

A STUDY ON THE SCOPE OF REUSABLE MENSTRUAL PANTIES: A BOON FOR WOMEN'S HEALTH, HYGIENE AND START-UPS FROM THE INFORMAL SECTOR

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Abstract:

Menstrual health and hygiene management remain significant challenges for women in India, particularly in low-resource settings. The research aims to understand the negative impacts of disposable menstrual products on women's health and hygiene and examine the potential of period pants for startups in the informal sector. The study reveals that disposable menstrual products pose several risks to women's health, including chemical exposure, skin irritation, and increased risk of Toxic Shock Syndrome. Reusable menstrual panties offer a sustainable and healthier alternative, with potential benefits for both women's health and the environment. The research identifies significant opportunities for startups in the informal sector to enter the period panties market, including product innovation, consumer education, and leveraging e-commerce platforms. A cost feasibility analysis demonstrates the potential profitability of such ventures, with an estimated daily production capacity of 320 units and a significant profit margin per unit. The study also highlights the importance of government support through MSME-focused schemes in facilitating the growth of this market. Overall, the findings suggest that reusable menstrual panties present a promising opportunity for improving women's health and hygiene while fostering entrepreneurship in the informal sector.

Key words: Female health; Informal sector; Menstrual hygiene; Reusable menstrual panties; startups.

JEL Classification: I15, Q01, D12, M13.

I. Introduction:

A plethora of menstrual hygiene products have been introduced to the market in recent years to make menstruators' lives easier. Among these, menstrual undergarments, commonly known as "period panties," stand out as some of the most advanced sanitary products available. In India, the demand for affordable feminine hygiene products, coupled with increasing awareness about women's health, is driving market growth. The expanding professional female population is also boosting the demand for period panties. These innovative products, available in Lite, Heavy, and Ultra absorbency levels, are primarily sold online, benefiting from the growing internet usage in both developed and developing countries. According to HealthFab, a leading intimate care brand, the Indian period panty market is expected to grow at a compound annual growth rate (CAGR) of 21%, reaching a total market value of \$13 million by 2025 (Financial Express, 2023).

Government initiatives are increasing awareness of period care products. For example, the Indian government has launched programs to educate women and girls in rural areas about menstruation and period care products. As a result, women are rapidly adopting advanced menstrual care solutions, which is expected to drive the growth of the period underwear market soon.

The informal economy is gaining prominence in both industrialized and emerging nations, recognized for its role in knowledge production and creative endeavours. Despite limited comprehensive studies, recent attention from development economists highlights its innovative capacity. Notably, Bhaduri (2016) and Sheikh (2014) emphasize the sector's intricate knowledge processes. Contrary to the myth of lacking creativity, studies, including those by White (2014), demonstrate the informal sector's innovative richness. India, despite its instability, exemplifies dynamic growth and innovation. Loayza and Rigolini (2011) argue that informal employment can drive growth due to its resourcefulness. Basole (2014) challenges claims of incompetence among informal workers, affirming their ability to innovate.

The reusable menstrual panties market is growing as a health-conscious and eco-friendly alternative to single-use products, presenting a promising opportunity for start-up entrepreneurs. This article examines the market's expansion, emphasizing its benefits for women's health and the innovation potential for informal startups.

I. Research Problem:

The study addresses the dual challenge of inadequate menstrual hygiene solutions and their impact on women's health in India, particularly in low-resource settings, while also exploring the potential for entrepreneurial avenues

in the informal sector. The problem encompasses the health risks associated with disposable menstrual products, the need for sustainable alternatives, and the lack of entrepreneurial opportunities in menstrual health management.

II. Significance of the Study:

This study is significant as it not only addresses critical health and environmental issues but also identifies a promising market for innovation and growth within the informal sector. Reusable menstrual panties offer a dual advantage: they provide a cost-effective, sustainable solution for menstrual hygiene management and create opportunities for local artisans and small-scale producers. By fostering entrepreneurship and emphasizing product innovation, education, and quality assurance, this study anticipates a positive impact on women's lives. Additionally, it aligns with global sustainable development goals by promoting gender equality, improving health outcomes, and reducing environmental pollution. The findings of this study are poised to contribute to policy formulation and practical interventions aimed at enhancing menstrual health and hygiene practices in India and similar contexts.

