour	2.5
Packaging	1.25
Transportation	2
Marketing Cost	2.25
Total Cost	13.5
Selling Price	70.00
Profit per pad	56.5

Primary source (2025-2026)

The total cost of production was estimated at ₹13.50 per pad, while the selling price was ₹70.00 per pad, resulting in a profit of ₹56.50 per pad. Among the cost components, cotton cloth accounted for the highest cost (₹3.00), followed by banana fibre and stitching & labour (₹2.50 each). The findings indicate that banana-fibre reusable sanitary pad production has favourable profitability and economic potential for the enterprise.

Cost, Return and Profitability of Banana-Fibre Reusable Sanitary Pads

Table 6: Presents the annual cost, return and profitability of banana-fibre reusable sanitary pads(n=74)

Particular	Amount (₹)
Annual Total Cost	2,43,000
Gross Return	12,60,000
Net Return	10,17,000
B:C Ratio	4.18

Primary source (2025-2026)

The analysis shows that the enterprise generated a gross return of ₹12.60 lakh and a net return of ₹10.17 lakh, with a B:C ratio of 4.18. The results indicate favourable economic returns from the production of banana-fibre reusable sanitary pads and suggest good economic potential for the enterprise.

5. Summary

The findings indicate a favourable market potential for banana-fibre reusable sanitary pads in the study area. Among the 74 respondents, 85.14 per cent were aware of banana-fibre reusable sanitary pads, while 74.32 per cent expressed willingness to adopt them. Disposable sanitary pads remained the most commonly used menstrual product (59.46%), whereas banana-fibre reusable pads were already used by 27.03% of respondents, indicating an existing level of consumer acceptance. The willingness-to-pay results showed that 66.22 per cent of respondents preferred a price range of ₹50–100, highlighting the importance of affordability in encouraging wider adoption. The economic analysis of the enterprise showed that the production cost was ₹13.50 per pad, against a selling price of ₹70.00, resulting in a profit of ₹56.50 per pad. The findings indicate favourable profitability and economic potential for banana-fibre reusable sanitary pad production. However, challenges such as consumer awareness, production capacity, raw-material supply, production costs and market promotion remain important areas requiring attention.

6. Limitations

The study is limited to 74 respondents from the selected study area of Raigarh District, which may restrict the generalisation of the findings to other areas. The study is based mainly on primary data collected through respondents' responses, and therefore, the findings may be influenced by individual perceptions and response bias. The study focuses on the social and market potential of banana-fibre reusable sanitary pads and the production and cost aspects of Shanti Anand Wellness Private Limited; hence, the findings may not represent all banana-fibre sanitary pad enterprises. The study also considers the cost and profitability based on the available

enterprise data, which may vary with changes in raw-material prices, labour costs, production volume and market conditions.

7. Conclusion

The study assessed the social and market potential, production activities and cost economics of banana-fibre reusable sanitary pads in Raigarh District, with special reference to Shanti Anand Wellness Private Limited. The findings revealed a favourable level of consumer awareness, with 85.14 per cent of respondents aware of banana-fibre reusable sanitary pads, while 74.32 per cent were willing or highly willing to adopt them. Disposable sanitary pads were still the most commonly used product (59.46%), but 27.03 per cent of respondents were already using banana-fibre reusable pads, indicating existing consumer acceptance and market potential. The willingness-to-pay analysis showed that 66.22 per cent of respondents preferred the ₹50–100 price range, highlighting the importance of affordability for wider adoption. The economic analysis further indicated that the production cost was ₹13.50 per pad, compared with a selling price of ₹70.00, generating a profit of ₹56.50 per pad. Thus, banana-fibre reusable sanitary pad production showed favourable economic potential. Overall, the study concludes that banana-fibre reusable sanitary pads have promising social acceptance, market potential and economic viability in the study area. However, greater consumer awareness, improved production capacity, regular raw-material supply, effective promotion and wider market availability are required to support their broader adoption and sustainable growth.

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