III. Objective of the Study: The paper pursues a dual objective.

1. To comprehend the detrimental impacts of disposable menstruation supplies on women's health and hygiene.
2. To study the potential of period pants for startups in the informal sector, considering their benefits for women's health and hygiene.

IV. Research Questions: These research questions that align with the stated objectives:

1. What are the detrimental impacts of disposable menstruation supplies on women's health and hygiene?
2. What is the potential of reusable menstrual panties (period pants) for startups in the informal sector, considering their benefits for women's health and hygiene?

V. Methodology: A brief literature review was done for this investigation. A rapid literature review partially adheres to the protocols of a systematic review and is a more transparent, rigorous method of conducting one than a regular one. This research constitutes a thorough analysis of the body of existing knowledge about the use of reusable menstrual products. There are four steps to it: Research questions are used to construct search strings and keywords, which are then used to search literature databases. Next, the articles are screened, coded, and finally, the findings are analysed. To conduct this research, we utilized specific search terms, including "reusable menstruation products" and "menstruation health and hygiene," "scope for startups in reusable menstruation products". We conducted searches for relevant articles using popular search engine of Google Scholar. After identifying a pool of eligible articles, we established exclusion criteria to ensure the selection of the most pertinent sources for our analysis.

The papers used for this study were selected using the inclusion-exclusion criteria listed below.

Criteria for Inclusion:

- Every journal article that has been released between 2000 and 2024.
- Every article is available in full text and can be accessed by everyone through a database.
- Every article that complies with the research's aims.

Criteria for exclusion

- Articles that have restricted access.
- Articles without keywords or articles unrelated to the subject of the study.

The Research methodology process:

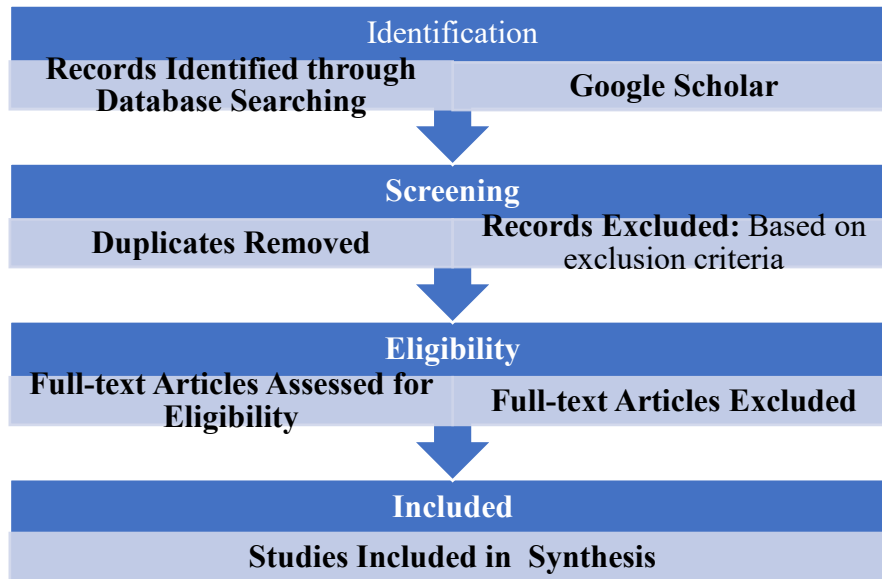


Figure1: The PRISMA Model

This enhanced PRISMA model includes a detailed cost feasibility analysis and production process in the discussion section, providing a comprehensive overview of the economic and practical aspects of producing reusable menstrual panties.

VI. Discussion and Results:

India is a nation characterized by stark contrasts, including great poverty, riches, and gender inequality. These disparities manifest significantly in the health and social status of girls and women, particularly regarding menstrual health and hygiene. The following literature matrix captures various studies and their findings on menstrual health and hygiene, highlighting the importance of effective Menstrual Hygiene Management (MHM) practices and the challenges faced by women in India. This review provides insights into the transition to womanhood, menstrual product usage, health risks, and the broader social implications of menstrual health.

Exhibit 1: Key Points on Menstrual Health and Hygiene in India

Author(s)	Year	Focus of the study	Key Findings
Rembeck et al.	2006	Menstrual cycle and transition to womanhood	Menstrual cycle signifies transition from childhood to womanhood, a critical period for girls' growth and development.
Chrisler et al.	2015	Body appreciation and attitudes toward menstruation	Menstrual cycle is a natural process preparing a woman's body for reproduction.
Thomas & Ellertson	2000	Menstrual cycle statistics	Women experience more than 400 periods from age 12 to 51.
Durkin	2017	Menstrual cycle statistics	During her lifetime, a single girl will experience more than 400 periods, beginning at age 12 and ending at age 51 when menopause occurs.
WHO/UNICEF	2012	Menstrual Hygiene Management (MHM)	Effective MHM involves clean menstrual materials, privacy for changing, soap and water for washing, and safe disposal facilities.
UNICEF	2019	Importance of MHM	MHM practices contribute to health, happiness, rights, equity, gender parity, education, and empowerment of women.
Koonan	2019	Menstrual hygiene challenges in India	Inadequate sanitation and infrastructure in homes lead to poor menstrual hygiene practices, raising infection risks.
Muralidharan	2018	Menstrual product usage in India	Only 36% of Indian menstruators use disposable sanitary napkins; 64% use

			different materials due to cost and accessibility issues.
Vishwakarma et al.	2021	Menstrual product usage in marginalized groups	Use of cloth is more common among marginalized groups due to cost and accessibility issues.
Garikipati	2020	Disposable pad usage practices	Girls may use disposable pads for extended periods due to lack of access and affordability, leading to unsanitary practices.
Dasra	2015	Menstrual health problems	Poor menstrual practices cause health issues like anaemia, menorrhagia, VVC, BV, HPV, HIV, and increase cervical cancer mortality.
Sumpter & Torondel	2013	Health impacts of poor menstrual hygiene	Poor menstrual hygiene can cause VVC, BV, and increase risk of STIs.
Ram et al.	2020	Infertility and menstrual hygiene	Poor menstrual hygiene can lead to infertility, affecting social status and psychological well-being.
Bae et al.	2018	Chemical exposure in menstrual products	Commercial products contain harmful chemicals like acetone, styrene, chloromethane, chloroethane, and chloroform.
Borowski	2011	Health risks of tampons	Tampon use linked to toxins exposure, TSS, and gynaecological issues.
Mercola	2013	Chemical content in menstrual products	Tampons and pads contain dioxins, which are carcinogenic and harmful to reproductive health.
Rabin	2017	FDA regulations on menstrual products	FDA does not require full ingredient disclosure for menstrual products.
McDermott & Sheridan	2015	Case study on TSS	TSS can occur with use of high-absorbency tampons, leading to serious health issues.
Fetters	2015	History and health risks of tampons	High-absorbency tampons linked to TSS; synthetic components increase risk of infection.
Jones	2016	Menstrual product health risks	In the 1980s, 91% of instances of toxic shock syndrome had a menstrual connection, which led to the first scandal involving the condition. Tampons with exceptional absorbency caused the deaths of 38 women.
Kounang	2015	Health risks of menstrual products	The risk of TSS is increased when extremely absorbent tampons are used for longer than eight hours.

Source: Author

VII. **Effects of Disposable Menstruation Products:** Millions of women throughout the world frequently use disposable menstruation products like tampons and pads during their menstrual cycles. Although these products are convenient, using them may have negative impacts on personal hygiene and human health. From the above discussion, a few of these detrimental effects emphasize how crucial educated decision-making is for women's health:

Exhibit 2: Impact of Disposable Menstrual Products

Impact	Details
Chemical Exposure	Chemicals like dioxins, artificial perfumes, and bleaching agents are frequently found in disposable menstrual products. These substances may have harmful impacts on one's health, such as: <ul style="list-style-type: none"> • Dioxins: These poisonous substances, which can build up in the body over time, may be present in tiny amounts in tampons and pads. Dioxin exposure

	<p>has been associated with several health problems, including cancer and reproductive disorders.</p> <ul style="list-style-type: none"> • Synthetic fragrances: Some disposable items contain perfumes that can irritate skin, trigger allergic reactions, and throw off the pH balance in the vagina, resulting in pain and infections. <p>Skin irritation and allergic responses: A lot of disposable menstrual products are composed of synthetic materials, such as plastics, which can lead to skin irritation and allergic reactions. These materials include:</p> <ul style="list-style-type: none"> • Skin rashes: These items' synthetic materials and chemicals have the potential to cause contact dermatitis and rashes, which can be painful and uncomfortable. • Dryness and irritation of the vagina: Tampons have the ability to absorb the body's natural lubricant.
Toxic Shock Syndrome (TSS)	Toxic Shock Syndrome (TSS) is a rare but potentially life-threatening condition caused by bacterial toxins that enter the bloodstream, often associated with tampon use. The risk increases when tampons are used for more than 8 hours. Symptoms of TSS include high fever, vomiting, diarrhea, rash, and organ failure.
Environmental Impact	Contributes significantly to landfill waste and ocean pollution, introducing harmful substances into ecosystems and contributing to environmental degradation.
Hygiene Concerns	When proper facilities for garbage disposal are lacking, disposable products can lead to significant hygiene issues. Inadequate disposal practices can result in unpleasant odors, unclean environments, and the spread of diseases.
Financial Burden	The ongoing expenses associated with buying disposable menstrual products can be very taxing, particularly for those with low incomes. This may cause people to use items longer than is advised, which raises the possibility of health issues.

Source: Author

Menstrual products that are disposable provide convenience, but women need to understand the possible risks to human health and hygiene that come with using them. Reusable menstruation products (such as menstrual underwear) offer women an alternative that can reduce these dangers while also being healthier and more environmentally friendly. Making educated decisions about menstruation products is crucial to improving female health and minimising harmful effects on the environment and personal health.

VIII. Opportunities for Startups in Informal Settings:

Menstrual poverty in India significantly hinders achieving key Sustainable Development Goals, affecting health, education, and employment due to a lack of access to menstrual products, education, and WASH facilities. Although laws and initiatives focus on sanitary pads, their ecological impact necessitates promoting sustainable alternatives like biodegradable banana fiber pads. Despite progress, challenges remain, particularly among impoverished populations. Comprehensive public policy is crucial for addressing period poverty sustainably. Stigma around menstruation, perpetuated since the 1920s, continues to hinder education and proper disposal practices. Emerging firms are now challenging these myths, offering sustainable solutions like period-proof underwear. This stylish, reusable product serves as an absorbent solution or complements traditional menstrual products, using materials like microfiber polyester, lycra, nylon, and organic cotton. The period panties market in India's informal sector is gaining traction, highlighting a shift towards eco-friendly menstrual management. The several opportunities of startups in informal sector's involvement in manufacturing period panties, including:

Exhibit 3: Opportunities for Startups in Period Panties Market

Opportunity	Details
Opportunities for Small Businesses	With the increasing popularity of period panties, smaller and local businesses find opportunities to cater to diverse consumer needs. Local artisans and small-scale producers offer unique and handmade period panties.
Flexibility in Design	The informal sector thrives on the flexibility to experiment with designs, providing a range of options not available in mainstream brands.
Affordability	The informal market often focuses on affordability, making period panties more accessible to a broader population.
Grassroots Initiatives	As awareness grows, grassroots initiatives and local entrepreneurs play a crucial role in reaching rural areas where traditional distribution channels might be limited.

Adaptability and Inclusivity	The informal sector's agility allows it to adapt to regional preferences and cultural nuances, contributing to the inclusivity of period panties in various demographics.
Local Production	Supports regional economies and provides local employment opportunities.
Niche Markets	Ability to cater to specific consumer preferences and regional needs.

Source: Author

IX. Production Process and Feasibility of Startups in Assam:

The production process of period panties involves several key steps to ensure they are effective, comfortable, and durable. It begins with the selection of high-quality, breathable, and moisture-wicking fabrics, often including a blend of cotton, spandex, and specialized absorbent layers. These fabrics are cut into the desired patterns using precise machinery. The next step is the assembly, where the cut pieces are stitched together, incorporating an absorbent core and a leak-proof barrier to prevent leaks. Seamless sewing techniques are often used to enhance comfort and prevent chafing. After assembly, the panties undergo rigorous quality control tests to ensure they meet hygiene and performance standards. Finally, they are packaged in eco-friendly materials and distributed to retailers or directly to consumers. The production process is explained in short below:

- Design and Prototyping:** First, creating designs of period panties that are functional and visually appealing, considering shape, style, and size range. And then need to develop prototypes to test for fit, comfort, and functionality.
- Material Selection:** The outer fabric of period panties is typically made from materials such as cotton, bamboo, or synthetic blends, ensuring comfort and breathability. The absorbent layers utilize specialized fabrics like microfiber, bamboo, or polyester blends to effectively absorb and retain menstrual fluid. Additionally, a breathable yet waterproof layer, often composed of PUL (polyurethane laminate), is incorporated to prevent leaks, combining functionality with comfort.
- Cutting:** Pattern making involves creating precise templates based on the design, which serve as blueprints for cutting fabric. Industrial cutting machines or laser cutters are then employed to accurately cut the fabric pieces according to these patterns, ensuring consistency and efficiency in production.
- Sewing and Assembly:** Layering involves assembling the various fabric layers, including the outer fabric, absorbent layers, and the waterproof layer. These layers are then stitched together using industrial sewing machines, with reinforced seams added to areas requiring extra strength. Finally, elastic bands are attached to the waistband and leg openings to ensure a secure and comfortable fit.
- Quality Control:** Inspection involves thoroughly checking for defects in stitching, fabric, and overall construction to ensure the highest quality. Absorbency testing is then conducted to verify that the panties meet the required standards for absorbency and leak-proof capabilities, ensuring reliable performance and comfort.
- Finishing:** Trimming involves cutting away any excess threads and fabric to ensure a clean, finished look. Following this, labels are attached, providing information on size, care instructions, and brand details, ensuring the product is ready for market.
- Packaging:** Folding involves neatly folding the finished panties to ensure they are presentable and easy to package. After folding, the panties are packaged either individually or in sets, often using eco-friendly materials to minimize environmental impact.
- Distribution:** Store the finished products in a clean, dry warehouse and distribute to retailers or directly to customers during shipping.

Setting up a period panties manufacturing unit in Assam involves acquiring the right machinery, ensuring skilled labour, and leveraging local resources and government support. By sourcing technology and machinery both locally and nationally, and by investing in training and quality control, a high-quality production process can be established. To see the viability of the startups a cost feasibility analysis is done based on available market research and presented below:

X. Cost Feasibility Analysis:

Exhibit 4: Initial Setup Costs (One-Time)

Item	Quantity	Cost per Unit (INR)	Total Cost (INR)
Design Software	1	50,000	50,000
Industrial Fabric Cutters	2	1,00,000	2,00,000
Laser Cutters	1	2,50,000	2,50,000
Overlock Sewing Machines	5	75,000	3,75,000
Flatlock Sewing Machines	5	1,00,000	5,00,000
Elastic Attachment Machines	2	1,50,000	3,00,000
Heat Sealing Machines	1	2,00,000	2,00,000
Absorbency Testing Kits	2	25,000	50,000

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Packaging Equipment	1	1,00,000	1,00,000
Miscellaneous	-	-	1,00,000
Total Initial Setup Cost	-	-	21,25,000

Source: Author

Exhibit 4 outlines the one-time costs required to set up the production of reusable menstrual panties. It includes the purchase of essential equipment like design software, industrial fabric cutters, laser cutters, various types of sewing machines, elastic attachment machines, heat sealing machines, absorbency testing kits, and packaging equipment. Additionally, a budget for miscellaneous expenses is included. This comprehensive list highlights the investment needed to establish a fully operational manufacturing facility based on market research.

Exhibit 5: Monthly Operating Costs:

Item	Quantity	Cost per Unit (INR)	Total Cost (INR)
Raw Materials (Fabric, Absorbent Layers, Waterproof Layer)	1,000 units	150	1,50,000
Labor Costs	20 workers	10,000/month	2,00,000
Utilities (Electricity, Water)	-	-	50,000
Maintenance			30,000
Packaging Materials	1,000 units	10	10,000
Marketing and Distribution	-	-	50,000
Miscellaneous	-	-	20,000
Total Monthly Operating Cost			5,10,000

Source: Author

Production Capacity:

Assuming a working schedule of 8 hours per day with efficient workflow:

- Sewing Time per Unit: 10 minutes (0.167 hours)
- Cutting Time per Unit: 5 minutes (0.083 hours)
- Total Production Time per Unit: 15 minutes (0.25 hours)

With 5 overlock sewing machines and 5 flatlock sewing machines, each machine can produce:

- Units per Machine per Day: (8 hours/day) / (0.25 hours/unit) = 32 units/day

If all machines are utilized efficiently:

- Total Daily Production Capacity: 10 machines X 32 units/day = 320 units/day

Cost per Unit Calculation

Monthly Production Capacity

- Monthly Production Capacity: 320 units/day X 25 days/month = 8,000 units/month

Exhibit 6: Total Monthly Operating Cost

Item	Cost (INR)
Raw Materials (Fabric, Absorbent Layers, Waterproof Layer)	1,50,000
Labor Costs	2,00,000
Utilities (Electricity, Water)	50,000
Maintenance	30,000
Packaging Materials	10,000
Marketing and Distribution	50,000
Miscellaneous	20,000
Total Monthly Operating Cost	5,10,000

Source: Author

Exhibit 7: Cost per Unit

Description	Amount (INR)
Total Monthly Operating Cost	5,10,000
Monthly Production Capacity	8,000 units
Cost per Unit	5,10,000 / 8,000 = 63.75

Source: Author

Exhibit 8: Revenue and Profit Analysis per Unit:

Item	Value (INR)
Selling Price per Unit	500
Cost per Unit	63.75
Profit per Unit	500 - 63.75 = 436.25

Source: Author

Exhibit 9: Daily Revenue and Profit

Item	Value (INR)
Units Produced per Day	320
Revenue per Day	$320 \times 500 = 1,60,000$
Cost per Day	$320 \times 63.75 = 20,400$
Profit per Day	$1,60,000 - 20,400 = 1,39,600$

Source: Author

Exhibit 9 details the daily financial performance of the reusable menstrual panties business. Essentially, it demonstrates that after covering the costs of production, the business generates a significant profit each day. Therefore, from the cost feasibility analysis, it can be inferred that reusable menstrual panties produced by local startups in Assam are very competitive in the market. These products can give strong competition to other branded or commercial menstrual products available in the region. If these startups receive proper and definite guidance in commercializing their products, they can also earn good revenues from their efforts and investments. The initial setup cost is substantial, but the profit margins per unit are high, making it a potentially profitable venture. With an estimated daily production of 320 units and a significant profit per unit, the business can achieve profitability quickly if the demand is met and operations are managed efficiently.

While the market for reusable menstrual panties has great potential, it is not without challenges. These include competition, educating the market, and building a customer base. However, with persistence and strategic planning, start-ups can turn these challenges into opportunities for growth.

XI. Conclusion:

This study could provide fresh insights into the management of menstrual hygiene, sustainability, and menstruation. Marketers can utilize this knowledge to develop methods that lower risk and foster trust to enhance the likelihood that consumers will purchase menstruation pants. In conclusion, the emergence of startups of reusable menstrual panties in Assam represents a significant stride in addressing women's health and hygiene needs, while simultaneously fostering entrepreneurial growth within the region. This innovative product has the potential to offer a sustainable alternative to conventional menstrual products, contributing to environmental conservation and economic empowerment. The support of government schemes aimed at promoting MSMEs has been instrumental in this development. Initiatives such as financial assistance, skill development programs, and market access facilitation have enabled local startups to thrive in this new market. Consequently, these efforts have not only enhanced the viability of reusable menstrual panties but have also opened up a promising entrepreneurial avenue for MSMEs in Assam, paving the way for future growth and innovation in the informal sector.

To tap into the burgeoning market for period panties, start-ups can consider the following strategies:

1. Product Innovation to develop unique, high-quality menstrual panties and to address diverse needs with various absorbency levels, sizes, and designs.
2. To educate the women on benefits and to raise awareness to drive market growth.
3. To establish a strong online presence using e-commerce and social media and to provide discreet shopping options.
4. To collaborate with stakeholders, women's health organizations, and influencers and to support period poverty initiatives and promote the brand mission.
5. To ensure product quality and safety with relevant certifications so that trust with consumers is build.

By implementing these strategies, start-ups can effectively tap into the growing market for period panties and contribute to improving menstrual health and sustainability. The development of a market for reusable menstrual panties is a win-win situation for both women's health and start-ups. Women can enjoy the benefits of sustainability, comfort, and cost savings, while start-ups can tap into a growing market by offering innovative, high-quality products and promoting environmental responsibility. As this market continues to expand, it presents an exciting opportunity for entrepreneurs to make a positive impact on women's lives and contribute to a more sustainable future.

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